Seabird Population Trends
and
Causes of Change: 1986-2018 Report

Seabird Population Trends and Causes of Change: 1986-2018 Report

Here we present the latest analysed trends in abundance, productivity, demographic parameters and diet of breeding seabirds, from the Seabird Monitoring Programme (SMP), along with interpretive text on the likely causes of change based on recent research.
It replaces and builds upon the now discontinued annual publication *Seabird numbers and breeding success in Britain and Ireland*. Like it, this online report will be updated annually.
Trend information is presented at the UK level and separately for Scotland, Wales, England, Northern Ireland, Republic of Ireland, all-Ireland, Channel Islands and Isle of Man.
Interpretation of trends and reasons for change are given largely at the UK level, unless there is country-specific evidence.
A download of data points presented in the graphs of abundance and productivity under species accounts is available on request.

The table below contains links to the species accounts and provides at-a-glance UK population trends (as percentage of change in breeding numbers) from complete censuses undertaken in 1969-70 (Operation Seafarer), 1985-88 (Seabird Colony Register, hereafter SCR), and 1998-2002 (Seabird 2000). Change from 1998-2000 to 2018 (i.e. over the period since the last national census) is estimated from trends derived from the SMP sample of colonies; this analysis is only available for species with sufficient data to accurately estimate trends. Any marked differences in the trend calculations between the last census and 2018 is due to a recent increase in sample data as part of the current seabird census Seabirds Count (2015-2020).

View the methods of analysis of breeding abundance and productivity data presented in the species accounts.

This report should be cited as: JNCC, (2020), Seabird Population Trends and Causes of Change: 1986-2018 Report (https://jncc.gov.uk/our-work/smp-report-1986-2018)
Joint Nature Conservation Committee. Updated 10 March 2020

Species	**Population change (%) 1969-70 to 1985-88**	**Population change (%) 1985-88 to 1998-2002**	**Population change (%) 2000-2018**
northern fulmar	+77	-3	-36
Manx shearwater	n/a	n/a	n/a
European storm-petrel	n/a	n/a	n/a
Leach's storm-petrel	n/a	n/a	n/a
northern gannet	+39	+39*	+41**
great cormorant	+9	+10	-7
European shag	+21	-27	-24
Arctic skua	+226	-37	-70
great skua	+148	+26	n/a
black-legged kittiwake	+24	-25	-50
black-headed gull	+5	0	+32
Mediterranean gull	n/a	+10,900	+2059

common gull	+25	+36	n/a
lesser black-backed gull	+29	+40	n/a
herring gull	-48	-13	n/a
great black-backed gull	-7	-4	n/a
little tern	+58	-23	-25
Sandwich tern	+33	-15	+12
common tern	+9	-9	+15
roseate tern	-66	-83	+106
Arctic tern	+50	-31	-13
guillemot	+77	+31	+1
razorbill	+16	+21	+33
black guillemot	n/a	+3**	n/a
Atlantic puffin	+15	+19	n/a

*change between censuses in 1984-85 and 2003-04.
**change between censuses in 2003-04 and 2013-2015
n/a: insufficient sample size or extremely wide confidence limits, so figure not provided

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Information about the population status of the common birds of the wider UK countryside (updated to 2019) can be accessed via the BTO report **Bird Trends: trends in numbers, breeding success and survival for UK breeding birds**.

Northern Fulmar *Fulmarus glacialis*

Description

The following has been adapted from original text by Mark L. Tasker in Seabird Populations of Britain and Ireland (with permission from A&C Black, London).

Northern fulmars are one of the commonest seabirds in northern Britain and are present year-round, with no pronounced migration after becoming adult. They usually nest on wide ledges near the top of cliffs, but will also nest on more gently sloping land, under boulders and in puffin burrows on islands free from mammalian predators. They feed at sea on a variety of foods ranging from zooplankton and small fish to offal and discards produced by commercial fishing. Consequently, they are ubiquitous companions of fishing vessels in northern waters.

An increase in food discarded by commercial fishing has been suggested as a contributing factor to the spectacular growth in numbers and distribution of northern fulmars in Britain and Ireland and the North Atlantic. Prior to the mid-18th century, they bred in only one or two colonies in Iceland and in St Kilda (Western Isles). They then expanded their breeding range around the coast of Iceland and onto the Faeroe Islands and in 1878, formed a second British colony on Foula (Shetland). Subsequently, they have spread around Britain and Ireland and NW Europe and across the Atlantic to Canada. Throughout most of the 20th century numbers rapidly increased but during the last 15 years of the century this rise ceased with declines recorded in some areas.

The environmental change which is most likely to have affected northern fulmars since the 1970s has come from a decline in the North Sea whitefish industry and a corresponding decline in the amount of offal discharged from its fleets - a trend which is likely to continue. Declines in the abundance of natural prey such as sandeels in the North Sea and of certain species of zooplankton in the North Atlantic, are also likely to have had a detrimental effect on the population. Climate change is likely to have contributed to these declines. Large numbers of northern fulmars may also still be caught and killed accidentally by the long-lining fleets in the Norwegian Sea and in the North Atlantic.

Conservation status

Northern fulmar is currently identified as a conservation priority in the following:

Amber listed in Birds of Conservation Concern 4 (2015 update)
further information on Conservation Designations for UK Taxa
Green listed in Birds of Conservation Concern in Ireland 2014-2019
EC Birds Directive - migratory species

International importance

UK Population	% Biogeographic Population	% World Population
501,600 AOS*	14.8 (ssp. *glacialis*)	8.0

* AOS = Apparently Occupied Sites

The UK population figure (rounded to the nearest hundred) was derived from data in Mitchell, P.I., Newton, S.F., Ratcliffe, N. and Dunn, T.E. (eds.) 2004. *Seabird Populations of Britain and Ireland.* Poyser, London. This was also the source of figures for the Biogeographic and World populations.

UK population estimates and change 1969-2002 (census data)

There was almost total survey coverage during Seabird 2000 with only a few gaps, notably Sula Sgeir (Western Isles). This was an improvement on both previous censuses, especially on Operation Seafarer (1969-70) when some large sections of coastline were covered rapidly or late in the breeding season.

	Operation Seafarer (1969-70)	Seabird Colony Register (1985-88)	Seabird 2000 (1998-2002)
UK Population estimate (AOS*)	291,294	516,939	501,609
% change since previous census	n/a	+77	-3

* AOS = Apparently Occupied Sites

For census results for individual countries and Ireland, the Channel Islands and the Isle of Man see under relevant sections below.

Distribution/abundance

The Seabird 2000 census provides the most comprehensive recent assessment of the distribution and abundance of breeding seabirds. Numbers of northern fulmar found in different regions, and a map showing the location and size of colonies, is provided in the Seabird 2000 northern fulmar results page.

The locations sampled during the annual Seabird Monitoring Programme provide some information on distribution and are accessible via the Seabird Monitoring Programme online database.

Annual abundance and productivity by geographical area

With reference to the regional accounts below please note the following.

Breeding abundance: graphs of abundance index with 95% CLs are only shown for a region where the trend produced has been deemed accurate (see methods of analysis). Where a trend was thought to be inaccurate, graphs of abundance at major colonies in a region may be shown instead, particularly if such colonies hold greater than 10% of the regional population, are monitored frequently and may thus help illustrate regional population fluctuations outwith national censuses. Occasionally, too few data have been collected regionally to produce either of these.

Productivity: graphs of productivity are only shown if analysis of productivity data produced a significant result for regional and/or year effects (again see methods of analysis). If results were not significant, then a regional mean productivity value is given. However, on some occasions, too few data are available from which to provide a meaningful average. Furthermore, for 11 species where the quality of monitoring data available was considered high, population viability analysis was undertaken at the UK level and the results of this are also reported.

United Kingdom

Breeding Abundance

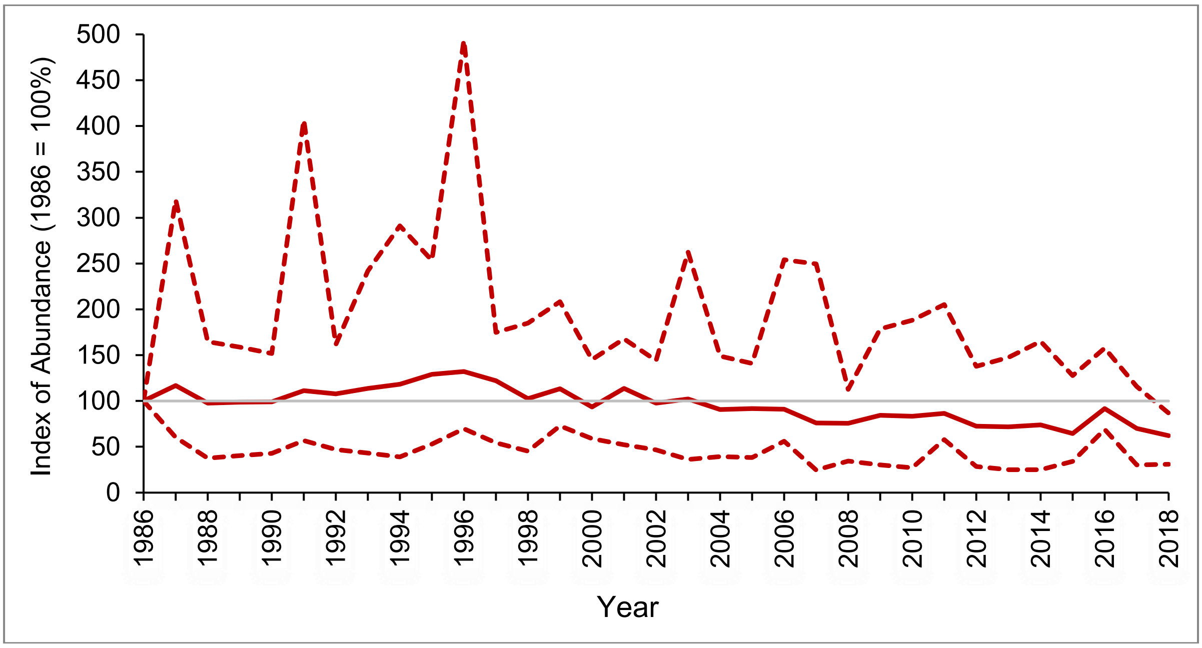

Figure 1. Trend in UK abundance index (solid line) of northern fulmar 1986-2018 with 95% confidence limits (dotted lines). Based on SMP data; view the methods of analysis.

Census results indicate a large increase between 1969-70 (291,000 pairs) and 1985-88 (517,000 pairs), with numbers then stable up to 1998-2002. The causes of long-term increase in the UK northern fulmar population is the subject of debate; some suggest an increase in food supplied by man[1] - formerly by waste from whaling fleets and later offal from trawling - while others suggest oceanographic changes[2], or even a genetic change in the population[3]. Indeed, recent declines in the abundance index may in part be due to declines in offal from trawlers, representing a 're-adjustment' to more natural levels following a period of artificially elevated population size.

The new EU Common Fisheries Policy came into effect in 2014. It included the obligation that all catches of regulated commercial species had to be landed and counted against quota. From 2015 to 2019, the landing obligation was phased in across the majority of EU fisheries. This is likely to impact on seabird populations that feed on discards. Species native to the north-east Atlantic that are currently extensively exploiting fishery discards are kittiwake, herring gull, lesser black-backed gull, great black-backed gull, great skua, northern fulmar and the northern gannet[4].

The majority of offal or small fishes discarded by whitefish trawlers was eaten by fulmars in Shetland and the North Sea[5,6], and it is generally assumed that fulmars rely heavily on discarding in southerly latitudes. However, the spatial overlap between fulmars and commercial fisheries is far from complete[7], and while it is indisputable that northern fulmars are major consumers of fishery waste in the southern part of their range, the extent to which their distribution is or was, constrained by the availability of this resource is debatable.

Data collected by the SMP suggest the abundance of fulmars breeding in the UK reached a peak in 1996 (Figure 1) but appears to have been declining since then although there is some fluctuation around the turn of the century and more recently in 2016.
The index for 2018 (38% below the baseline) is the lowest value recorded since the index began in 1986.
Table 1 below shows how numbers have changed at some of the most important UK colonies (those in the SPA network) in the period since they were surveyed for Seabird 2000. Numbers have fallen in all areas although the greatest declines appear to be at colonies in the north and west of the UK.

Northern fulmars are caught accidentally by long-line and coastal gillnet-fishery in the Norwegian Sea. Between 2012 and 2014, an estimated 312 birds were caught by the small-vessel demersal long-line fishery[8], while 389 individuals were caught in the coastal Norwegian gillnet-fishery between 2006 and 2015[9]. Reductions in sandeel abundance and changes to plankton communities, probably caused by increases in sea surface temperature, are also likely to be responsible for recent fulmar declines.

Area	**SPA Name**	**Seabird 2000**	**Count** (Year)	**Change (%)**	**%** *per annum*
Shetland	Hermaness NNR	13,958 1999	12,228 2016	-12	-0.8
Shetland	Noss	4,999 1998	5,092 2016	+2	+0.1
Shetland	Foula	21,106 2000	8,438 2015	-60	--5.9
Shetland	Fair Isle	20,424 2000	32,061 2016	+57	+2.7
Orkney	West Westray Cliffs	4,027 1999	677 2007	-83	-20.0
Orkney	Copinsay	2,054 1999	1,685 2015	-18	-1.2
Orkney	Hoy	31,596 1999	19,586 2007	-38	-3.9
East Coast	Troup, Pennan and Lion's Heads	2,900 2001	1,828 2017	-37	-2.8

Area	SPA Name	Seabird 2000	Count (Year)	Change (%)	% *per annum*
East Coast	Buchan Ness to Collieston Coast	1,976 [2001]	1,389 [2007]	-30	-5.7
East Coast	Fowlsheugh	352 [1999]	157 [2018]	-55	-4.2
East Coast	Flamborough Head and Bempton Cliffs	1,360 [2000]	846 [2017]	-38	-2.8
Minches	North Rona	3,520 [1998]	1,438 [2012]	-59	-6.2
Minches	Handa	3,550 [2000]	1,423 [2017]	-60	-5.2
Minches	Mingulay and Berneray	10,020 [1998]	8,614 [2014]	-14	-0.9
Minches	Rathlin Island	2,032 [1999]	1,518 [2011]	-25	-1.5
North West	Flannan Isles	8,143 [1998]	2,263 [2013]	-72	-8.2
North West	Hirta, Dun, Soay & Stacs	63,283 [1999]	27,552 [2015]	-56	-5.1
Irish Sea	Lambay Island	585 [1999]	375 [2015]	-36	-2.7

Table 1. Recent counts of the number of northern fulmar (AOS) recorded in SPAs in Britain and Ireland compared to the number recorded in them during Seabird 2000. The percentage that each colony has changed by, and the *per annum* change, is also provided. (Note: data for Hermaness and North Rona relate to only part of the respective SPAs).

Productivity

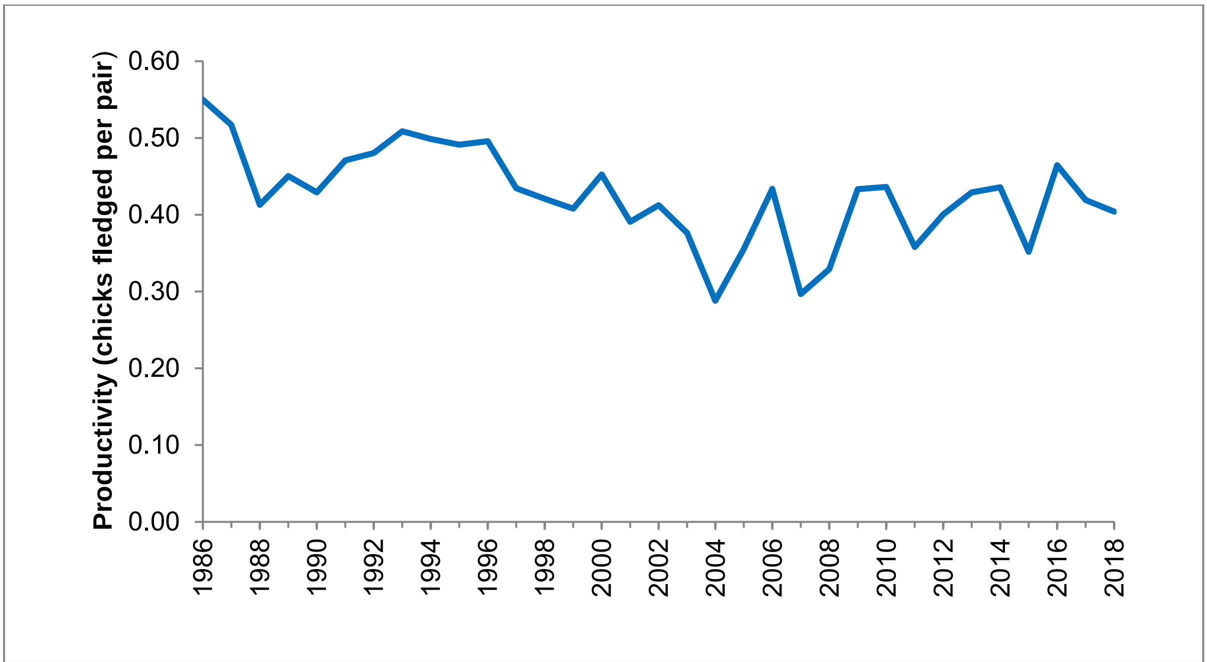

Figure 2. Trend in UK breeding productivity (no. of chicks fledged per pair) of northern fulmar 1986-2018. Based on SMP data; view the methods of analysis.

Declines in productivity since the mid-1990s may have contributed to the observed population decline in abundance shown in Figure 1, although in a long-lived species that does not breed until it is nine years old, we would expect a greater lag-time for changes in breeding output to be reflected in population size. Indeed, because of this we may expect further declines in the population. Productivity appears to have declined since 1986 and was at its lowest in 2004 and 2007 although the exact reasons as to why are unknown. From 2008 onwards, northern fulmars have had more variable breeding seasons.

Analysis of the SMP dataset found that mean productivity of northern fulmars was 0.39 between 1986 and 2008, declining at a rate of 0.05 chicks per nest per year[12]. This equates to a decline in productivity of 11% over the study period. The quality of the dataset meant a change in productivity greater than 10% over 25 years would be detected with confidence. Using available life history information (population size, clutch size, age at first breeding and survival rates of different age classes) to parameterise population viability analysis, it was predicted that if this level of productivity (0.39) were maintained, northern fulmar abundance would decline by about 12% over 25 years. Since 2009 the index has fluctuated but has starting to climb again, albeit very slowly. Between 2016 and 2018, the number of chicks fledged per pair decreased from 0.46 to 0.40.

Scotland

Population estimates and change 1969-2002 (census data)

	Operation Seafarer (1969-70)	Seabird Colony Register (1985-88)	Seabird 2000 (1998-2002)
Population estimate (AOS*)	285,067	504,640	485,852
% change since previous census	n/a	+77	-4

* AOS = Apparently Occupied Sites

Breeding Abundance

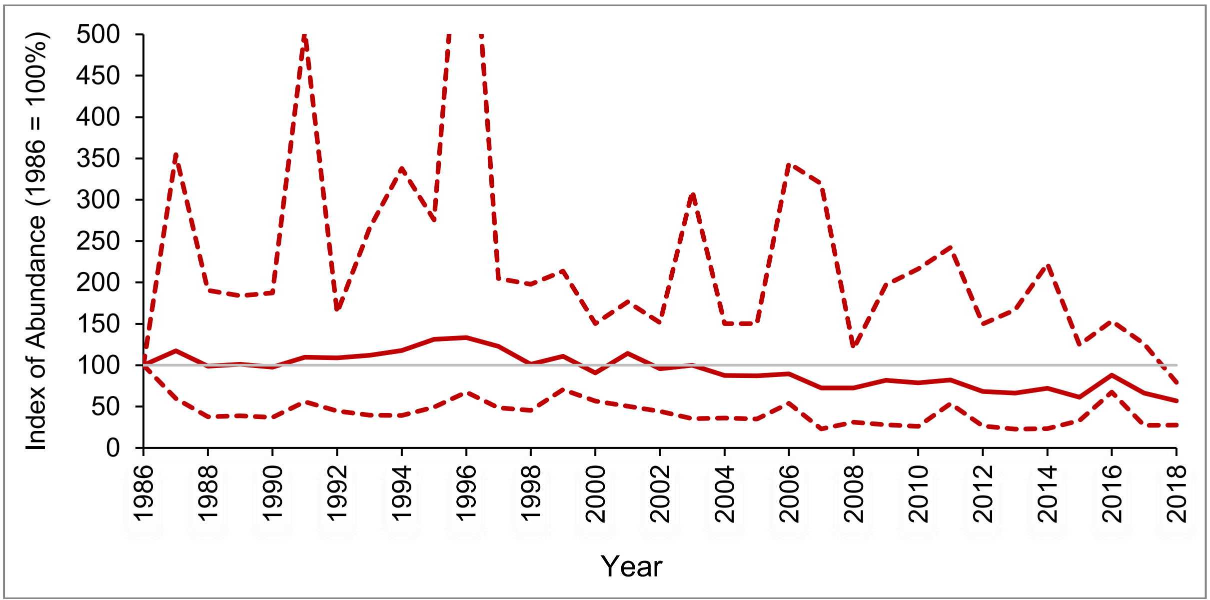

Figure 3. Trend in abundance index (solid line) of northern fulmar in Scotland, 1986-2018 with 95% confidence limits (dotted lines; drawing of upper limit restricted to preserve detail in the abundance index). Based on SMP data; view the methods of analysis.

Scotland holds the majority of the UK population of northern fulmars (about 97% during the Seabird 2000 census) so it is unsurprising that the trend shown above matches closely the UK trend with the key feature being the protracted shallow decline evident since the mid to late 1990s. Longer term census results indicate a large increase between 1969-70 and 1985-88, which apparently continued beyond the Seabird Colony Register (SCR), although numbers had declined by the time of the Seabird 2000 census in 1998-2002. The probable causes of their population increase and decrease, and current pressures affecting the Scottish population, are the same as those referred to in the UK section. The index in 2018 (43% below the baseline) is at its lowest point since monitoring began.

Productivity

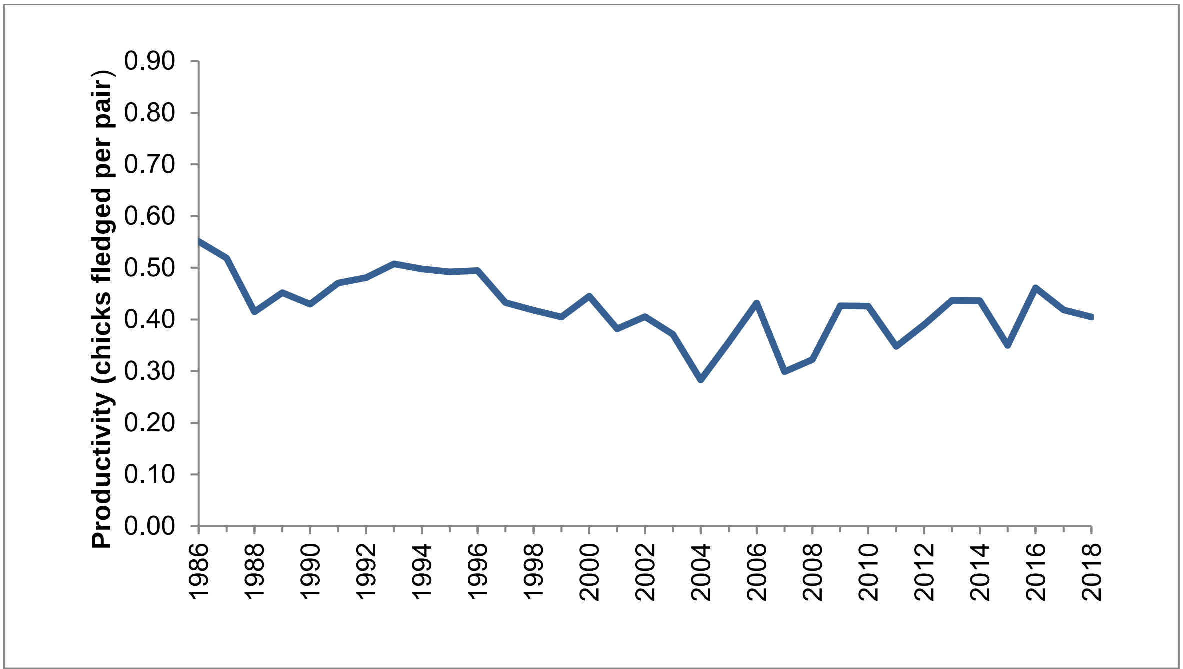

Figure 4. Trend in breeding productivity (no. of chicks fledged per pair) of northern fulmar in Scotland, 1986-2018. Based on SMP data; view the methods of analysis.

The trend in productivity for Scotland closely matches that of the UK because much of the data have been collected at Scottish colonies. Comments under the UK section are thus also pertinent to Scotland - declines in productivity since the mid-1990s may have contributed to the observed fall in abundance since that time, although it should be noted that immature birds take approximately nine years to recruit into the breeding population. Since 2009 the index is fluctuating but starting to climb again, albeit very slowly. Heavy rain at several colonies is likely to have contributed to the decline in productivity observed in Scotland in 2015. Between 2016 and 2018, the number of chicks fledged per pair decreases from 0.46 to 0.40.

England

Population estimates and change 1969-2002 (census data)

	Operation Seafarer (1969-70)	**Seabird Colony Register (1985-88)**	**Seabird 2000 (1998-2002)**
Population estimate (AOS*)	3,063	6,018	6,291
% change since previous census	n/a	+96	+5

* AOS = Apparently Occupied Sites

Breeding Abundance

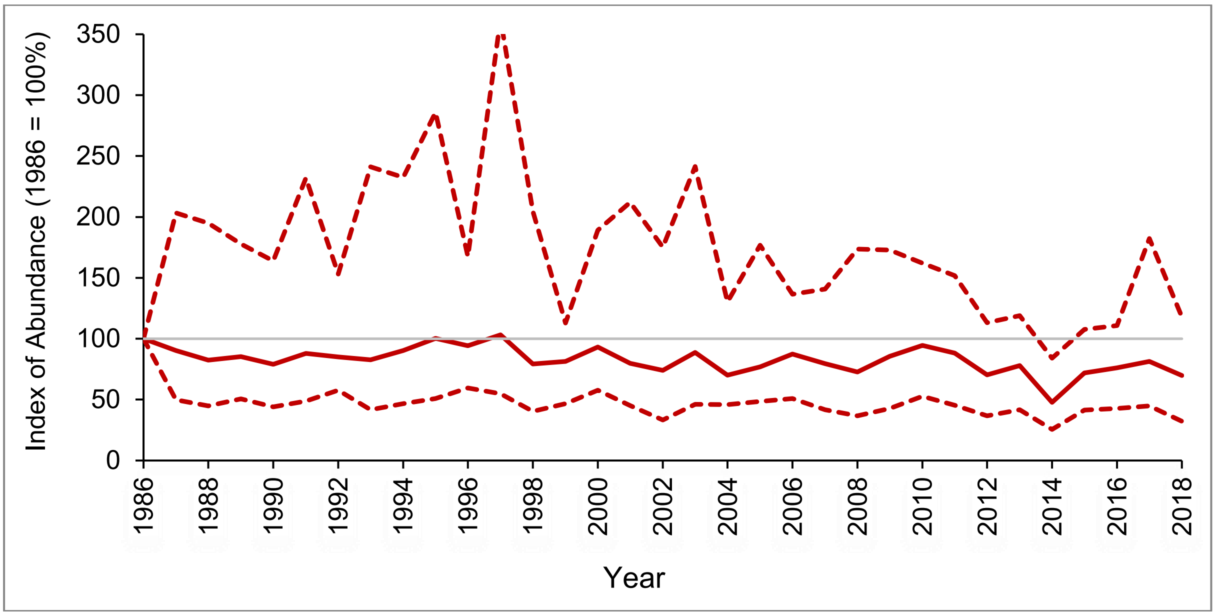

Figure 5. Trend in abundance index (solid line) of northern fulmar in England, 1986-2018 with 95% confidence limits (dotted lines). Based on SMP data; view the methods of analysis.

In England, northern fulmar numbers almost doubled between the first two national censuses but appeared to stabilise afterward. The distribution of northern fulmars in England is roughly split between the north-east and south-west (see Distribution section). However, most regular monitoring occurs in the north-east where several colonies have been counted annually up to 2018. Between the years 2000 and 2010, the index fluctuates with no discernible trend but then declines sharply to almost 50% below the 1986 baseline in 2014. Since then, the index has risen again although is still 30% below the baseline.

Productivity

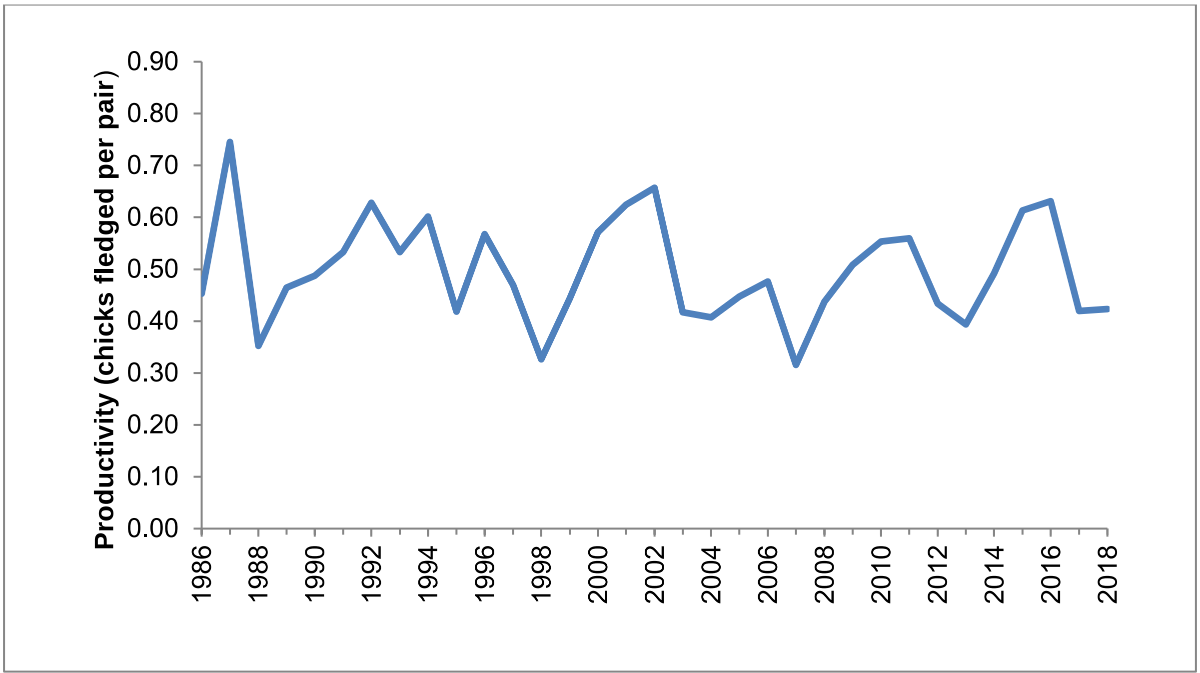

Figure 6. Trend in breeding productivity (no. of chicks fledged per pair) of northern fulmar in England, 1986-2018. Based on SMP data; view the methods of analysis.

The productivity of northern fulmars in England shows no clear trend over time. Levels are generally moderate to high and seldom fall below 0.40. In 2018, productivity was 0.42, lower than the long-term average of 0.48 chicks fledged per pair per year between 1986-2018.

Wales

Population estimates and change 1969-2002 (census data)

	Operation Seafarer (1969-70)	**Seabird Colony Register (1985-88)**	**Seabird 2000 (1998-2002)**
Population estimate (AOS*)	925	2,741	3,474
% change since previous census	n/a	+196	+27

* AOS = Apparently Occupied Sites

Breeding Abundance

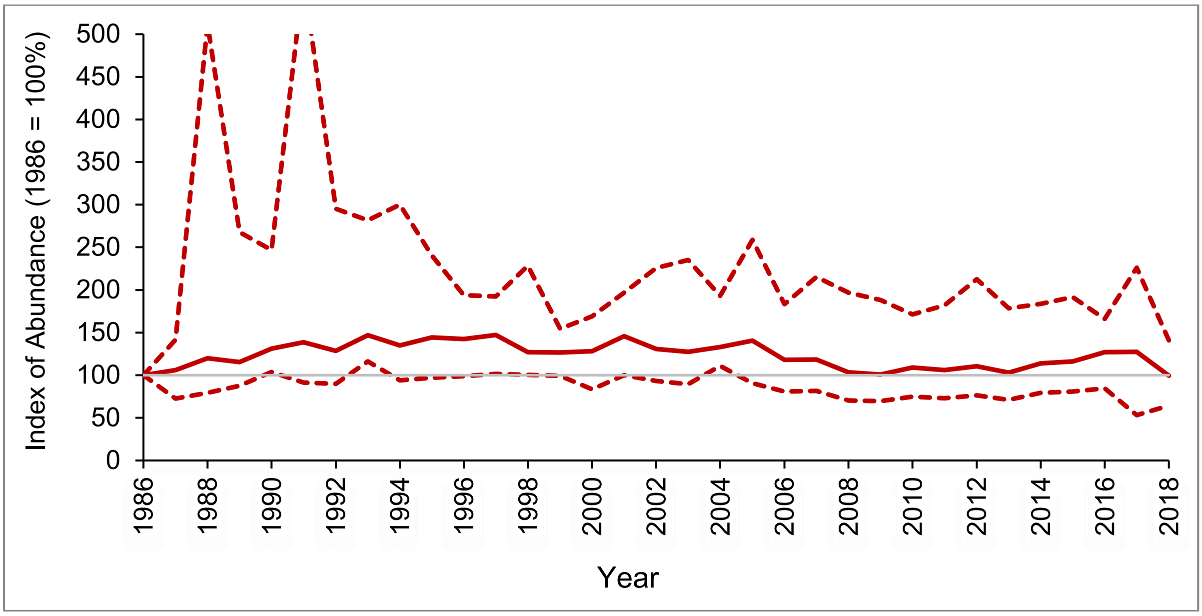

Figure 7. Trend in abundance index (solid line) of northern fulmar in Wales, 1986-2018 with 95% confidence limits (dotted lines; drawing of upper limit restricted to preserve detail in the abundance index). Based on SMP data; view the methods of analysis.

The abundance index of northern fulmars in Wales shows an increasing trend at least up to the mid-1990s. The steady decline in abundance evident for the UK and Scotland starting around the mid to late 1990s is absent, with the index being relatively stable until 2005. However, thereafter a noticeable decline occurs up to 2009 after which abundance has been more or less stable again. The long-term change shows that numbers have increased markedly since Operation Seafarer; the population during 1998-2002 was almost four times that recorded in 1969-70.

Productivity

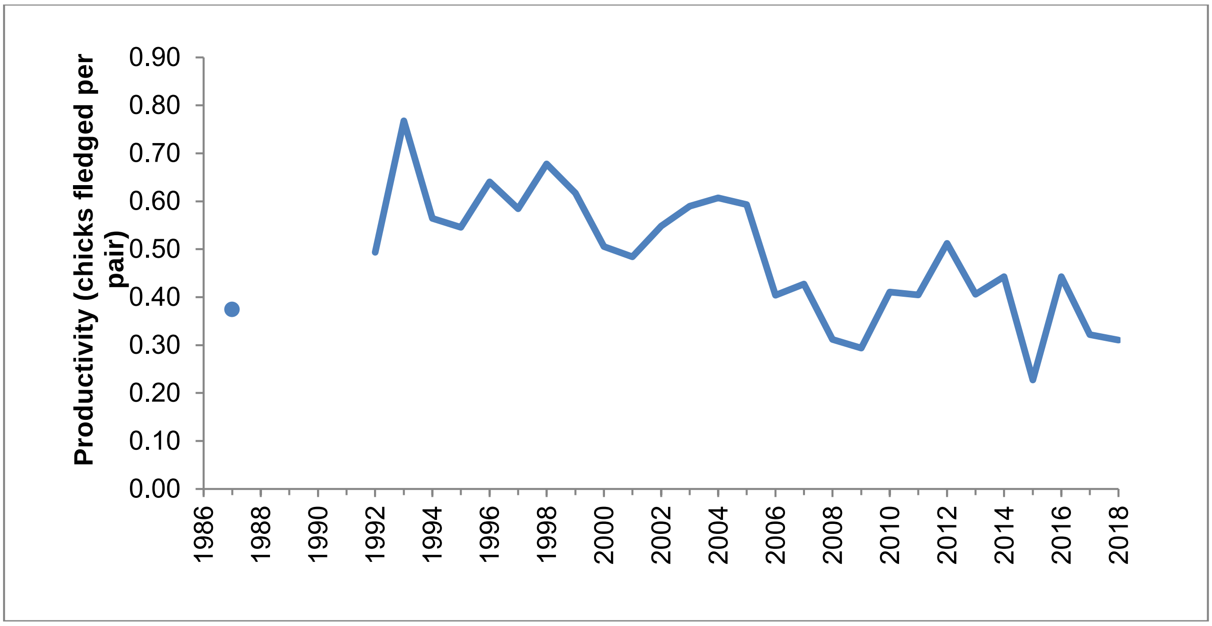

Figure 8. Trend in breeding productivity (no. of chicks fledged per pair) of northern fulmar in Wales, 1986-2018. Based on SMP data; view the methods of analysis.

Although few data are available until 1992, productivity in Wales has on average been higher than in Scotland and England over the same period. However, productivity in Wales has declined between 2005 and 2009 closer to that recorded in Scotland. From 2009 onwards productivity rose again until 2014, however, it fell in 2015 to its lowest value recorded (0.23 chicks fledged per pair) and is currently in decline again after a short recovery in 2016. The reasons for this decline in productivity are unknown.

Northern Ireland

Population estimates and change 1969-2002 (census data)

	Operation Seafarer (1969-70)	**Seabird Colony Register (1985-88)**	**Seabird 2000 (1998-2002)**
Population estimate (AOS*)	2,239	3,540	5,992
% change since previous census	n/a	+58	+69

* AOS = Apparently Occupied Sites

Breeding Abundance

The Seabird 2000 census recorded 5,992 AOS in Northern Ireland, 69% more than the previous SCR census which found 3,540 AOS. Few colonies are monitored annually so it is difficult to draw conclusions as to the population trend since Seabird 2000. However, in 2018, extensive survey work resulted in data submitted from 25 colonies which held a total of 624 AOS, 61% fewer than recorded at the same colonies during Seabird 2000 (1,615 AOS). Rathlin Island, not part of the suite of colonies surveyed in 2018, is the largest and most important colony in Northern Ireland, holding almost 60% of the country's total population during Seabird 2000. A large decline occurred there between 1999 and 2007 with whole-colony counts revealing a 47% fall from 2,032 to 1,072 AOS, although a repeat survey in 2011 found 1,518 AOS, but still 25% fewer than in 1999. The exact reasons for these large changes at Rathlin are unknown but it is possible, given the subsequent increase between 2007 and 2011, that numbers in 2007 were unusually low due to other reasons e.g. a non-breeding event. Obviously, numbers in Northern Ireland are falling but estimating the size of the decline accurately is problematic given the lack of more recent data from Rathlin.

Productivity

Data submitted to the SMP on the productivity of northern fulmars in Northern Ireland are sparse; thus, no meaningful average productivity value can be provided.

Republic of Ireland

Population estimates and change 1969-2018 (census data)

	Operation Seafarer (1969-70)	Seabird Colony Register (1984-85)	Seabird 2000 (1998-2002)	Republic of Ireland Census (2015-18)
Population estimate (AON*)	17,080	16,975	32,918	32,899
% change since previous census	n/a	n/a	n/a	0

* AOS = Apparently Occupied Sites

Breeding Abundance

National census data indicate that numbers of northern fulmar were stable between Operation Seafarer and the Seabird Colony Register but then almost doubled by Seabird 2000. The recent Republic of Ireland seabird census (2015-2018) recorded a total of 32,899 pairs (at 120 sites), almost equal to the 32,918 AOS counted during Seabird 2000[15].

Productivity

Northern fulmar productivity in the Republic of Ireland is falling but estimating the trend of the decline accurately is problematic given the lack of more recent data. On average, 0.36 chicks were fledged per pair per year between 2006 and 2015.

All Ireland

Population estimates and change 1969-2002 (census data)

	Operation Seafarer (1969-70)	Seabird Colony Register (1985-88)	Seabird 2000 (1998-2002)
Population estimate (AOS*)	19,319	20,515	38,910
% change since previous census	n/a	+6	+90

* AOS = Apparently Occupied Sites

Breeding Abundance

For the whole of Ireland, northern fulmar numbers were relatively stable between Operation Seafarer and the Seabird Colony Register but then almost doubled by Seabird 2000. The recent Republic of Ireland seabird census (2015-2018) recorded a total of 32,899 pairs, almost equal to that counted during Seabird 2000 (32,918 AOS)[14]. However, it is difficult to draw conclusions as to the population trend since Seabird 2000 in Northern Ireland. Rathlin Island, which held almost 60% of the country's total population during Seabird 2000 has not been surveyed since 2011, when it hosted 25% fewer AOS than in 1999. Based on 25 sample sites being counted in 2018, numbers in Northern Ireland might be falling, but estimating the size of the decline accurately is problematic given the lack of more recent data from Rathlin. The Republic of Ireland held the majority of the all-Ireland population of northern fulmars (about 85% during Seabird 2000) therefore suggesting that northern fulmar numbers might be stable or slightly decreasing across Ireland.

Productivity

Data submitted to the SMP on the productivity of northern fulmars in all-Ireland are sparse; thus, no meaningful average productivity value can be provided.

Isle of Man

Population estimates and change 1969-2018 (census data)

	Operation Seafarer (1969-70)	Seabird Colony Register (1984-85)	Seabird 2000 (1998-2002)	Isle of Man Census (2017-18)
Population estimate (AON/AOS*)	586	2,463	3,147	1,095
% change since previous census	n/a	+320	+28	-65

* AOS = Apparently Occupied Sites

Breeding Abundance

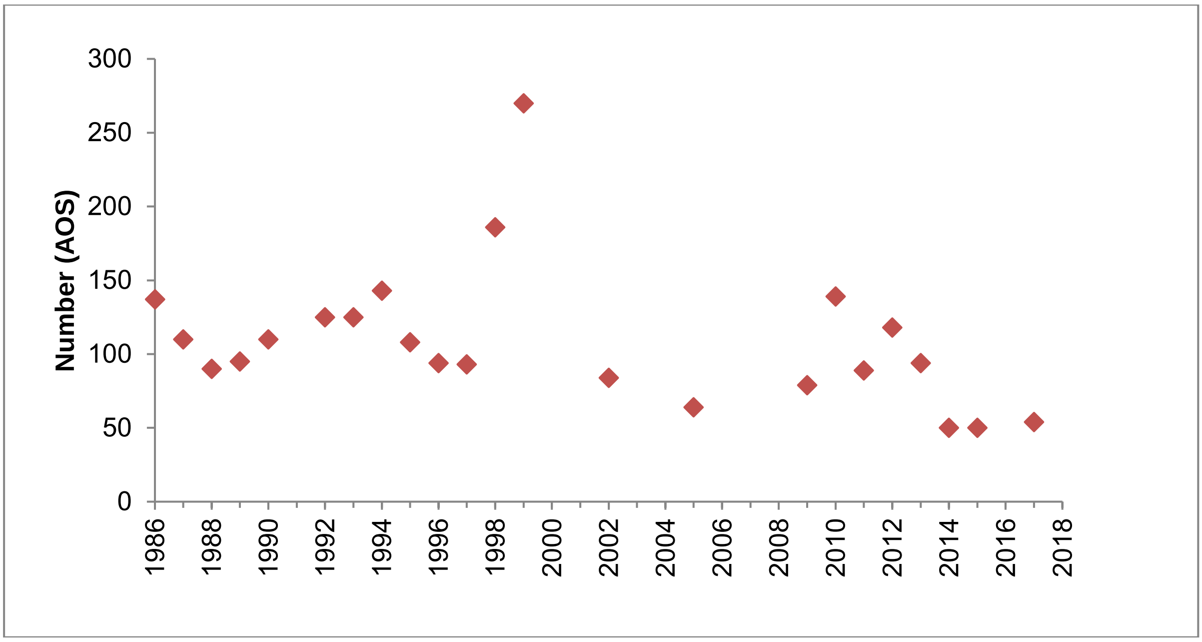

Figure 9. Abundance of northern fulmar on the Calf of Man, 1986-2017.

In common with other regions, the northern fulmar population on the Isle of Man increased hugely after Operation Seafarer. An increase of 320% occurred between 1969-70 and 1985-88 with another less dramatic increase of 28% between 1985-88 and 1998-2002. After Seabird 2000, data are available only from a few small colonies. However, the trend derived from the colonies sampled between census periods does not match the change in the Isle of Man population that is known to have occurred (e.g. from census data). The largest colony counted regularly is the Calf of Man, where numbers have fluctuated, particularly in the late 1990s and between 2010-2012. Since then, there appears to have been a decline with numbers in 2014 and 2015 (both 50 AOS) at their lowest since 1986. In 2017, as very slight increase to 54 AOS occurred[16].

Productivity

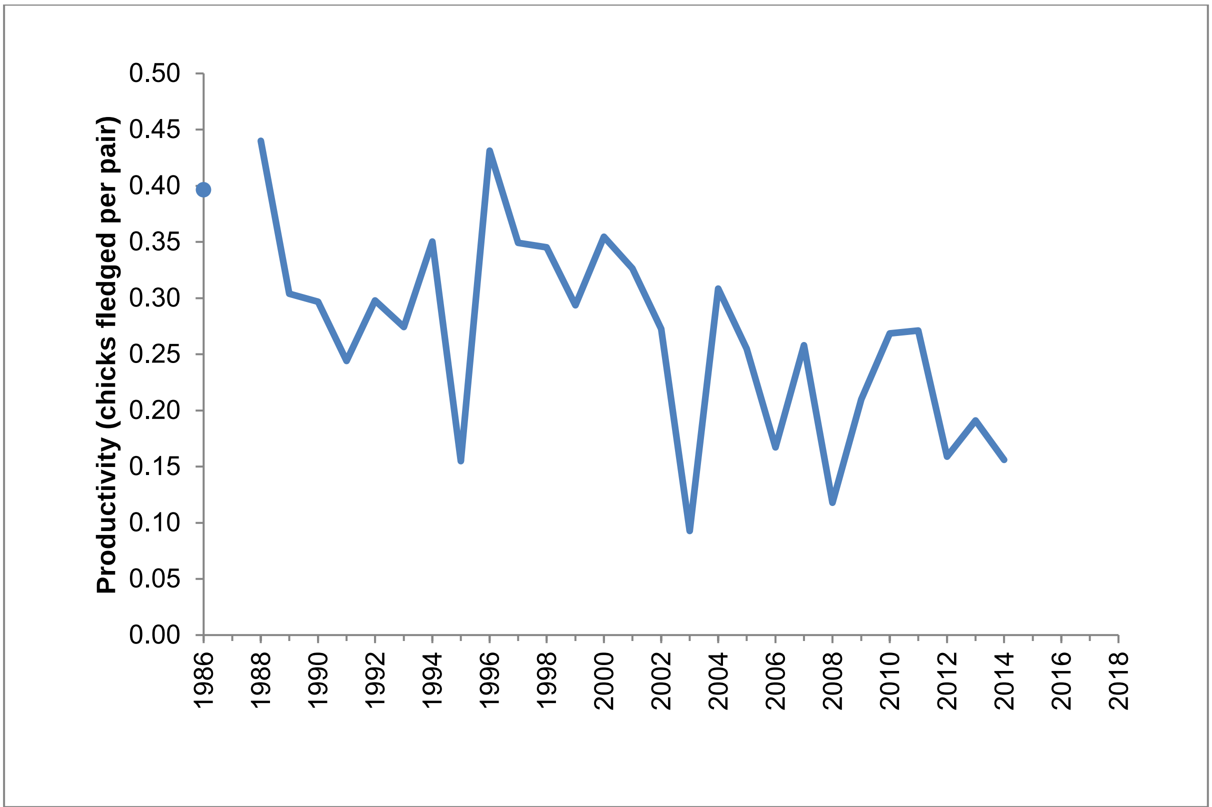

Figure 10. Trend in breeding productivity (no. of chicks fledged per pair) of northern fulmar on the Isle of Man, 1986-2014. Based on SMP data; view the methods of analysis.

Northern fulmar productivity on the Isle of Man has fluctuated greatly over the recording period. However, within this variation there does appear to be a declining trend in productivity since the mid-1990s at least. Productivity was very low in 1995, 2003, 2006, 2008 and from 2012 to 2014. In 1995, an unknown proportion of chicks died from heat stress during a hot and dry summer, and in 2012 low productivity was probably due to high rainfall during June and July. The reasons for low productivity in other years are unknown. From 2015 to 2018, no productivity data on northern fulmar were submitted to the SMP.

Channel Islands

Population estimates and change 1969-2016 (census data)

	Operation Seafarer (1969-70)	**Seabird Colony Register (1984-85)**	**Seabird 2000 (1998-2002)**	**Channel Islands Census (2015-16)**
Population estimate (AOS*)	0	200	317	330

	Operation Seafarer (1969-70)	Seabird Colony Register (1984-85)	Seabird 2000 (1998-2002)	Channel Islands Census (2015-16)
% change since previous census	n/a	n/a	+59	+4

* AOS = Apparently Occupied Sites

Breeding Abundance

During Operation Seafarer, no northern fulmars were recorded on the Channel Islands despite extensive survey coverage. The first recorded breeding was in 1975, on Jersey and Alderney, with Guernsey colonised in 1985 and Sark in 1986. By the time of the Seabird Colony Register, at least 200 pairs were breeding. Seabird 2000 recorded a further increase, of 59%, with 317 AOS counted. In 2015, a Channel Island Seabird Census was carried out which recorded 330 AOS, a decline of 57% compared to Seabird 2000[18].

Productivity

Data submitted to the SMP on the productivity of northern fulmars in the Channel Islands are sparse; thus, no meaningful average productivity value can be given.

Phenology, diet, survival rates

No data have been collected as part of the Seabird Monitoring Programme.

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Partners

Data have been provided to the SMP by the generous contributions of its partners, other organisations and volunteers throughout Britain and Ireland. Partners to the SMP are: BirdWatch Ireland; The British Trust for Ornithology; UK Centre for Ecology and Hydrology; Natural Resources Wales; Department of Environment, Food and Agriculture (Isle of Man); Department of Environment, Heritage and Local Government (Republic of Ireland); States of Guernsey Government; JNCC; Manx Birdlife; Manx National Heritage; The National Trust; National Trust for Scotland; Natural England; Northern Ireland Department of Agriculture, Environment and Rural Affairs ; The Royal Society for the Protection of Birds; Scottish Natural Heritage; Seabird Group; Shetland Oil Terminal Environmental Advisory Group; Scottish Wildlife Trust.

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Manx Shearwater *Puffinus puffinus*

Description

The following has been adapted from original text by Stephen F. Newton, Kate Thompson and P. Ian Mitchell in [Seabird Populations of Britain and Ireland] (with permission from A&C Black, London).

Manx shearwaters spend most of the year at sea returning to land only to breed. They nest in burrows and under boulders and come ashore only under the hours of darkness in order to evade predators such as great skuas and great black-backed gulls. They breed exclusively on islands, usually free of rats *Rattus* sp. that depredate eggs, chicks and adults. Manx shearwaters were believed to have been exterminated from their eponymous colony on the Calf of Man by the introduction of rats from a wrecked ship in the late 18th Century. More recently rats and cats *Felis catus* were responsible for the extirpation of Manx shearwaters from Canna (Lochaber). Those few colonies that occur on islands with rats are generally small and limited in distribution. The exception is on Rum (Lochaber), where the largest single colony in the world coexists with rats, though there is evidence that deleterious impacts are occurring. Coexistence has been allowed by shearwaters nesting on the slopes of the island's mountains at altitudes of more than 450m - higher than rats normally occur, though milder winters in recent years may be increasing the habitable range of rats into the shearwaters' range.

Most of the estimated world population of *c.*340,000–410,000 pairs of Manx shearwaters breed in Britain and Ireland. Of the UK population, 40% breed on Rum, and 50% in Pembrokeshire on the adjacent islands of Skomer, Skokholm and Middleholm (all Dyfed).

Conservation status

Manx shearwater is currently identified as a conservation priority in the following:

Amber listed in Birds of Conservation Concern 4 (2015 update)
further information on Conservation Designations for UK Taxa
Amber listed in Birds of Conservation Concern in Ireland 2014-2019
EC Birds Directive - migratory species

International importance

UK Population	% Biogeographic Population	% World Population
299,700 AOS*	n/a	79.9

* AOS = Apparently Occupied Sites

The UK population figure (rounded to the nearest hundred) was derived from data in Mitchell, P.I., Newton, S.F., Ratcliffe, N. and Dunn, T.E. (eds.) 2004. *Seabird Populations of Britain and Ireland.* Poyser, London. This was also the source of figures for the Biogeographic and World populations.

UK population estimates and change 1969-2002 (census data)

Manx shearwaters' nocturnal and subterranean habits have caused problems for surveyors in the past. Hence, Operation Seafarer and the SCR Census' estimates of 175,000-300,000 pairs and 250,000-300,000 pairs respectively were based solely on order of magnitude estimates and should not be compared to results obtained during Seabird 2000 which represent the first attempt to survey and quantify accurately the number of Manx shearwaters breeding in the UK. Surveyors used tape-playback which involved playing calls of Manx shearwaters to elicit a response from adults occupying burrows during the day. Unfortunately, not all adults present at a colony will respond to the taped calls, thus counts of responses will underestimate numbers and therefore have to be adjusted by a response rate measured at the colony. Some colonies were also surveyed by counting burrow entrances that had visible signs of use, though this method is difficult or impossible to use in colonies that are shared with other burrowers, i.e. rabbits and Atlantic puffins, or where burrow entrances are obscured, i.e. under boulders or in thick vegetation.

The main gaps in survey coverage in the UK were in the northern Isles (where only relict populations remain), Bearasay, Eigg and Muck and the Sanda Islands. However, the combined population of all these islands is thought to be no more than 1,000 apparently occupied burrows.

	Operation Seafarer (1969-70)	Seabird Colony Register (1985-88)	Seabird 2000 (1998-2002)
UK Population estimate (AOS)*	n/a	n/a	299,678
% change since previous census	n/a	n/a	n/a

* AOS = Apparently Occupied Sites

For census results for individual countries and Ireland, the Channel Islands and the Isle of Man see under relevant sections below.

Distribution/abundance

The Seabird 2000 census provides the most comprehensive recent assessment of the distribution and abundance of breeding seabirds. Numbers found in different regions, and a map showing location and size of colonies, are provided in the Seabird 2000 Manx shearwater results page.

The locations sampled during the annual Seabird Monitoring Programme provide some information on distribution and are accessible via the Seabird Monitoring Programme online database

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Annual abundance and productivity by geographical area

With reference to the regional accounts below please note the following.

Breeding abundance: graphs of abundance index with 95% Confidence Levels (CLs) are only shown for a region where the trend produced has been deemed accurate (see methods of analysis). Where a trend was thought to be inaccurate, graphs of abundance at major colonies in a region may be shown instead, particularly if such colonies hold greater than 10% of the regional population, are monitored frequently and may thus help illustrate regional population fluctuations outwith national censuses. Occasionally, too few data have been collected regionally to produce either of these.

Productivity: graphs of productivity are only shown if analysis of productivity data produced a significant result for regional and/or year effects (again see methods of analysis). If results were not significant, then a regional mean productivity value is given. However, on some occasions too few data are available from which to provide a meaningful average. Furthermore, for 11 species where the quality of monitoring data available was considered high, population viability analysis was undertaken at the UK level and the results of this are also reported.

United Kingdom

Breeding abundance

The first comprehensive estimates of population size of Manx shearwater were obtained during the Seabird 2000 Census, when 300,000 pairs were estimated. Over 90% of the UK population is found on the islands of Rum in Scotland and on Skomer and Skokholm in Wales. Due to the logistical difficulty in monitoring this nocturnal and burrow-nesting species, little information exists from which to derive population trends since Seabird 2000, although the colony on Skomer was re-surveyed in 2011[1]. However, census methods used in 1998 and 2011 differed markedly, introducing an element of uncertainty in the results (see 'Wales' tab for details). Bardsey Island, which hosts the third largest colony in the UK, was counted between 2014 and 2016 when an estimated 20,675 AOB were counted, showing an increase of 28% to the numbers recorded during Seabird 2000[2].

Productivity

Because of the logistical difficulties involved, both in visiting remote islands and in collecting data from a nocturnal burrow-nesting seabird, productivity is monitored at only a few Manx shearwater colonies in the UK (three colonies in Wales, two in Scotland and one in Northern Ireland). Analysis has shown that there is no statistically significant annual variation in productivity within the sampled colonies, with Manx shearwaters fledging an average of 0.62 chicks per breeding pair per year between 1986 and 2018.

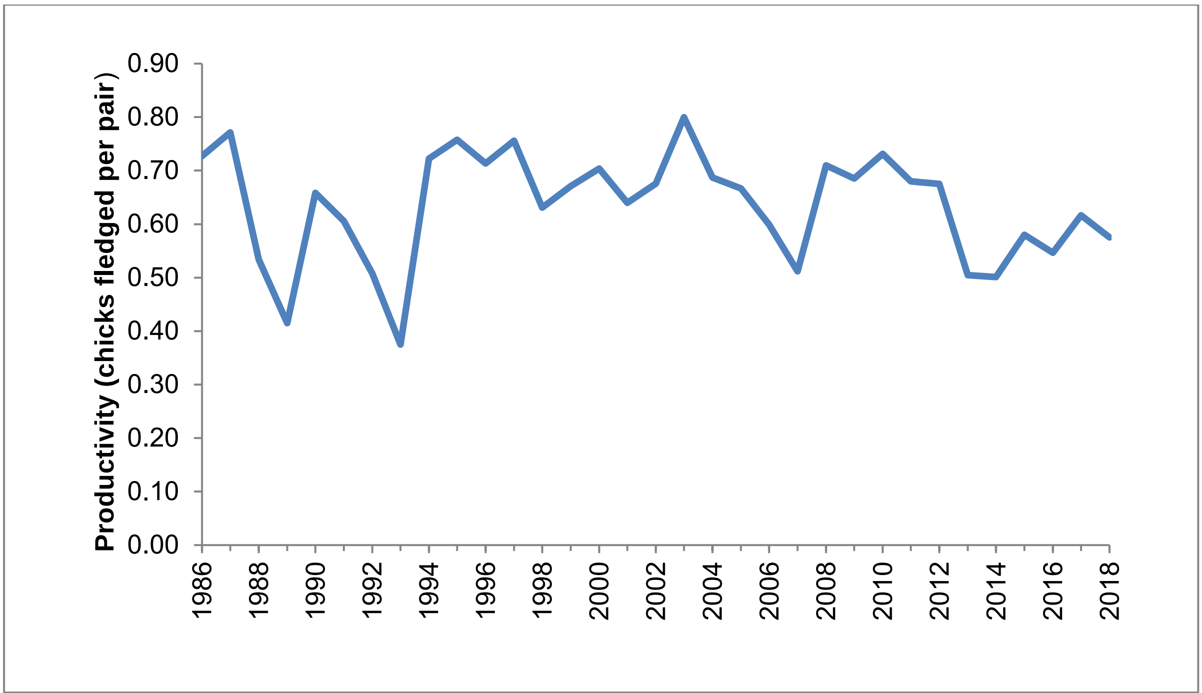

Figure 1. Trend in breeding productivity (no. of chicks fledged per pair) of Manx shearwater in the UK, 1986-2018. Based on SMP data; view the methods of analysis.

Scotland

Population estimates and change 1969-2002 (census data)

	Operation Seafarer (1969-70)	Seabird Colony Register (1985-88)	Seabird 2000 (1998-2002)
Population estimate (AOS*)	n/a	n/a	126,545
% change since previous census	n/a	n/a	n/a

* AOS = Apparently Occupied Sites

Breeding Abundance

The first comprehensive estimates of population size of Manx shearwater in Scotland were obtained during the Seabird 2000 Census, when 126,545 AON were estimated. The majority of these (approximately 120,000 AON) were found on Rum with a further 4,803 AON in the next largest concentration on the island group of St Kilda. Due to the logistical difficulty in monitoring this nocturnal and burrow-nesting species, no information exists on population trends at these two largest colonies since Seabird 2000. The Treshnish Isles (1,283 AON) were the only other colonies holding over one thousand pairs. The Treshnish Isles were re-surveyed in 2018 when 1,992 AON were counted, an increase of 55%.

Productivity

Productivity data are currently collected on Rum, Canna and Sanday. Analysis for these colonies showed no statistically significant variation in average productivity between 1986 and 2018, with approximately 0.62 chicks fledged per AOS per year. On Canna, Manx shearwater used to be present in good numbers (1,500 AOB in the mid-1970s) but suffered very poor productivity due to predation by Brown rats *Rattus norvegicus* and, by 2000, had been virtually wiped out [3,4]. Following rat eradication in 2006[5], the first nesting shearwater was detected in 2009, but by 2018 this had grown to only two nests. However, productivity has increased from an average of 0.6 in the 1980s to 0.74 in 2017[6] and 0.76 chicks fledged per pair in 2018[7].
The shearwater colony on Rum is subject to predation by a large population of brown rats. The impact of this predation is unclear and it is not known whether the colony is stable or declining[8]. Productivity in study plots on Rum was an average of 0.67 chicks per pair between 1986 to 2018

England

Population estimates and change 1969-2002 (census data)

	Operation Seafarer (1969-70)	Seabird Colony Register (1985-88)	Seabird 2000 (1998-2002)
Population estimate (AOS*)	n/a	n/a	367
% change since previous census	n/a	n/a	n/a

* AOS = Apparently Occupied Sites

Breeding Abundance

At the time of the Seabird 200 census, the relatively few Manx shearwaters breeding in England were located at several sites on the Isles of Scilly (201 AOS), and on the island of Lundy (166 AOS). A project to eradicate rats from Lundy, completed in spring 2004, appears to have benefited breeding Manx shearwaters, with a series of whole-island surveys showing a significant increase in the population since Seabird 2000; with 1,081 AOS in 2008, 3,451 AOS in 2013 and 5,504 AOB in 2018 - almost 15 times the English population found during Seabird 2000[9,10]. A survey of the Isles of Scilly in 2015 found 439 AOS on the same islands counted during Seabird 2000, however an additional 84 AOS were also found at five other locations[11], an increase of 160% since Seabird 2000.

Productivity

No systematic data on the productivity of Manx shearwaters in England have been submitted to the SMP.

Wales

Population estimates and change 1969-2002 (census data)

	Operation Seafarer (1969-70)	Seabird Colony Register (1985-88)	Seabird 2000 (1998-2002)
Population estimate (AOS*)	n/a	n/a	168,133
% change since previous census	n/a	n/a	n/a

* AOS = Apparently Occupied Sites

Breeding Abundance

Scotland and Wales together hold over 90% of the UK population of Manx shearwaters. The first comprehensive estimate of their population size in Wales was obtained during the Seabird 2000 census, when 101,800 pairs were estimated on Skomer, 46,200 pairs on Skokholm and a maximum of 16,183 pairs on Bardsey. Smaller colonies of 1,000-3,000 pairs were recorded on Middleholm and Ramsey. Until recently, little information existed on population trends. However, a census carried out in 2011 estimated the Skomer population to be 316,070 AOS[1]. This figure is greatly in excess of the estimate made just 13 years earlier and would require an increase of approximately 9% *per annum*, a very high value for a bird with a low reproductive rate (*c.*0.65) and a long period of deferred maturity. Various reasons for the apparent increase (e.g. immigration, lowering of age of first breeding, estimation of response rate) were considered and thought unlikely. However, survey methods used in 1998 and 2011 differed markedly so it was concluded that the methods used in one (or both) of the surveys were sufficiently flawed to account for the difference, or part of it[1].A census was undertaken on Bardsey Island between 2014 and 2016 when an estimated 20,675 AOB were counted, showing an increase of 28% to the number recorded during Seabird 2000[2].

Productivity

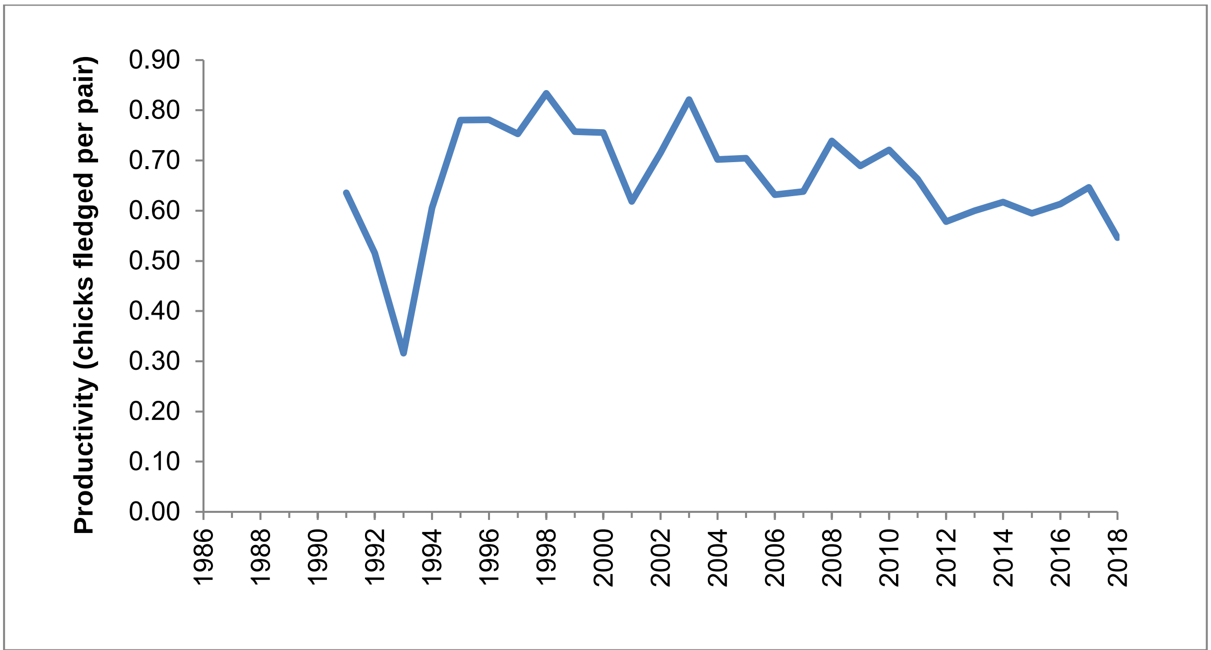

Figure 2. Trend in breeding productivity (no. of chicks fledged per pair) of Manx shearwater in Wales, 1986-2018. Based on SMP data; view the methods of analysis.

Productivity data are currently collected mostly from colonies on Skomer (since 1991) and Bardsey (since 1996), with the addition of data from Skokholm since 2013. Since 1995, mean productivity in Wales has been relatively high but variable. Detailed monitoring and reporting has been undertaken on Skomer and highlights some problems faced by the shearwaters breeding there. Very low productivity was recorded between 1992 and 1994; the reasons for this are largely unknown although very wet weather in May 1993 (the poorest breeding season to date) flooded many burrows on Skomer. A lack of food may have affected productivity on Skomer in 2007 and 2008; annual comparison of chick growth and adult food provisioning behaviour found that birds bred later and chicks attained lower peak and fledging masses than in any previous recorded year dating back to 1965[12]. These changes were accompanied by a reduction in parental attendance at the colony, which was probably the result of parents switching to a dual foraging strategy in 2007 and 2008. These events were linked to higher sea surface temperature in the preceding winter and to a reduction in prey quality, as indicated by the mean body mass of two-year-old herring[12]. On Skomer in 2012, lack of food around hatching time was considered to have had the highest effect on productivity (0.41 fledged young per egg laid) although wet weather and the flooding of a small number of burrows may also have contributed. In 2014, the highest productivity was recorded since 1998 (0.71) but then began to decline to reach 0.45 in 2018, the second lowest figure since studies began in 1995 and the lowest since 2012. This is considerably lower than the five-year average of 0.59 (2014-2018) and the long-term 1991-2018 average of 0.59[13]. It is unknown what caused this low productivity on Skomer but it might be localised as productivity on Skokholm was in 2018 0.70, 0.10 lower than in 2017 (when a remarkable 0.80 chicks fledged per pair).

On Bardsey, flooding also reduced productivity in some parts of the study area in 2012, although this was compensated for by high values of success in drier areas. A greater threat on Bardsey were carrion crows *Corvus corone* which exploited accessible nest chambers in several years between 2002 and 2007 at least. In 2017 and 2018, productivity on Bardsey was poor at 0.65 and 0.60 chicks fledged per pair, respectively. In fact, in 2018 Manx shearwaters on Bardsey had the poorest breeding season since monitoring began in 1998 (18% lower than the mean (0.73 ±s.e.0.02). The previous lowest productivity was 0.61 in 2013, when the weather like in 2018 was also cold and generally poor through the spring. However, the main reason for low productivity might be that population size on Bardsey is reaching its maximum capacity, increasing competition for food and space which will also result in more new and inexperienced pairs breeding on the island[2].

Northern Ireland

Population estimates and change 1969-2002 (census data)

	Operation Seafarer (1969-70)	Seabird Colony Register (1985-88)	Seabird 2000 (1998-2002)
Population estimate (AOS*)	n/a	n/a	4,633
% change since previous census	n/a	n/a	n/a

* AOS = Apparently Occupied Sites

Breeding Abundance

The first comprehensive estimates of population size of Manx shearwater in Northern Ireland were obtained during the Seabird 2000 census. Only two colonies are known, both on the Copeland Islands; Big Copeland was estimated to hold 1,766 AOS, with a further 2,867 AOS on nearby Lighthouse Island (total 4,633). The islands were re-surveyed in 2007, when 1,406 AOS were recorded on Big Copeland and 3,444 AOS on Lighthouse Island (total 4,850) indicating that numbers had changed little overall[14]. Changes at the respective islands between these two censuses (-20% on Big Island and +20% on Lighthouse) may be associated with logistical difficulties in surveying this nocturnal, burrow-nesting species.

Productivity

Productivity data were collected annually on Lighthouse Island, one of the Copeland Islands, between 2007 and 2013[15]. On average 0.73 chicks were fledged per pair per year up to 2013. In 2018, a sample of 117 study burrows contained 31 chicks in August. If this number is assumed to be the number of fledged chicks, productivity would be 0.78 chicks per pair. Methods differed between years; therefore, this productivity estimate should be treated with caution[16]. No data from Lighthouse Island has been submitted to the SMP since 2013.

Republic of Ireland

Population estimates and change 1969-2002 (census data)

	Operation Seafarer (1969-70)	Seabird Colony Register (1985-88)	Seabird 2000 (1998-2002)
Population estimate (AOS*)	n/a	n/a	32,545
% change since previous census	n/a	n/a	n/a

* AOS = Apparently Occupied Sites

Breeding Abundance

During Seabird 2000, 32,545 pairs of Manx shearwater were recorded in the Republic of Ireland although several small colonies each probably holding a few hundred pairs were not surveyed. The main concentration of colonies was in the south-west on the offshore islands of County Kerry, several of which each held between 2,000-10,000 pairs. In County Galway, Cruagh held 3,286 pairs with small numbers on a couple of other islands. A few small colonies were recorded in counties Wexford and Dublin. Due to the logistical difficulty in monitoring this nocturnal and burrow-nesting species, no information exists as to population trends since Seabird 2000. The recent Republic of Ireland seabird census (2015-2018) did not publish data on Manx shearwater due to on-going survey work[17].

Productivity

No systematic data on the productivity of Manx shearwaters in the Republic of Ireland have been submitted to the SMP. Thus, data is only available from Northern Ireland (see relevant section of report).

All Ireland

Population estimates and change 1969-2002 (census data)

	Operation Seafarer (1969-70)	Seabird Colony Register (1985-88)	Seabird 2000 (1998-2002)
Population estimate (AOS*)	n/a	n/a	37,178
% change since previous census	n/a	n/a	n/a

* AOS = Apparently Occupied Sites

Breeding Abundance

The first comprehensive estimates of population size of Manx shearwater for Ireland were obtained during the Seabird 2000 Census, when 37,178 pairs were estimated. The majority of these (approximately 33,000 pairs) were found in the Republic of Ireland where many colonies exist on offshore islands. In contrast, only two colonies are known in Northern Ireland, both on the Copeland Islands. During Seabird 2000, Big Copeland was estimated to hold 1,766 pairs with a further 2,867 pairs on nearby Lighthouse Island (total 4,633). The islands were re-surveyed in 2007, when 1,406 pairs were recorded on Big Copeland and 3,444 pairs on Lighthouse Island (total 4,850) indicating that numbers had changed little overall[14]. Changes at the respective islands between these two censuses (-20% on Big Island and +20% on Lighthouse) may be associated with logistical difficulties in surveying this nocturnal, burrow-nesting species. For the same reason, no other information exists as to population trends for the whole of Ireland since Seabird 2000. The recent Republic of Ireland seabird census (2015-2018) did not publish data on Manx shearwater due to on-going survey work[17].

Productivity

No systematic data on the productivity of Manx shearwaters in the Republic of Ireland have been submitted to the SMP. Thus, data is only available from Northern Ireland where productivity has been monitored annually on Lighthouse Island, one of the Copeland Islands, between 2007 and 2013[14,15]. On average 0.73 chicks were fledged per pair per year up to 2013. In 2018, a sample of 117 study burrows contained 31 chicks in August. If this number is assumed to be the number of fledged chicks, productivity would be 0.78 chicks per pair. Methods differed between years; therefore, this productivity estimate should be treated with caution[16].

Isle of Man

Population estimates and change 1969-2002 (census data)

	Operation Seafarer (1969-70)	Seabird Colony Register (1984-85)	Seabird 2000 (1998-2002)	Isle of Man Census (2017-18)
Population estimate (AON/AOS*)	n/a	n/a	34	536
% change since previous census	n/a	n/a	n/a	+1,576

* AOS = Apparently Occupied Sites

Breeding Abundance

The population of Manx shearwaters on the Isle of Man is small and confined to the Calf of Man; during Seabird 2000 only 34 AOS were recorded. In 2005, tape playback methods obtained responses from 104 burrows and 91 burrows were found to be occupied in 2010. Since the completion of a rat eradication programme during autumn and winter of 2012/13, the population has increased substantially; counts of apparently occupied burrows between 2015 and 2018 recorded 464, 265, 400 and 536 in each year respectively[18].

Productivity

No systematic data on the productivity of Manx shearwaters on the Isle of Man have been submitted to the SMP.

Channel Islands

Population estimates and change 1969-2002 (census data)

	Operation Seafarer (1969-70)	Seabird Colony Register (1985-88)	Seabird 2000 (1998-2002)
Population estimate (AOS*)	n/a	55	10
% change since previous census	n/a	n/a	-82

* AOS = Apparently Occupied Sites

Breeding Abundance

Numbers have declined from 55 AOS records during the Seabird Colony Register to 10 AOS during the Seabird 2000 census. During the Channel Island Seabird Census of 2015, several burrows were identified that may have been occupied in the traditional breeding area on the island of Jethou and, in 2016, Manx shearwaters were heard calling over Burhou, Alderney. Further survey work is, therefore, required to ascertain the current size of the Manx shearwater population[19].

Productivity

No systematic data on the productivity of Manx shearwaters on the Channel Islands have been submitted to the SMP.

UK phenology, diet, survival rate

Phenology

No systematic data on phenology (timing of life-cycle events) have been collected as part of the SMP.

Diet

No data on diet have been collected as part of the SMP.

Survival rate

Figure 3 shows the annual estimated adult survival rate of breeding Manx shearwaters on Skomer, the only colony at which this parameter is monitored in the UK. Adult survival since 1994 shows an increase between 1994 and 2000, then a decline to 2015 (to the same value as 1994) followed by an increase to 2018[13]. The survival rate for adult breeding Manx shearwaters at Skomer from 2016 to 2017 was 0.87%, slightly above the study average (1978-2016: 0.86) and the average since the study became more robust in 1992 (1992-2016): 0.88. As reported previously, these survival estimates are low, both in comparison with more detailed studies carried out in the 1960s and 70s on Skokholm (when productivity was 93-96% and 94%, respectively) and with what might be expected for a species with such a low reproductive rate[20,21].

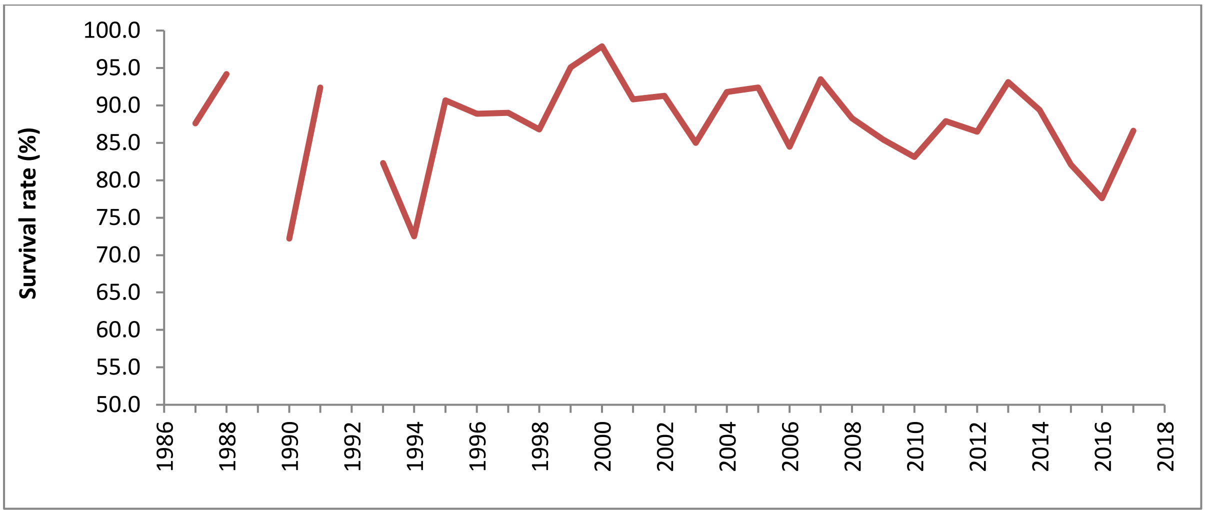

Figure 3. Estimated adult survival rate of Manx shearwaters on Skomer, 1986-2017.

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European Storm-petrel *Hydrobates pelagicus*

Description

The following has been adapted from original text by P. Ian Mitchell and Stephen F. Newton in [Seabird Populations of Britain and Ireland] (with permission from A&C Black, London).

European storm-petrels are pelagic, returning to land only to breed, choosing to nest on remote offshore islands where nocturnal access by surveyors is often difficult and dangerous. They nest below ground, appearing above ground only during darkness and are much more widespread in the UK than Manx shearwaters and Leach's storm-petrels. These characteristics of European storm-petrel behaviour and distribution have meant that obtaining accurate estimates of breeding numbers has been virtually impossible.

Conservation status

European storm-petrel is currently identified as a conservation priority in the following:

Amber listed in Birds of Conservation Concern 4 (2015 update)
further information on Conservation Designations for UK Taxa
Amber listed in Birds of Conservation Concern in Ireland 2014-2019
EC Birds Directive - listed in Annex 1 and as a migratory species

International importance

UK Population	% Biogeographic Population	% World Population
25,700 AOS*	5.2 (ssp. *pelagicus*)	5.1

* AOS = Apparently Occupied Sites

The UK population figure (rounded to the nearest hundred) was derived from data in Mitchell, P.I., Newton, S.F., Ratcliffe, N. and Dunn, T.E. (eds.) 2004. *Seabird Populations of Britain and Ireland.* Poyser, London. This was also the source of figures for the Biogeographic and World populations.

UK population estimates and change 1969-2002 (census data)

Both Operation Seafarer and the SCR Census had largely to guess at the location of many colonies, let alone make an accurate estimate of size. Consequently, the results of Seabird 2000 represented the first accurate baseline estimate of the number of European storm-petrels breeding in the UK. A method called tape-playback was used to count apparently occupied sites (AOS) of breeding European storm-petrels. The method involves playing the species' calls to elicit a response from adults occupying burrows during the day whilst incubating. Unfortunately, not all adults present at a colony will respond to taped calls, thus counts of responses underestimate the number of AOS and have to be adjusted by a response rate measured at the colony.

Evidence of possible or probable breeding (e.g. birds present in suitable habitat during the breeding season) obtained during Operation Seafarer and SCR Census and from other sources was used as a basis for selection of sites to survey during Seabird 2000. However, of the 164 islands (in Britain and Ireland) that were surveyed for European storm-petrels during Seabird 2000, breeding had not previously been confirmed or suspected on 98 islands. Surveys were not possible on 17 islands (e.g. inaccessible colonies) where breeding was either confirmed or suspected during the last 30 years and on a further eight where breeding had been suggested from historical records prior to 1969. It is highly unlikely that any substantial colonies (i.e. greater than 100 pairs) were missed.

	Operation Seafarer (1969-70)	**Seabird Colony Register (1985-88)**	**Seabird 2000 (1998-2002)**
UK Population estimate (AOS*)	n/a	n/a	25,650
% change since previous census	n/a	n/a	n/a

* AOS = Apparently Occupied Sites

For census results for individual countries and Ireland, the Channel Islands and the Isle of Man see under relevant sections below.

Distribution/abundance

The Seabird 2000 census provides the most comprehensive recent assessment of the distribution and abundance of breeding seabirds. Numbers found in different regions, and a map showing the location and size of colonies, is provided in the Seabird 2000 European storm-petrel results page.

The locations sampled during the annual Seabird Monitoring Programme provide some information on distribution and are accessible via the Seabird Monitoring Programme online database.

Annual abundance and productivity by geographical area

With reference to the regional accounts below please note the following.

Breeding abundance: graphs of abundance index with 95% CLs are only shown for a region where the trend produced has been deemed accurate (see methods of analysis). Where a trend was thought to be inaccurate, graphs of abundance at major colonies in a region may be shown instead, particularly if such colonies hold greater than 10% of the regional population, are monitored frequently and may thus help illustrate regional population fluctuations outwith national censuses. Occasionally, too few data have been collected regionally to produce either of these.

Productivity: graphs of productivity are only shown if analysis of productivity data produced a significant result for regional and/or year effects (again see methods of analysis). If results were not significant, then a regional mean productivity value is given. However, on some occasions too few data are available from which to provide a meaningful average. Furthermore, for 11 species where the quality of monitoring data available was considered high, population viability analysis was undertaken at the UK level and the results of this are also reported.

United Kingdom

Breeding abundance

The first comprehensive estimate of European storm-petrel population size was obtained during the Seabird 2000 Census, when 25,650 AOS were recorded. Due to the logistical difficulty in monitoring of this nocturnal and burrow-nesting species, little information exists on population trends, although survey work at the largest UK colony on Mousa has been carried out more frequently between 2008 and 2015. In 2008, Mousa was estimated to hold 11,781 AOS, an almost 120% increase on the 5,410 AOS recorded during Seabird 2000. A tape playback survey in 2015 estimated a population size of 10,778 AOS[1], which still represented an almost 100% increased since Seabird 2000. A similar increase of 109% occurred on the Treshnish Isles of Fladda, Lunga and Sgeir a' Chaisteil from 4,127 in 1996 to 8,664 AOS in 2018. These recent counts may reflect an overall increase in the UK population size of European storm-petrels, although this will only be known for certain when the Seabirds Count census is complete.

Productivity

No systematic data on the productivity of European storm-petrels in the UK have been submitted to the SMP.

Scotland

Population estimates and change 1969-2002 (census data)

	Operation Seafarer (1969-70)	Seabird Colony Register (1985-88)	Seabird 2000 (1998-2002)
Population estimate (AOS*)	n/a	n/a	21,370
% change since previous census	n/a	n/a	n/a

* AOS = Apparently Occupied Sites

Breeding Abundance

Seabird 2000 estimated that Scotland held 21,370 AOS of European storm-petrel, the first comprehensive estimate obtained for the species. Almost all colonies are found on offshore islands to the west and north of the mainland. Over 50 colonies are known but only three held more than 1,000 AOS during Seabird 2000; Mousa (5,410 (from data re-analysed in 2010, originally 6,800 AOS)[2], Treshnish Isles (5,040) and Priest Island (4,400). Due to the logistical difficulty in monitoring this nocturnal and burrow-nesting species, little information exists on population trends. A tape playback survey on Mousa in 2015 estimated a population size of 10,778 AOS[1], which represented an almost 100% increased since Seabird 2000. A similar increase of 109% occurred on the Treshnish Isles of Fladda, Lunga and Sgeir a' Chaisteil from 4,127 in 1996 to 8,664 AOS in 2018. On Priest Island, a survey estimated 4,259 AOS in 2014 which represented a slight (-3.2%) decline since the island was surveyed during Seabird 2000. These recent counts may reflect an overall increase in the Scottish population size of European storm-petrels, although this will only be known for certain when the Seabirds Count census is complete.

Productivity

No systematic data on the productivity of European storm-petrels in Scotland have been submitted to the SMP.

England

Population estimates and change 1969-2002 (census data)

	Operation Seafarer (1969-70)	Seabird Colony Register (1985-88)	Seabird 2000 (1998-2002)
Population estimate (AOS*)	n/a	n/a	1,475
% change since previous census	n/a	n/a	n/a

* AOS = Apparently Occupied Sites

Breeding Abundance

In England, European storm-petrel is confined as a breeding species to the Isles of Scilly. Intensive surveys during Seabird 2000, covering all islands in the archipelago, found 11 colonies and estimated a total population of 1,475 AOS with the majority of these on Annet (938). Melledgan (140 AOS) and Round Island (183 AOS) were the only other islands to hold over 100 AOS. A repeat survey of the archipelago in 2015 found 14 colonies holding 1,299 AOS3[3], indicating that the English population on the islands may have experienced a slight decline since Seabird 2000.

Productivity

No systematic data on the productivity of European storm-petrels in England have been submitted to the SMP.

Wales

Population estimates and change 1969-2002 (census data)

	Operation Seafarer (1969-70)	Seabird Colony Register (1985-88)	Seabird 2000 (1998-2002)
Population estimate (AOS*)	n/a	n/a	2,805
% change since previous census	n/a	n/a	n/a

* AOS = Apparently Occupied Sites

Breeding Abundance

Seabird 2000 found 2,805 AOS of European storm-petrel breeding at six colonies in Wales. Only one small colony was found in Gwynedd, on Bardsey, with the other five in Dyfed. By far the most important colony was on Skokholm where 2,450 AOS were found. Due to the logistical difficulty in monitoring this nocturnal and burrow-nesting species, little information exists on population trends, with all recent data collected from a few small colonies on Bishop and Clerks Islands, and Grassholm. In 2010, 149 AOS were recorded on the Bishop and Clerks Islands compared to 108 AOS during Seabird 2000. The small colony on Grassholm (where 4, 3 and 11 AOS were recorded in 2010, 2012 and 2014, respectively), was unknown at the time of Seabird 2000. On Ramsey Island seven AOS were recorded in 2018. For the first time since monitoring began, two AOS were found in 2018 on Middleholm which is part of the Skomer, Skokholm and the Seas off Pembrokeshire SPA.

Productivity

No systematic data on the productivity of European storm-petrels in Wales have been submitted to the SMP.

Northern Ireland

European storm-petrels do not breed in Northern Ireland.

Republic of Ireland

Population estimates and change 1969-2002 (census data)

	Operation Seafarer (1969-70)	Seabird Colony Register (1985-88)	Seabird 2000 (1998-2002)
Population estimate (AOS*)	n/a	n/a	99,065
% change since previous census	n/a	n/a	n/a

* AOS = Apparently Occupied Sites

Breeding Abundance

During Seabird 2000, 30 colonies in the Republic of Ireland were known to hold breeding European storm-petrels, all located on the west coast between counties Kerry and Donegal. Of these, 12 were surveyed but the populations of the remaining colonies could only be estimated. Surveyed colonies were found to hold 57,110 pairs with another 41,955 pairs estimated for un-surveyed colonies. The most important colonies surveyed were all in Co. Kerry; Inishtooskert (27,297 pairs), Great Skellig (9,994 pairs), Inishvickillane (6,394 pairs) and Puffin Island (5,177 pairs). Only three other colonies hold over 1,000 pairs. The largest colony for which an estimate only was made was Inishtearaght at 15,000 pairs with five others each estimated to hold between 3,000 and 8,000 pairs. Due to the logistical difficulty in monitoring this nocturnal and burrow-nesting species, no information exists as to population trends and no sizable colonies have been re-surveyed since Seabird 2000. The recent Republic of Ireland Seabird Census (2015-2018) did not publish a population estimate of European storm petrels due to on-going survey work[4].

Productivity

No systematic data on the productivity of European storm-petrels in the Republic of Ireland have been submitted to the SMP.

All Ireland

Population estimates and change 1969-2002 (census data)

	Operation Seafarer (1969-70)	Seabird Colony Register (1985-88)	Seabird 2000 (1998-2002)
Population estimate (AOS*)	n/a	n/a	99,065
% change since previous census	n/a	n/a	n/a

* AOS = Apparently Occupied Sites

Breeding Abundance

Within Ireland, the European storm-petrel nests only in the Republic of Ireland. Thus, all data and text for the Republic of Ireland is also pertinent to the status of the species for the whole of Ireland.

Productivity

No systematic data on productivity have been collected as part of the SMP.

Isle of Man

European storm-petrel does not breed on the Isle of Man.

Channel Islands

Population estimates and change 1969-2002 (census data)

	Operation Seafarer (1969-70)	**Seabird Colony Register (1985-88)**	**Seabird 2000 (1998-2002)**
Population estimate (AOS*)	n/a	n/a	60
% change since previous census	n/a	n/a	n/a

* AOS = Apparently Occupied Sites

Breeding Abundance

During Seabird 2000, only one colony in the Channel Islands was surveyed, Burhou which lies off the coast of Alderney. This small colony held 60 AOS in 2002. Several more colonies are suspected to exist but probably hold no more than a few pairs. Due to the logistical difficulty in monitoring this nocturnal and burrow-nesting species, little information exists as to population trend at Burhou during the last 16 years. Routine monitoring at this colony recorded 90 AOS in 2006, falling to 40 AOS in 2008 with only 28 AOS recorded in 2011. No data has been submitted to the SMP since the 2015 census.

Productivity

No systematic data on the productivity of European storm-petrels on the Channel Islands have been submitted to the SMP.

UK phenology, diet, survival rates

No data have been collected as part of the Seabird Monitoring Programme.

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Leach's Storm-petrel *Oceanodroma leucorhoa*

Description

The following has been adapted from original text by P. Ian Mitchell in *Seabird Populations of Britain and Ireland* *(with permission from A&C Black, London).*

Leach's storm-petrel is a truly oceanic species, only returning to remote island colonies during hours of darkness. It ranges widely in both the Atlantic and Pacific Oceans. In the east Atlantic, breeding colonies are confined to a few islands off the coasts of Iceland, the Faeroes and Norway, as well as just eight remote islands and archipelagos situated along the Atlantic Frontier of Britain and Ireland. Obtaining estimates of breeding numbers has been virtually impossible in the past, due to the species' nocturnal and subterranean breeding habits plus accessing the remote colonies during the hours of darkness is often difficult and dangerous.

Conservation status

Leach's storm-petrel is currently identified as a conservation priority in the following:

Amber listed in Birds of Conservation Concern 4 (2015 update)
Wildlife and Countryside Act 1981 - protected under Schedule 1
(further information on Conservation Designations for UK Taxa)
Red listed in Birds of Conservation Concern in Ireland 2014-2019EC Birds Directive - listed in Annex 1 and as a migratory species

International importance

UK Population	% Biogeographic Population	% World Population
48,000 AOS*	0.9 (ssp. leucorhoa)	0.5

* AOS = Apparently Occupied Sites

The UK population figure (rounded to the nearest hundred) was derived from data in Mitchell, P.I., Newton, S.F., Ratcliffe, N. and Dunn, T.E. (eds.) 2004. *Seabird Populations of Britain and Ireland.* Poyser, London. This was also the source of figures for the Biogeographic and World populations.

UK population estimates and change 1969-2002 (census data)

Seabird 2000 used a method called tape-playback to survey apparently occupied sites (AOS) of breeding Leach's storm-petrels. The method involves playing calls of the species to elicit a response from adults hidden in burrows during the day whilst incubating. Unfortunately, not all Leach's storm-petrels present at a colony will respond to the taped calls; thus, counts of responses will underestimate the number of AOS and have to be adjusted by a response rate measured at the colony.

Ninety-four percent of the UK population breeds on four islands in the St Kilda archipelago (Western Isles), with the remainder on the Flannan Isles (Western Isles), three other islands in the Western Isles and two islands in Shetland. There is also one Irish colony. Colonisation of islands by Leach's storm-petrels is dependent on the absence of mammalian predators and on proximity to their feeding grounds. The species feeds on macro-zooplankton (e.g. myctophids, amphipods, euphausiids) and during the east Atlantic breeding season is confined to feeding in areas beyond the continental shelf break (deeper than 200m). All Leach's storm-petrel colonies are within 37-67km of the shelf break and 65-119km from the bottom of the continental slope (200m-1000m).

	Operation Seafarer (1969-70)	Seabird Colony Register (1985-88)	Seabird 2000 (1998-2002)
UK Population estimate (AOS*)	n/a	n/a	48,047
% change since previous census	n/a	n/a	n/a

* AOS = Apparently Occupied Sites

For census results for individual countries and Ireland, the Channel Islands and the Isle of Man see under relevant sections below.

Distribution/abundance

The Seabird 2000 census provides the most comprehensive recent assessment of the distribution and abundance of breeding seabirds. Numbers found in different regions, and a map showing the location and size of colonies, is provided in the Seabird 2000 Leach's storm-petrel results page.

The locations sampled during the annual Seabird Monitoring Programme provide some information on distribution and are accessible via the Seabird Monitoring Programme online database

Annual abundance and productivity by geographical area

With reference to the regional accounts below please note the following.

Breeding abundance: graphs of abundance index with 95% CLs are only shown for a region where the trend produced has been deemed accurate (see methods of analysis). Where a trend was thought to be inaccurate, graphs of abundance at major colonies in a region may be shown instead, particularly if such colonies hold greater than 10% of the regional population, are monitored frequently and may thus help illustrate regional population fluctuations outwith national censuses. Occasionally, too few data have been collected regionally to produce either of these.

Productivity: graphs of productivity are only shown if analysis of productivity data produced a significant result for regional and/or year effects (again see methods of analysis). If results were not significant, then a regional mean productivity value is given. However, on some occasions too few data are available from which to provide a meaningful average. Furthermore, for 11 species where the quality of monitoring data available was considered high, population viability analysis was undertaken at the UK level and the results of this are also reported.

United Kingdom

Breeding abundance

The first comprehensive estimates of Leach's storm-petrel population size were obtained during the Seabird 2000 Census, when 48,000 AOS were counted. Due to the logistical difficulty in monitoring this nocturnal and burrow-nesting species, little information exists on population trends. However, repeat surveys of the largest colony in the UK, on Dun in the St Kilda archipelago, which at the last census held around 58% of the UK population, have shown a decline. Surveys have shown that the population here fell from 27,800 AOS in 1999 to 14,500 in 2003, with a repeat survey in 2006 estimating 12,800 AOS[1]. A decline has also recently been found on North Rona, where 1,084 AOS were estimated in 2001. A repeat survey there in 2009 estimated the population to be 713 AOS – a fall of 34%[2]. The causes of both these declines are unknown, although predation at breeding colonies by great skua *Stercorarius skua* and great black-backed gulls *Larus marinus* has been suggested as a possible cause. On St Kilda, it was estimated that great skuas can consume as many as 21,000 individual Leach's storm-petrels per year[3], predominantly non-breeding individuals, which could subsequently impact on the size of the colony through reduced recruitment. Other causes of decline could include reduced adult survival or a decrease in food supply during chick rearing, but no information is currently available on these. In Shetland, where small numbers of Leach's storm-petrel nest, tape-playback surveys of 10 islands in 2011 found the species only on two of these; 13 responses were recorded on Gruney with a single responding bird on Gloup Holm. Examination of four burrows from which birds had responded on Gruney found that two actually contained non-breeders. While sample sizes here are very small, burrow occupancy by non-breeders is unexpected and further work is required to determine the extent of this behaviour, as it has potential implications for the interpretation of Leach's storm-petrel population estimates derived from tape-playback surveys[4].

Productivity

Data submitted to the SMP on the productivity of Leach's storm-petrels at Scottish colonies is sparse; thus, no meaningful average productivity value can be given.

Scotland

Population estimates and change 1969-2002 (census data)

	Operation Seafarer (1969-70)	**Seabird Colony Register (1985-88)**	**Seabird 2000 (1998-2002)**
Population estimate (AOS*)	n/a	n/a	48,047
% change since previous census	n/a	n/a	n/a

* AOS = Apparently Occupied Sites

Breeding Abundance

The first comprehensive estimates of population size of Leach's storm-petrel were obtained during the Seabird 2000 Census, when 48,000 pairs were counted. Due to the logistical difficulty in monitoring this nocturnal and burrow-nesting species, little information exists on population trends. However, repeat surveys of the largest colony in the UK, on Dun in the St Kilda archipelago, which at the last census held around 58% of the UK population, have shown a decline. Surveys revealed that the population here fell from 27,800 AOS in 1999 to 14,500 in 2003, with a repeat survey in 2006 estimating 12,800 AOS[1]. A decline has also been found on North Rona, where 1,084 AOS were estimated in 2001. A repeat survey there in 2009 estimated the population at 713 AOS – a fall of 34%[2]. The causes of both these declines are not known, although predation at breeding colonies by great skua *Stercorarius skua* and great black-backed gulls *Larus marinus* has been suggested as a possible cause. On St Kilda, it was estimated that great skuas can consume as many as 21,000 individual Leach's storm-petrels per year[3], predominantly non-breeders, which could subsequently impact on the size of the colony through reduced recruitment. Other causes of decline include reduced adult survival or a decrease in food supply during chick rearing, but no information is currently available on these. In Shetland, where small numbers of Leach's storm-petrel nest, tape-playback surveys of 10 islands in 2011 found the species only on two islands; 13 responses were recorded on Gruney with a single responding bird on Gloup Holm. Examination of four burrows from which birds had responded on Gruney found that two actually contained non-breeders. While sample sizes here are very small, burrow occupancy by non-breeders is unexpected and further work is required to determine the extent of this behaviour as it has potential implications for the interpretation of Leach's storm-petrel population estimates derived from tape-playback surveys[4]. Due to the logistical difficulty in monitoring this nocturnal and burrow-nesting species, no information exists as to population trends and no sizable colonies have been re-surveyed since Seabird 2000.

Productivity

Data submitted to the SMP on the productivity of Leach's storm-petrels in Scotland are sparse; thus, no meaningful average productivity value can be given.

England

Leach's storm-petrel does not breed in England.

Wales

Leach's storm-petrel does not breed in Wales.

Northern Ireland

Leach's storm-petrel does not breed in Northern Ireland.

Republic of Ireland

Population estimates and change 1969-2002 (census data)

	Operation Seafarer (1969-70)	Seabird Colony Register (1985-88)	Seabird 2000 (1998-2002)
Population estimate (AOS*)	n/a	n/a	310
% change since previous census	n/a	n/a	n/a

* AOS = Apparently Occupied Sites

Breeding Abundance

The first comprehensive estimate of the Leach's storm-petrel breeding population size in the Republic of Ireland were obtained during the Seabird 2000 Census. Only one colony was found, on the Stags of Broadhaven which held 310 AOS. Two other suspected colonies, on Great Skellig and Inishglora, were also surveyed but no Leach's storm-petrels were found nesting. In 2015, Great Skellig was re-surveyed but no Leach's storm-petrels were found nesting[5].

Productivity

No systematic data on the productivity of Leach's storm-petrels in the Republic of Ireland have been submitted to the SMP.

All Ireland

Population estimates and change 1969-2002 (census data)

	Operation Seafarer (1969-70)	Seabird Colony Register (1985-88)	Seabird 2000 (1998-2002)
Population estimate (AOS*)	n/a	n/a	310
% change since previous census	n/a	n/a	n/a

* AOS = Apparently Occupied Sites

Breeding Abundance

Within Ireland, Leach's storm-petrel only nest in the Republic of Ireland. Thus, all data and text for the Republic of Ireland is also pertinent to the status of the species for the whole of Ireland.

Productivity

This species does not breed in Northern Ireland and no systematic data on the productivity of Leach's storm-petrels in the Republic of Ireland have been submitted to the SMP.

Isle of Man

Leach's storm-petrel does not breed on the Isle of Man.

Channel Islands

Leach's storm-petrel does not breed on the Channel Islands.

UK phenology, diet, survival rates

No data have been collected as part of the Seabird Monitoring Programme.

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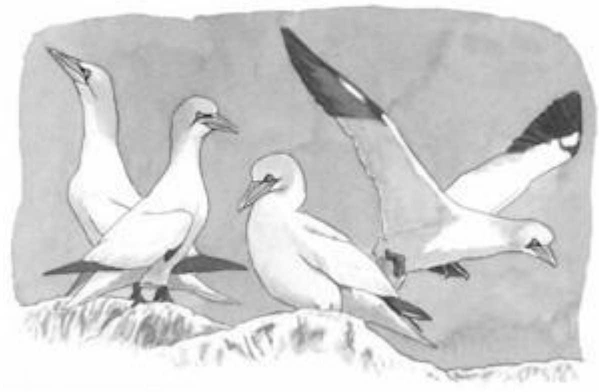
Northern Gannet *Morus bassanus*

Description



The following has been adapted from original text by Sarah Wanless and Mike P. Harris in [Seabird Populations of Britain and Ireland] (with permission from A&C Black, London).

The northern gannet is the largest seabird in the North Atlantic. Gannets often perform dramatic plunge dives from high in the sky to catch fish up to depths of 20m and can stay submerged for over half a minute. They also feed from the surface on small shoaling fish like sandeels and on discards from fishing vessels, where their large size helps them out-compete most other scavenging species. The northern gannet is endemic to the North Atlantic and most breed in Britain and Ireland. There are 21 gannetries around Britain and Ireland, with most being on remote offshore islands and stacks, and two on mainland cliffs. Some colonies have been occupied for centuries and are large and conspicuous.

Conservation status

Northern gannet is currently identified as a conservation priority in the following:

Amber listed in Birds of Conservation Concern 4 (2015 update)
further information on Conservation Designations for UK Taxa
Amber listed in Birds of Conservation Concern in Ireland 2014-2019
EC Birds Directive - migratory species

International importance

UK Population	% Biogeographic Population	% World Population
293,200 AOS*	418,441	55.6

*AON = Apparently Occupied Nests

The UK population figure (rounded to the nearest hundred), Biogeographic and World population figures were derived from data in Murray, S., Harris, M.P. and Wanless, S. 2015.

The status of the gannet in Scotland in 2013-14. *Scottish Birds* 35: 3-18. However, figures were updated according to the latest Bempton Cliffs (Humberside) and Grassholm (Dyfed) counts in 2015, taking into account an increase of 1,151 AOS.

UK population estimates and change 1969-2013/14 (census data)

There is a long tradition of counting northern gannets and the world population has been censused several times since the early 1900s, revealing a remarkably consistent increase of 2.0% per annum. While many of the smaller gannetries are surveyed annually, the larger colonies on remote offshore islands can only be censused by aerial survey which is a formidable undertaking. A complete census was carried out in 1994/95 and therefore full coverage of the species was not a top priority for Seabird 2000. Further censuses were conducted in 2004/05 and 2013-15.

	Operation Seafarer (1969-70)	Seabird Colony Register (1984-85)	Gannet Census (2003-04)	Gannet Census (2013-15)
UK Population estimate (AON/AOS*)	113,006	157,247	218,546	293,161
% change since previous census	n/a	+39	+39	+34**

*AON = Apparently Occupied Nests/Sites

** change between 2003-04 and 2013-15 censuses.

For census results for individual countries, the Channel Islands and the Isle of Man see relevant sections below.

Distribution/abundance

The Seabird 2000 census provides the most comprehensive recent assessment of the distribution and abundance of breeding seabirds. Although many large northern gannet colonies were not surveyed during this census, numbers found in different regions, and a map showing the location and size of colonies, is provided in the Seabird 2000 northern gannet results page.

The locations sampled during the annual Seabird Monitoring Programme provide some information on distribution and are accessible via the Seabird Monitoring Programme online database.

Annual abundance and productivity by geographical area

With reference to the regional accounts below please note the following.

Breeding abundance: graphs of abundance index with 95% CLs are only shown for a region where the trend produced has been deemed accurate (see methods of analysis).

Where a trend was thought to be inaccurate, graphs of abundance at major colonies in a region may be shown instead, particularly if such colonies hold greater than 10% of the regional population, are monitored frequently and may thus help illustrate regional population fluctuations outwith national censuses. Occasionally, too few data have been collected regionally to produce either of these.

Productivity: graphs of productivity are only shown if analysis of productivity data produced a significant result for regional and/or year effects (again see methods of analysis). If results were not significant, then a regional mean productivity value is given. However, on some occasions too few data are available from which to provide a meaningful average. Furthermore, for 11 species where the quality of monitoring data available was considered high, population viability analysis was undertaken at the UK level and the results of this are also reported.

United Kingdom

Breeding abundance

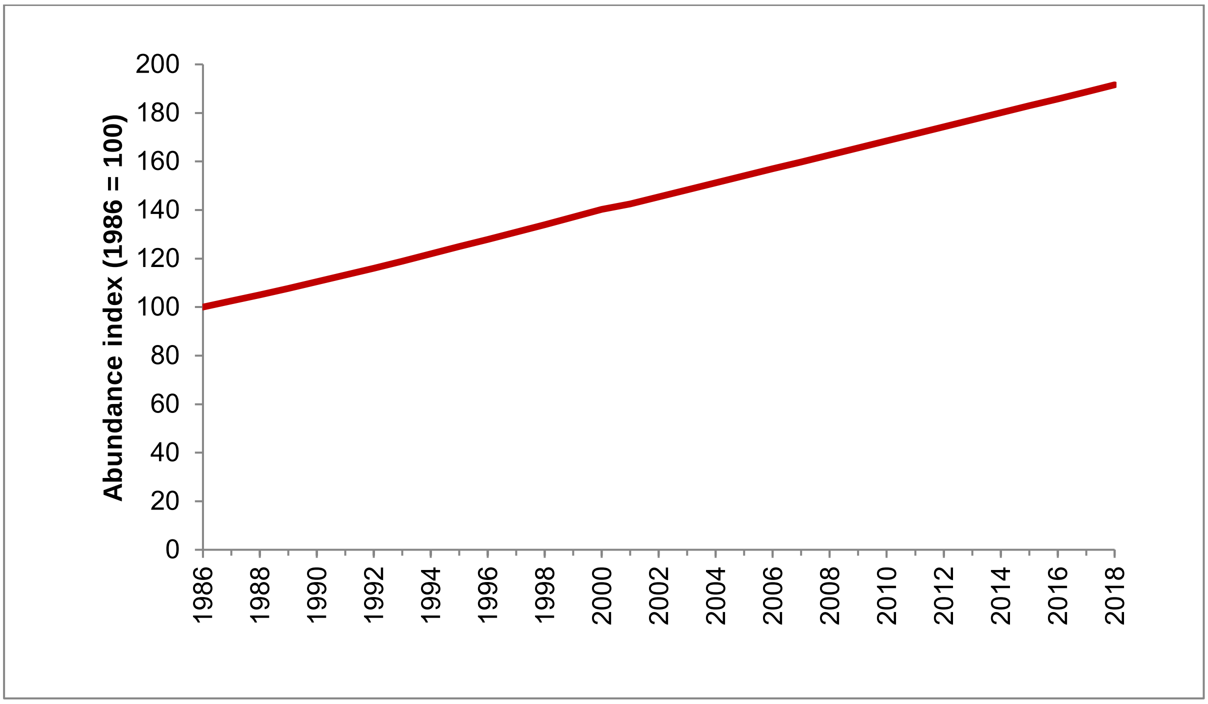


Figure 1. Trend in UK abundance index of northern gannet 1986-2018.

Given the logistical problems of surveying gannet colonies, annual sampling of all but the smaller colonies is impractical. The few colonies counted annually tend to be the smaller and increase at a greater rate than larger colonies (see Table 1), leading to bias in any estimated trends. Instead, decadal censuses have been undertaken since the 1980s[1,2,3]. The last census to cover all UK gannetries was carried out over two breeding seasons in 2003 and 2004[4]. Figure 1 shows interpolated and extrapolated values from these complete censuses, expressed as an index. Over the long-term, the UK gannet population increased from 113,000 pairs in 1969/70 to 175,000 in 1984/85 to 218,000 AON in 2003/04 and reached 293,161 AON between 2013-2015.

In 2013 and 2014 all Scottish colonies were surveyed[5, 6, 7, 8], while Bempton Cliffs (England) and Grassholm (Wales) were counted in 2015 (Table 1). Most have continued to increase, except the gannetries at Sule Stack and Scar Rocks, and new gannetries continue to be formed (Berneray, Western Isles) or re-colonised (Rockall, Western Isles). Since the 2013-15 gannet census, a few colonies have been surveyed again resulting in an additional 2,117 AOS (the dominant survey unit). Most colonies recorded an increase, however, at Troup Head numbers reduced from 6,456 AOS in 2014 to 3,847 AOS in 2016.

Table 1. Recent counts at UK gannetries compared to counts during the 2003-04 census (all data are of AON/AOS).

Area	Colony	2003-04 Census	Count (year)	Change (%)	% *per annum*
Shetland	Hermaness	15,633	25,580 2014	+64	+4.6
Shetland	Noss	8,652	11,786 2014	+36	+2.9
Shetland	Foula	919	1,226 2013	+33	+3.3
Shetland	Fair Isle	1,875	4,291 2018	+129	+6.1
Orkney	Noup Head	14	1,148 2018	+8,100	+37.0
Orkney	Sule Skerry	57	4,600 2018	+7,970	+36.8
Orkney	Sule Stack	4,618	4,550 2013	-1	-0.2
East Coast	Troup Head	1,547	3,847 2016	+149	+7.9
East Coast	Bass Rock	49,098	75,259 2014	+53	+4.4
East Coast	Bempton Cliffs	3,940	13,392 2017	+240	+9.9
Minches	Berneray	Not counted	8 2016	n/a	n/a
Irish Sea	Ailsa Craig	27,130	33,226 2014	+22	+2.0
Irish Sea	Scar Rocks	2,394	2,375 2014	-1	-0.1
Irish Sea	Grassholm	32,094	36,011 2015	+12	+1.1
North West	Sula Sgeir	9,225	11,230 2013	+22	+2.2
North West	Flannan Isles	2,760	5,280 2013	+91	+7.5
North West	St Kilda	59,622	60,290 2013	+1	+0.1
North West	Rockall	Not counted	28 2014	n/a	n/a

Productivity

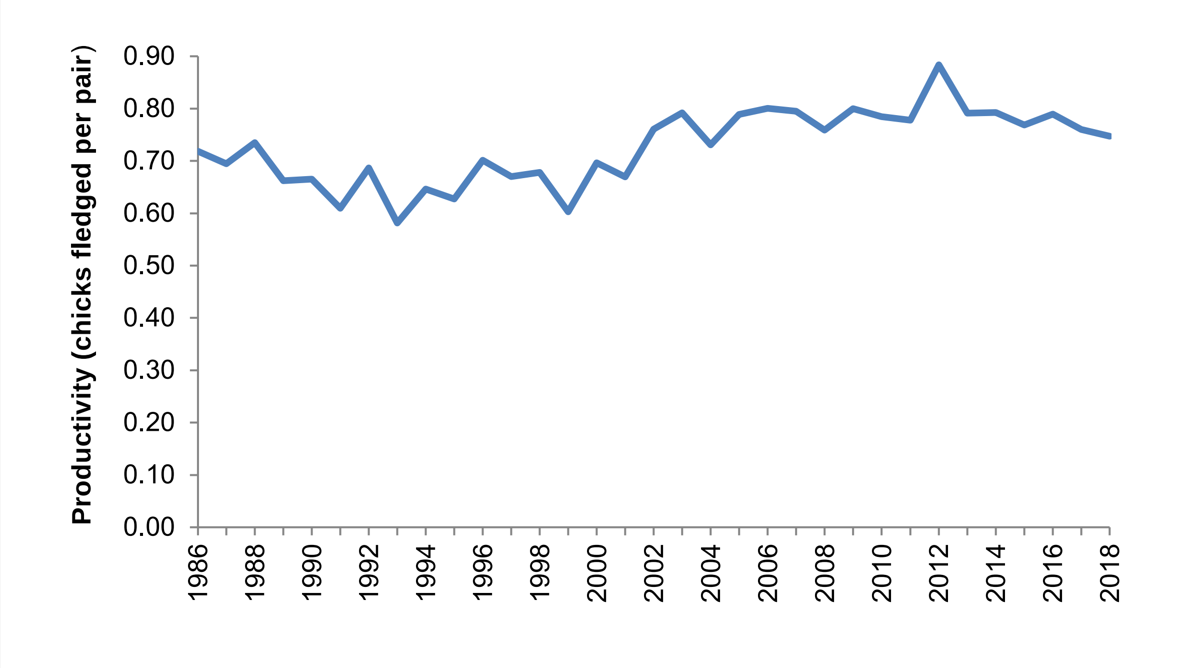


Figure 2. Trend in UK breeding productivity (no. of chicks fledged per pair) of northern gannet 1986-2018. Based on SMP data; view the methods of analysis.

Gannet productivity has varied very little since monitoring started in 1986. At monitored colonies, productivity generally lies between 0.60-0.90 chicks per breeding pair over the study period (Figure 2). It is thought that because gannets can travel great distances (up to 500 km) from their nest site to forage[9] and they are adaptable in what they eat (including live fish of various species and discards from the fishing industry), they rarely encounter food shortages. This and high adult survival rates, may be the main factors behind observed population increases.

Analysis of the SMP dataset found mean productivity of northern gannets to be 0.69 chicks per nest per year between 1986 and 2008[10]. The quality of the dataset meant a change in productivity of 10% or more would be detected with confidence. Using available life history information (population size, clutch size, age at first breeding and survival rates of different age classes), it was predicted that if this level of productivity were maintained then northern gannet populations may decline by 59% within 25 years. Results from population viability analysis further suggested that if productivity is less than one, such a decline is likely. Because populations of northern gannets are currently increasing and productivity can never be above one for a species that lays a single egg this suggests that survival (which is not currently measured as part of the SMP), or some other parameter, may be underestimated.

The new EU Common Fisheries Policy came into effect in 2014. It included the obligation that all catches of regulated commercial species had to be landed and counted against quota. From 2015 to 2019, the landing obligation was phased in across the majority of EU fisheries. This is likely to impact on seabird populations that feed on discards. Species native to the north-east Atlantic that are currently extensively exploiting fishery discards are kittiwake, herring gull, lesser black-backed gull, great black-backed gull, great skua, northern fulmar and the northern gannet[11]. It is, therefore, possible that this decline in discards may affect the growth rate of the UK gannet population in the future.

Scotland

Population estimates and change 1969-2013/4 (census data)

	Operation Seafarer (1969-70)	**Seabird Colony Register (1985-88)**	**Gannet Census (2003-2004)**	**Gannet Census (2013-2014)**
Population estimate (AON/AOS*)	96,860	127,867	182,511	243,505
% change since previous census	n/a	+32	+43	+33

* AON = Apparently Occupied Nests/Sites

Breeding Abundance

The few colonies counted annually tend to be smaller colonies, which often increase at a greater rate than large colonies leading to bias in any estimated trends. Thus, only data from national censuses, when all colonies are surveyed, are considered to show an accurate trend. Northern gannet populations in Scotland have been steadily increasing since 1969/70 when 96,860 AON/AOS were recorded; numbers increased by 32% by the time of the Seabird Colony Register and then by 43% by the time of the gannet census in 2003 and 2004. All 16 gannet colonies in Scotland were counted in 2013 and 2014 (see Table 1 in UK section) with combined colony totals indicating that Scotland currently holds 243,505 apparently occupied sites (58% and 46% of the east Atlantic and world populations, respectively)[5]. Numbers were divided very unevenly between the colonies with Bass Rock (now the world's largest colony), St Kilda and Ailsa Craig together holding 70% of the Scottish population. A new colony on Berneray was formed in 2007 and held eight AON in 2016. Breeding may also now be regular on Rockall where 28 AOS were recorded in 2014, although all nests were subsequently lost in a storm[5]. Numbers at St Kilda, Sule Stack and Scar Rocks were stable, but all other colonies had increased, some spectacularly. The colony on Sula Sgeir, the only one where the harvesting of young for food occurs, increased by 22% between 2004 and 2013, reversing the trend recorded between 1994 and 2004 during which this colony declined by 12%. Many of the gannet colonies appear to have plenty of unused, suitable nesting habitat and thus have considerable potential for further expansion. Overall the Scottish population increased by 33% between the 2003/04 and 2013/14 gannet censuses, or by 2.9% per annum[5].

Note: During analysis of the 2014 survey, the images used to assess the population at Bass Rock in 2009 were re-counted. This gave a revised colony total of 60,853 AOS for 2009[7], 5,371 AOS higher than the total given in previous editions of this report and elsewhere. However, this change for 2009 does not affect any of the data presented in the tables for the UK and Scotland.

Productivity

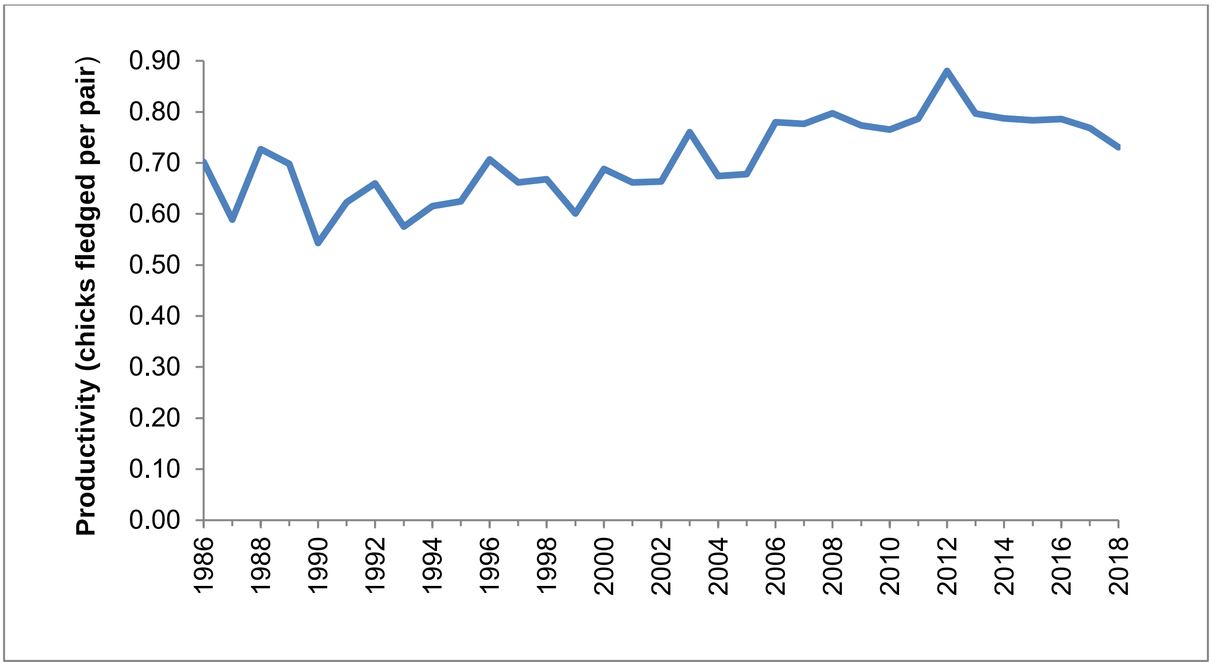


Figure 3. Trend in breeding productivity (no. of chicks fledged per pair) of northern gannet in Scotland, 1986-2018. Based on SMP data; view the methods of analysis.

Data on northern gannet productivity have been collected each year at several gannetries in Scotland. Productivity at these monitored colonies has generally been high, seldom lower than 0.60 chicks fledged per pair, and appears to have increased over the study period. Productivity was low in the years 1987, 1990 and 1993, but the reasons for this are unclear. However, in 1993, productivity was severely reduced on Ailsa Craig due to poor weather (including snow and ice) in May. In 2015, northern gannet again had a successful breeding season on Ailsa Craig fledging 0.90 chicks per pair. During 2018, gannets in Scotland suffered a freezing spring followed by a very warm summer which may have contributed to the low productivity recorded that year (0.73 chicks fledged per pair).

England

Population estimates and change 1969-2013/14 (census data)

	Operation Seafarer (1969-70)	Seabird Colony Register (1985-88)	Gannet Census (2003-2004)	Gannet Census (2013-2015)
Population estimate (AON/AOS*)	18	780	3,940	12,494
% change since previous census	n/a	+4,233	+405	+217**

* AON = Apparently Occupied Nests/Sites

** change between census in 2003-04 and colony surveyed in 2015.

Breeding Abundance

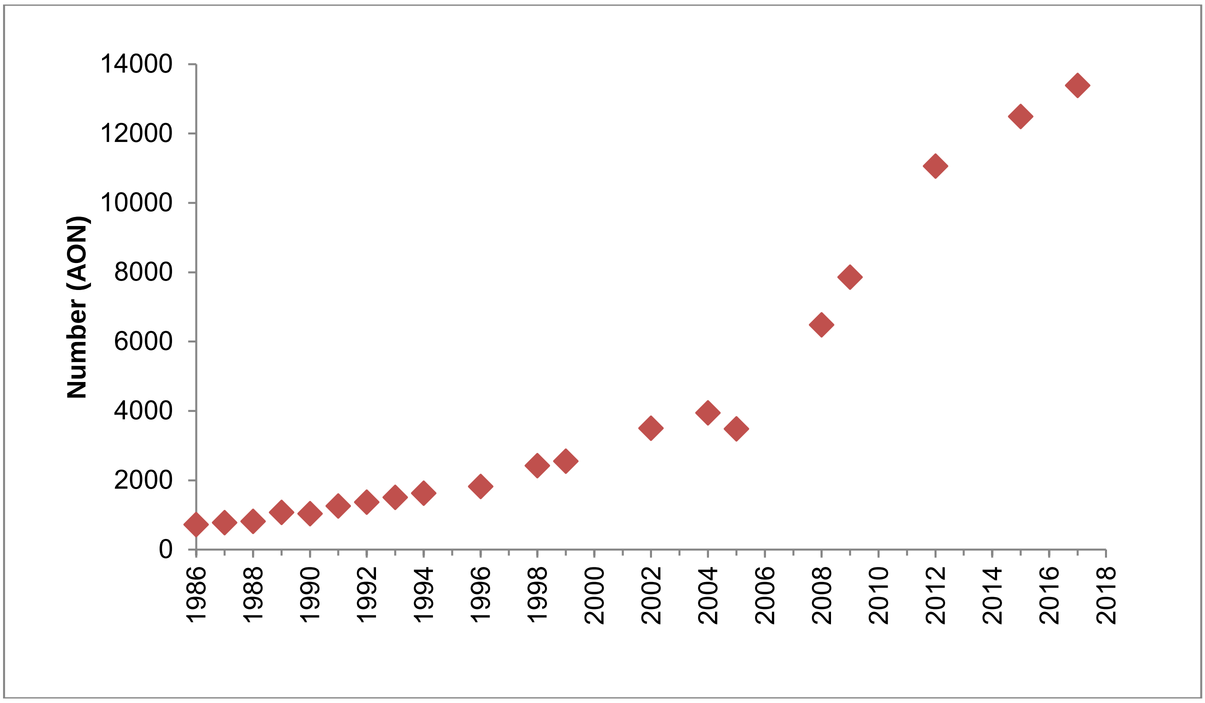


Figure 4. Abundance of northern gannet at Bempton Cliffs, England, 1986-2017.

Only one northern gannet colony exists in England, at Bempton Cliffs in Humberside. This colony has been increasing steadily since its formation in the 1960s although, in recent years, the growth rate appears to have escalated. A steep increase can be seen between counts in 2004 and 2017, although there is an uncharacteristic decrease in 2005. Between 2008 and 2009 numbers increased by just over 900 AON from 6,954 to 7,859. During the survey in 2009, a further 1,470 non-breeding immature birds were counted in 'club' areas of the gannetry which suggested further increases could be expected. Predictably, the high rate of increase was sustained in 2017, when 13,392 nests were counted. On average, approximately 700 AON have been added each year since 2009. Gannets at Bempton Cliffs were not counted in 2018.

Productivity

The productivity of gannets breeding at Bempton Cliffs shows no statistically significant variation over time; on average 0.80 chicks were fledged per nest between 1986 and 2018.

Wales

Population estimates and change 1969-2013/14 (census data)

	Operation Seafarer (1969-70)	**Seabird Colony Register (1985-88)**	**Gannet Census (2003-2004)**	**Gannet Census (2013-2015)**
Population estimate (AON/AOS*)	16,128	28,545	32,095	39,011

	Operation Seafarer (1969-70)	Seabird Colony Register (1985-88)	Gannet Census (2003-2004)	Gannet Census (2013-2015)
% change since previous census	n/a	+77	+12	+21**

* AON = Apparently Occupied Nests/Sites

** change between census in 2003-04 and colony surveyed in 2015.

Breeding Abundance

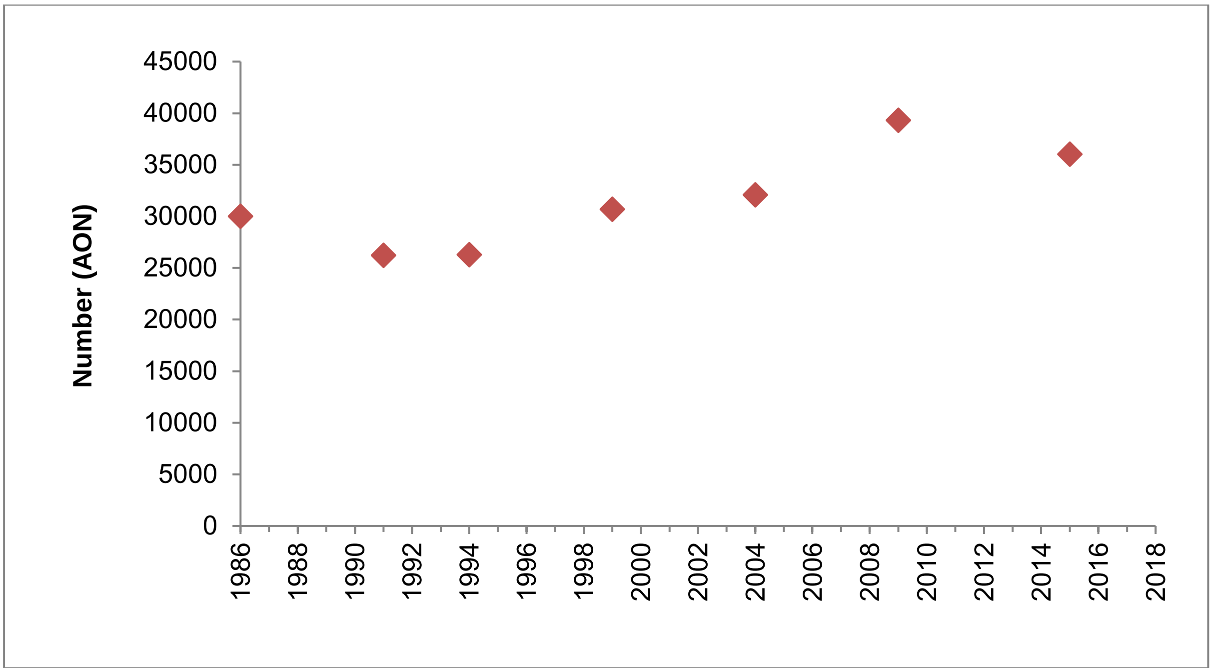


Figure 5. Abundance of northern gannet on Grassholm, Wales, 1986-2015.

There is just a single gannet colony in Wales, although occasionally single pairs have set-up territories elsewhere without colonies becoming established. Changes in the size of the Grassholm gannetry have been documented since its foundation around 1820. Since the 1940s, when 6,000 apparently occupied sites (AOS) were estimated, the colony has grown rapidly, with 15,500 AOS estimated by aerial survey in 1964. Since 1984, counts have been made from aerial photographs, varying in quality of resolution and coverage. In 2009, using high resolution digital images, 39,282 AOS were recorded - making it the third largest gannetry in the UK and Ireland. The most recent survey in 2015 counted 36,011 AOS. Directly comparable with counts in 1984, 1999 and 2004, in terms of image quality and coverage, the 2015 count suggests that the colony has decreased by 8% since 2009.

Productivity

Productivity data have been collected on Grassholm since 2002. Analysis shows no statistically significant variation over time; an average of 0.71 chicks are fledged per nest each year.

Northern Ireland

Northern gannet does not breed in Northern Ireland.

Republic of Ireland

Population estimates and change 1969-2013-13/14 (census data)

	Operation Seafarer (1969-70)	Seabird Colony Register (1985-88)	Gannet Census (2004)	Gannet Census (2013-14)
Population estimate (AON/AOS*)	21,655	24,740	36,111	47,946
% change since previous census	n/a	+14	+46	+32**

* AON = Apparently Occupied Nests/Sites

** change between census in 2003-04 and colony surveyed in 2011.

Breeding Abundance

Census results indicate that northern gannet populations in the Republic of Ireland have been increasing since 1969/70. In 2004, when all gannetries in Ireland were counted, five colonies were known (Little Skellig, Bull Rock, Great Saltee Ireland's Eye and Clare Island), supporting 36,111 AOS. A census of gannet colonies in Ireland in 2013-2014 showed an increase of 32.8% (47,946 AOS) compared to the 2004 census[12]. A new (sixth) colony on Lambay had established since the last census (in 2007) and significant increases at all sites were recorded, although Ireland's Eye apparently reached capacity between 2004 and 2014. The largest proportion of the Irish population nests on Little Skellig, which held 29,683 AOS in 2004 and 35,294 AOS in 2014, an increase of 19%. Factors underlying the sustained growth of the Irish gannet population are not known, but food supply cannot be a limiting factor up to the present time. Recent changes to the EU Common Fisheries Policy have led to a reduction in discards which may, in due course, effect gannet population growth[11]. No northern gannet abundance data from the Republic of Ireland have been submitted to the SMP since 2015.

Productivity

Data submitted to the SMP on the productivity of northern gannets in the Republic of Ireland are sparse; thus, no meaningful average productivity value can be given.

All Ireland

Population estimates and change 1969-2013/14 (census data)

	Operation Seafarer (1969-70)	Seabird Colony Register (1985-88)	Gannet Census (2004)	Gannet Census (2013-14)
Population estimate (AON/AOS*)	21,655	24,740	36,111	47,946
% change since previous census	n/a	+14	+46	+32**

* AON = Apparently Occupied Nests/Sites

** change between census in 2003-04 and colonies surveyed in 2013-14.

Breeding Abundance

Within Ireland, the northern gannet only breeds in the Republic of Ireland. Thus, all data and text for the Republic of Ireland is also pertinent to the status of the species for the whole of Ireland.

Productivity

This species does not breed in Northern Ireland and data submitted to the SMP on the productivity of northern gannets in the Republic of Ireland are sparse; thus, no meaningful average productivity value can be given.

Isle of Man

Northern gannet does not breed on the Isle of Man.

Channel Islands

Population estimates and change 1969-2015 (census data)

	Operation Seafarer (1969-70)	Seabird Colony Register (1985-88)	Seabird 2000 (1998-2002)	Channel Islands Census (2015)
Population estimate (AON/AOS*)	3,000	4,521	5,920	8,686
% change since previous census	n/a	+51	+31	+47

* AON = Apparently Occupied Nests/Sites

Breeding Abundance

Figure 6. Abundance of northern gannet on Ortac and Les Etacs, 1986-2015.

There are two gannetries in the Channel Islands, on Ortac and Les Etacs, which became established during 1940-45. Small in size compared to some other gannet colonies around the British and Irish coastlines, they nevertheless also show the familiar upward trend in numbers since Operation Seafarer visible at other gannetries. However, the most recent surveys, in 2015, recorded 2,777 AON on Ortac with 5,909 AON on Les Etacs. In summary, Les Etacs has apparently been increasing at a steady rate since 1986 while numbers on Ortac appear relatively stable over the same time period[13].

Productivity

Data submitted to the SMP on the productivity of northern gannets on the Channel Islands are sparse; thus, no meaningful average productivity value can be given.

UK phenology, diet, survival rates

No data have been collected as part of the Seabird Monitoring Programme.

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Great Cormorant *Phalacrocorax carbo*

Description

The following has been adapted from original text by Robin M. Sellers in Seabird Populations of Britain and Ireland (with permission from A&C Black, London).

Historically, great cormorants have been regarded as primarily coastal birds in Britain and Ireland, but during the last 40 years there has been a gradual shift of wintering quarters inland, to the extent that almost every lowland lake and river has some. In England, the number nesting inland in trees has increased from just 151 pairs at one colony in 1986 to 1,334 pairs at 35 colonies in 1999-2002. This growth of inland colonies has been fuelled by the immigration of the sub-species *P. c. sinensis* from continental Europe. *P. c. carbo* nests predominantly on the coast and constitutes most of the UK population, which accounts for 13% of the world population that is restricted to the northern Atlantic coasts.

Conservation status

Great cormorant is currently identified as a conservation priority in the following:

Green listed in Birds of Conservation Concern 4 (2015 update)
(further information on Conservation Designations for UK Taxa)
Amber listed in Birds of Conservation Concern in Ireland 2014-2019
EC Birds Directive - migratory species

International importance

UK Population	% Biogeographic Population	% World Population
8,900 AON*	2.4 (ssp. *carbo/sinensis*)	1.5

*AON = Apparently Occupied Nests

The UK population figure (rounded to the nearest hundred) was derived from data in Mitchell, P.I., Newton, S.F., Ratcliffe, N. and Dunn, T.E. (eds.) 2004. *Seabird Populations of*

Britain and Ireland. Poyser, London. This was also the source of figures for the Biogeographic and World populations.

Note: The UK population figure above includes data from both inland and coastal colonies hence differs from that tabled below.

UK population estimates and change 1969-2002 (census data)

Great cormorants build large conspicuous nests with coastal colonies normally situated on stacks, rocky islets, cliffs or rocky promontories. Many colonies persist at the same location for long periods, but others come and go or suddenly shift location – the presence of a colony in one year is no guarantee that there will be one there the following year. This introduces uncertainty in population size when counts from a number of years have to be combined, as was the case during all three national censuses. To limit this problem, an effort was made during Seabird 2000 to reduce the number of years over which counts were obtained. However, the timing of breeding by different pairs of great cormorants within the same colony is not always synchronous resulting in no guarantee that a single count of the nests will reflect precisely the true number of breeding attempts. Seabird 2000, like previous censuses, conducted a single count at an optimum time within a given year (1 May-25 June), so population estimates are comparable although the absolute size of the breeding population is probably underestimated.

	Operation Seafarer (1969-70)	**Seabird Colony Register (1985-88)**	**Seabird 2000 (1998-2002)**
UK Population estimate (AON*) **Inland** **Total**	**6,071**	**6,610**	**7,238** **1,646** **8,884**
% change since previous census	n/a	+9	+10

*AON = Apparently Occupied Nests

Note: Inland colonies were not counted during the first two national censuses, so, to enable direct comparison, the percentage change refers to coastal colonies only.

For census results for individual countries and Ireland, the Channel Islands and the Isle of Man, see under relevant sections below.

Distribution/abundance

The Seabird 2000 census provides the most comprehensive recent assessment of the distribution and abundance of breeding seabirds. Numbers found in different regions, and a map showing the location and size of colonies, is provided in the Seabird 2000 great cormorant results page.

The locations sampled during the annual Seabird Monitoring Programme provide some information on distribution and are accessible via the Seabird Monitoring Programme online database

Annual abundance and productivity by geographical area

With reference to the regional accounts below please note the following.

Breeding abundance: graphs of abundance index with 95% CLs are only shown for a region where the trend produced has been deemed accurate (see methods of analysis). Where a trend was thought to be inaccurate, graphs of abundance at major colonies in a region may be shown instead, particularly if such colonies hold greater than 10% of the regional population, are monitored frequently and may thus help illustrate regional population fluctuations outwith national censuses. Occasionally, too few data have been collected regionally to produce either of these.

Productivity: graphs of productivity are only shown if analysis of productivity data produced a significant result for regional and/or year effects (again see methods of analysis). If results were not significant, then a regional mean productivity value is given. However, on some occasions too few data are available from which to provide a meaningful average. Furthermore, for 11 species where the quality of monitoring data available was considered high, population viability analysis was undertaken at the UK level and the results of this are also reported.

United Kingdom

Breeding abundance

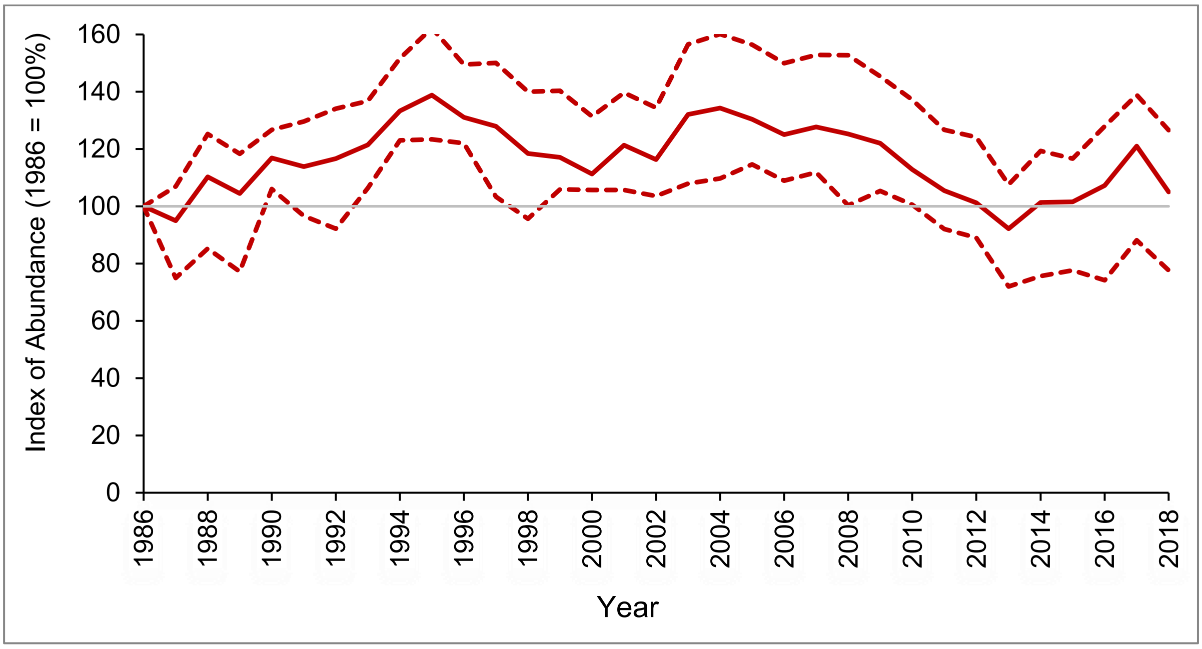

Figure 1. Trend in UK abundance index (solid line) of great cormorant 1986-2018 with 95% confidence limits (dotted lines). Based on SMP data; view the methods of analysis. The abundance index for cormorant (which includes inland and coastal breeders) increased between 1986 and 1995 but has mostly been in decline since then, apart from a short period of increase between 2000 and 2004. The index in 2018 lies close to that recorded at the

start of the SMP. Prior to this, census results indicate that the coastal population increased slightly between 1969-70 (6,100 pairs) and 1985-88 (6,600 pairs).

In the UK, inland breeding cormorants are largely confined to England and increased markedly during the 1990s (helped in part by immigration of birds from continental Europe of subspecies *P. c. sinensis*). At the last census, in 1999-2002, inland breeders in the UK comprised approximately 18% of the total breeding population (*c.* 1,646 of 8,884 AON). There is pronounced regional variation in the trends of abundance in great cormorant. Populations in northern Scotland have declined severely. In England, inland colonies at least have increased with 2,362 pairs nesting in 2012[1]. In Wales, numbers have been more stable. Increases in abundance up to 1995 are likely to have been facilitated by increased legal protection instigated under the Wildlife and Countryside Act 1981. Factors responsible for recent declines are likely to include increased mortality from licensed and unlicensed shooting[2,3], as well as possible changes in food availability.

Productivity

In the UK, first-year survival and productivity is higher for inland breeding cormorants which is linked to earlier and greater food availability at inland sites[4].
Great cormorants at colonies in the United Kingdom fledged approximately 1.81 chicks per nest per year between 1991 and 2018; there was no statistically significant variation over time.

However, analysis of the SMP dataset found great cormorant average productivity to be 1.89 between 1986 and 2008 but declining at a rate of 0.027 chicks per nest per year[5]. This equates to a decline in productivity of 47% between 1986 and 2008. The quality of the dataset meant a change greater than 5% over 25 years would be detected with confidence. Although productivity has shown a significant decline over this time period, because the number of nests monitored each year fluctuated widely from 48 in 1989 to 1,095 in 2002, this trend may not be representative of the population as a whole. If this level of average productivity was maintained, population viability analysis (using available life history information such as population size, clutch size, age at first breeding and survival rates of different age classes) suggests a large population increase, greater than 200%, may be expected over the next two decades. For the population to decline by 25% over 25 years, productivity would have to fall to 0.70 chicks per nest per year.

Scotland

Population estimates and change 1969-2002 (census data)

	Operation Seafarer (1969-70)	Seabird Colony Register (1985-88)	Seabird 2000 (1998-2002)
Population estimate (AON*) Inland Total	3,438	2,986	3,626 0 3,626
% change since previous census	n/a	-13	+21

* AON = Apparently Occupied Nests

Note: Inland colonies were not counted during the first two national censuses, so, to enable direct comparison, the percentage change refers to coastal colonies only.

Breeding Abundance

Between Operation Seafarer and the Seabird Colony Register the great cormorant population declined by 13% although numbers had recovered by Seabird 2000, increasing by 21% since the previous census. Although the SMP annual sample is not thought to be representative of the Scottish population (e.g. the derived trend from SMP data indicates a decline between SCR and Seabird 2000 in contrast to the above table), the number of breeding pairs has probably declined since the last national census. For example, compared with data collected during Seabird 2000, 15 colonies counted in 2018 held 932 AOS, 29% fewer, suggesting numbers have fallen. However, cormorant colonies can move location quite quickly, so apparent declines at those monitored regularly may be due to birds moving to nest elsewhere. These new colonies may not be detected during routine SMP monitoring but will be detected by national censuses, when geographical coverage is complete.

Productivity

Great cormorants at Scottish colonies on average fledged approximately 1.81 chicks per nest per year between 1991 (no productivity data were submitted before this) and 2018; there was no statistically significant variation over time.

England

Population estimates and change 1969-2002 (census data)

	Operation Seafarer (1969-70)	Seabird Colony Register (1985-88)	Seabird 2000 (1998-2002)
Population estimate (AON*) **Inland** **Total**	1,057	1,220	1,315 1,581 2,896
% change since previous census	n/a	+13	+8

* AON = Apparently Occupied Nests

Note: Inland colonies were not counted during the first two national censuses, so, to enable direct comparison, the percentage change refers to coastal colonies only.

Breeding Abundance

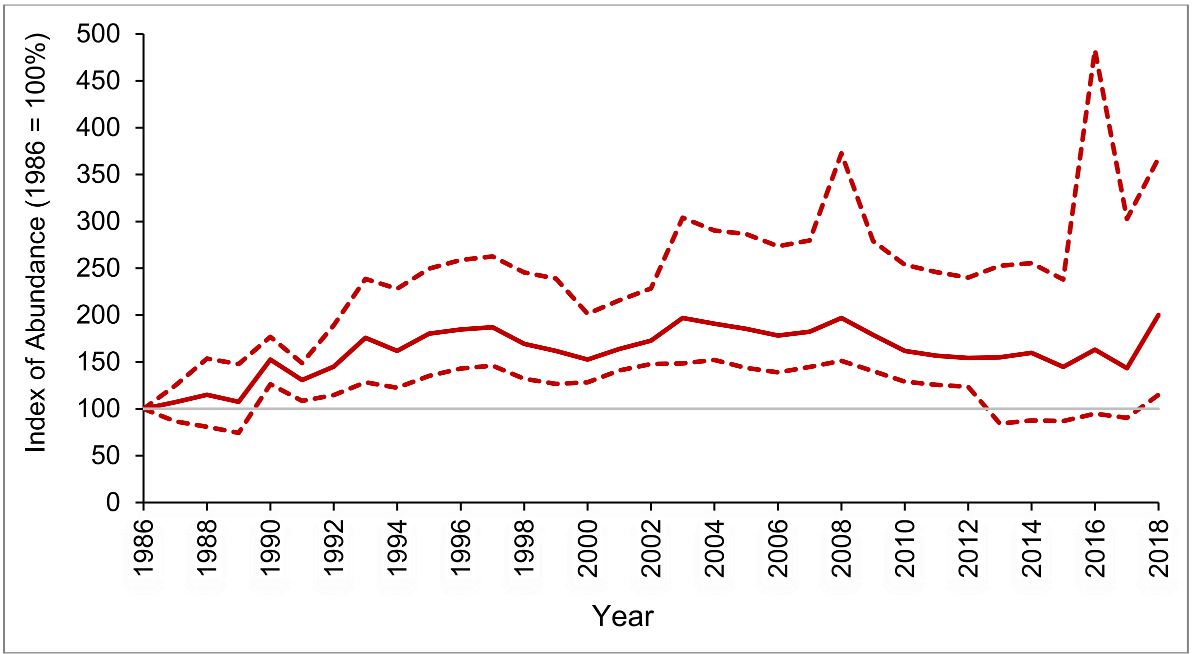

Figure 2. Trend in abundance index (solid line) of great cormorant in England, 1986-2018 with 95% confidence limits (dotted lines). Based on SMP data; view the methods of analysis.

National census data indicate that numbers at coastal colonies in England have increased between 1969-70 and 1998-2002. In conjunction with this, inland breeding cormorants (in the UK largely confined to England) increased markedly during the 1990s, helped in part by immigration of birds from continental Europe of the subspecies *P. c. sinensis*. During Seabird 2000, the inland breeding population totalled 1,581 AON - slightly more than recorded on the coast. In 2012, this inland population was estimated at 2,362 pairs breeding at 48 sites[5]. Figure 2 shows how abundance at colonies (both coastal and inland) has overall increased since 1986. The trend climbs until 2003, after which there is some slight fluctuation and then a steep climb between 2017 and 2018, where the highest index (200) since monitoring began was reached. This contrasts markedly with the UK trend which fell to its lowest point in 2013, although has recovered since to then.

Productivity

The productivity of great cormorants at colonies in England showed no statistically significant variation over time; approximately 1.65 chicks were fledged per pair per year between 1986 and 2018.

Wales

Population estimates and change 1969-2002 (census data)

	Operation Seafarer (1969-70)	Seabird Colony Register (1985-88)	Seabird 2000 (1998-2002)
Population estimate (AON*)	1,468	1,668	1,634

	Operation Seafarer (1969-70)	Seabird Colony Register (1985-88)	Seabird 2000 (1998-2002)
Inland **Total**			65 1,699
% change since previous census	n/a	+14	-2

* AON = Apparently Occupied Nests

Note: Inland colonies were not counted during the first two national censuses, so, to enable direct comparison, the percentage change refers to coastal colonies only.

Breeding Abundance

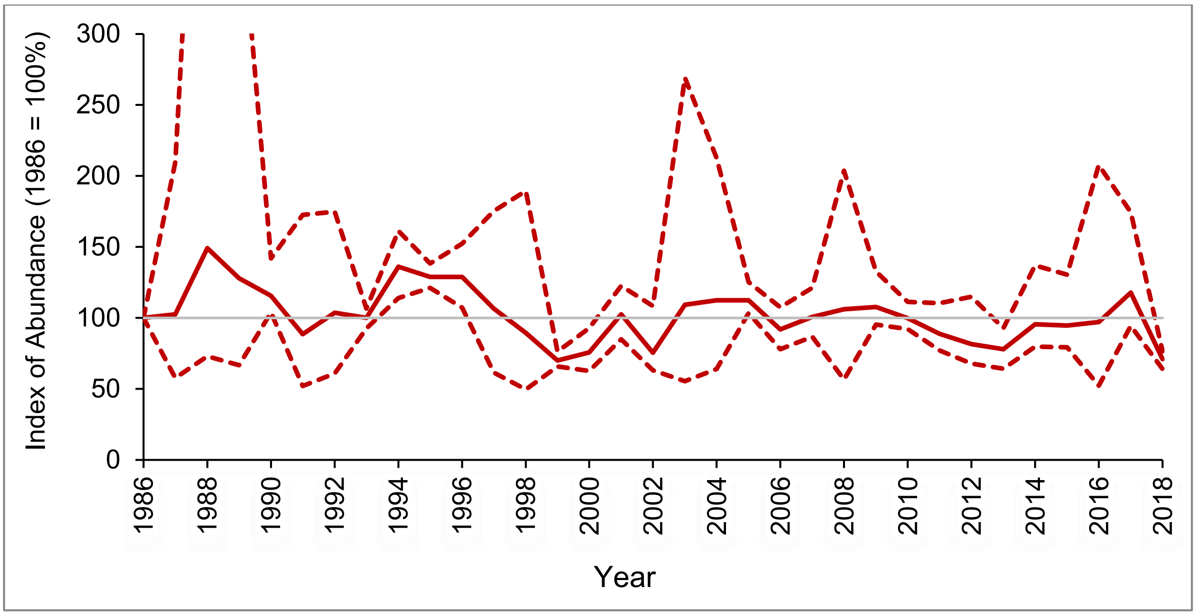

Figure 3. Trend in abundance index (solid line) of great cormorant in Wales, 1986-2018 with 95% confidence limits (dotted lines; drawing of upper limit restricted to preserve detail in the abundance index). Based on SMP data; view the methods of analysis.

National census data, together with the trend calculated from colonies sampled by the SMP, indicate that great cormorant abundance in Wales has remained fairly stable since 1969-70, albeit with some fluctuation. The trend peaks in 1988 and 1994 with troughs in 1991, 1999, 2002 and in 2018. Although the index has declined in recent years, reaching its lowest value in 2018, it suggests numbers may still be on a par with that recorded during the Seabird Colony Register and Seabird 2000. Few inland colonies exist in Wales and no recent information is available for these. The largest two colonies of great cormorant in Wales have had contrasting fortunes between 2010 and 2018; at Puffin Island numbers have increased by 2% and at Little Orme they have decreased by -58%.

Productivity

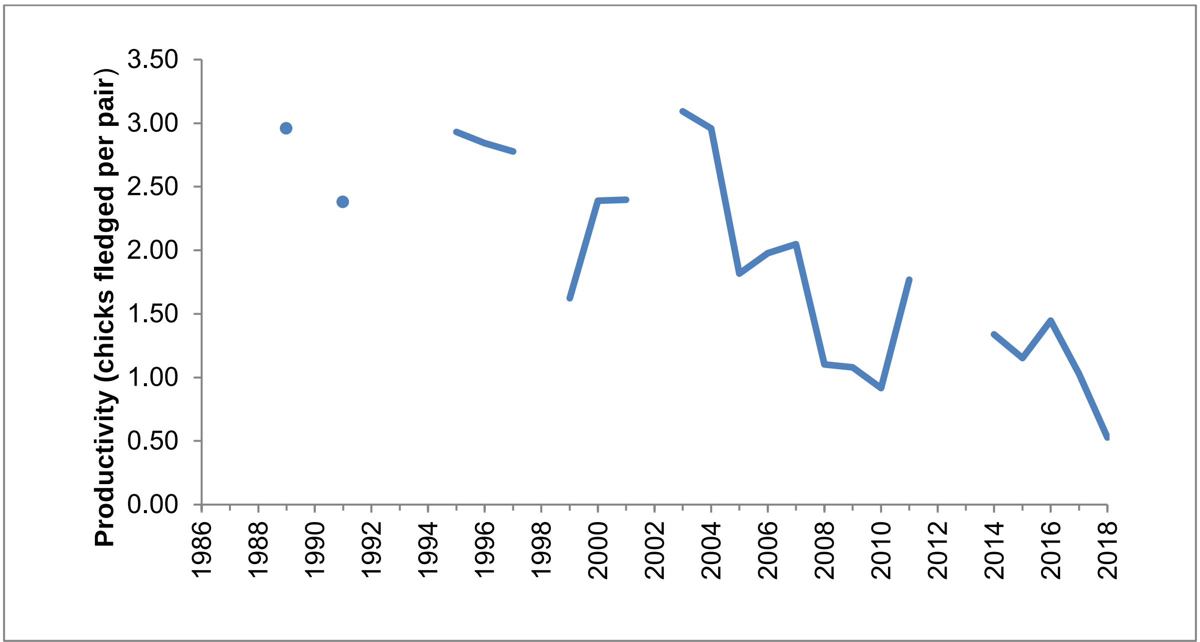

Figure 4. Trend in productivity (no. of chicks fledged per pair) of great cormorant in Wales, 1986-2018. Based on SMP data; view the methods of analysis.

Collection of productivity data at colonies in Wales has been sporadic, especially in the first half of the recording period, such that no clear trend is evident. However, there appears to have been a decline in the number of chicks fledged each year although the cause is unknown. Great cormorants no longer breed on Skomer, with the colony moving from the Mew Stone to Middleholm in 2017, where 11 AON were counted in 2018.

Northern Ireland

Population estimates and change 1969-2002 (census data)

	Operation Seafarer (1969-70)	Seabird Colony Register (1985-88)	Seabird 2000 (1998-2002)
Population estimate (AON*) **Inland** **Total**	108	736	663 0 663
% change since previous census	n/a	+581	-10

* AON = Apparently Occupied Nests

Note: Inland colonies were not counted during the first two national censuses, so, to enable direct comparison, the percentage change refers to coastal colonies only.

__Breeding Abundance__

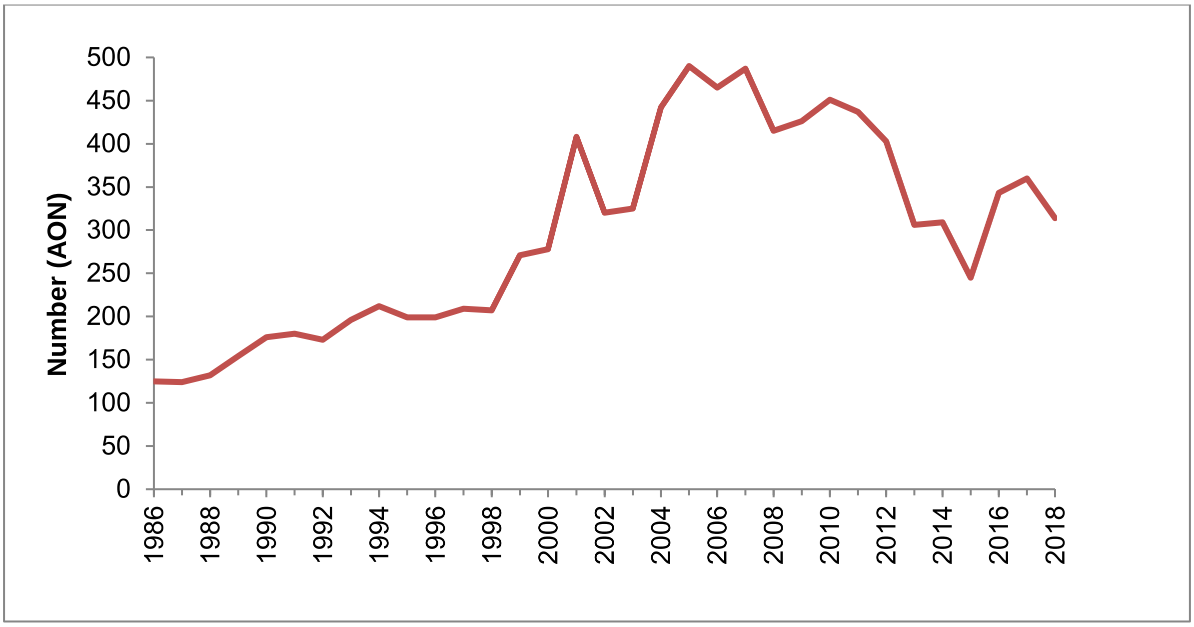

Figure 5. Abundance of great cormorant at Strangford Lough (Co. Down), 1986-2018.

In Northern Ireland, there are only six known great cormorant colonies. These held 663 AON during Seabird 2000, which was 10% fewer than that recorded during the SCR Census (736 AON) but six-times more than recorded by Operation Seafarer (108 AON). However, from 2017 to 2018, five colonies (Strangford Lough, Burial Island, Gobbins, Little Skerries and Sheep Island) held 673 AON, a very similar number to the Seabird 2000 count. At Strangford Lough, the most frequently surveyed colony (and also one of the largest colonies in the country), numbers increased substantially post Seabird 2000 from 125 AON to a peak of 490 AON in 2005 (Figure 5). Since then numbers have fallen back to 314 AONs in 2018[6]. Numbers of cormorants at Sheep Island have fluctuated annually but has shown an overall decrease in size, from 380 AON in 1985 to 88 AON in 2018. The colony at Gobbins has fluctuated in numbers recently, dropping as low as two AON in 2007, increasing to 33 AON in 2008, but falling again to 12 AON in 2018. In summary, it would seem likely that the Northern Ireland cormorant population is currently stable.

__Productivity__

Data submitted to the SMP on the productivity of great cormorants in Northern Ireland are sparse; thus, no meaningful average productivity value can be given.

Republic of Ireland

__Population estimates and change 1969-2018 (census data)__

	Operation Seafarer (1969-70)	Seabird Colony Register (1984-85)	Seabird 2000 (1998-2002)	Republic of Ireland Census (2015-18)
Population estimate (AON*) **Inland** **Total**	1,842	3,981	4,073 475 4,548	4,688**
% change since previous census	n/a	+116	+2	+15

* AON = Apparently Occupied Nests
** Combination of inland and coastal. Information on the exact split was not provided[7].

Note: Inland colonies were not counted during the first two national censuses, so, to enable direct comparison, the percentage change refers to coastal colonies only.

Breeding Abundance

Great cormorant numbers in the Republic of Ireland more than doubled between Operation Seafarer and the Seabird Colony Register (SCR) to 3,981 pairs. Seabird 2000 found numbers had been relatively stable since the SCR, having increased by fewer than 100 pairs. A total of 65 sites were counted during the recent Republic of Ireland Seabird Census (2015-2018), 21 more sites compared to Seabird 2000. At these a total of 4,688 AON were recorded compared to 4,548 AON during Seabird 2000, an increase of 3%. Less than 10% of the estimated breeding population of great cormorant occurred at inland sites[5]. There were insufficient data from the Republic of Ireland to allow trends to be generated for the period 2015 to 2018.

A 56% decline at Lambay Island has coincided with an increase at Ireland's Eye, St. Patrick's Island and a new colony at Bray Head (established 2009)[8]. No breeding great cormorants were recorded in 2017 at Lough Cutra, which held 150 AON during Seabird 2000. However, the population on Deer Island increased by 6% from 200 AON during Seabird 2000 to 212 AON in 2017 when surveyed using a drone[9].

Productivity

Data submitted to the SMP on the productivity of great cormorants in the Republic of Ireland are sparse; thus, no meaningful average productivity value can be given.

All Ireland

Population estimates and change 1969-2002 (census data)

	Operation Seafarer (1969-70)	Seabird Colony Register (1985-88)	Seabird 2000 (1998-2002)
Population estimate (AON*) **Inland** **Total**	1,950	4,717	4,736 475 5,211
% change since previous census	n/a	+142	<+1

* AON = Apparently Occupied Nests

Note: Inland colonies were not counted during the two earlier national censuses, so, to enable direct comparison, the Seabird 2000 figure refers to the coastal population only.

Breeding Abundance

In summary, it appears that the Northern Ireland cormorant population is currently stable.

For the whole of Ireland combined, national censuses show an increase between Operation Seafarer and the Seabird Colony Register, but numbers between the SCR and Seabird 2000 were similar. Since then, data from a few of the largest colonies suggest numbers have been stable in the interim. For example, in Northern Ireland, five known colonies held 673 AON in 2017/18, very similar to the count (663 AON) during Seabird 2000. The recent Republic of Ireland Seabird Census (2015-2018) recorded 4,688 AON, a 3% increase to the 4,548 AON counted during Seabird 2000, indicating that the all-Ireland great cormorant population of is currently stable. Less than 10% of the estimated breeding population was counted at inland sites[7]. Data from the Republic of Ireland are received from very few colonies each year, but the two largest colonies during Seabird 2000 (Lambay Island and Ireland's Eye) were counted in 2015[8]. They held totals of 299 and 424 pairs respectively, a decrease of -56% and an increase of +39% compared to the Seabird 2000 counts. Cormorant colonies may move between years, therefore decreases at some colonies may be offset by increases elsewhere.

Productivity

Data submitted from colonies in Northern Ireland and the Republic of Ireland are sparse. Thus, no meaningful average productivity value can be given for All-Ireland.

Isle of Man

Population estimates and change 1969-2018 (census data)

	Operation Seafarer (1969-70)	Seabird Colony Register (1984-85)	Seabird 2000 (1998-2002)	Isle of Man Census (2017-18)
Population estimate (AON*) **Inland** **Total**	35	102	134 0 134	251 0 251
% change since previous census	n/a	+191	+40	+87

* AON = Apparently Occupied Nests

Note: Inland colonies were not counted during the first two national censuses, so, to enable direct comparison, the percentage change refers to coastal colonies only.

Breeding Abundance

Great cormorant numbers on the Isle of Man almost trebled between Operation Seafarer and the Seabird Colony Register to 102 pairs. By the time of Seabird 2000 a further increase had occurred with numbers rising to 134 pairs. All colonies were surveyed in 2011 and 2017 when totals of 206 and 251 pairs were counted, respectively. The 2017 data indicate an increase of 87% since 1999 when all colonies were counted for Seabird 2000. The increase does not reflect that for Britain and Ireland as a whole, but does reflect the St Bee's Head trend, indicating a possible regional increase in the north east of the Irish Sea[10].

Productivity

Data submitted to the SMP on the productivity of great cormorants in the Isle of Man are sparse; thus, no meaningful average productivity value can be given.

Channel Islands

Population estimates and change 1969-2015 (census data)

	Operation Seafarer (1969-70)	Seabird Colony Register (1984-85)	Seabird 2000 (1998-2002)	Channel Islands Census (2015)
Population estimate (AON*) **Inland** **Total**	62	113	115 0 115	185 0 185
% change since previous census	n/a	+82	+2	+61

* AON = Apparently Occupied Nests

Note: Inland colonies were not counted during the first two national censuses, so, to enable direct comparison, the percentage change refers to coastal colonies only.

Breeding Abundance

National census data indicate numbers of great cormorants have doubled on the Channel Islands since Operation Seafarer in 1969/70. However, this increase occurred before the 1985-88 census as numbers recorded during the Seabird Colony Register and Seabird 2000 were almost identical. A number of small colonies are counted each year sporadically. In 2015, Les Amfroques held 34 AON compared to 20 AON during Seabird 2000 and Lihou Island was counted for the first time with 16 AON. Only the small colony at Burhou was counted for great cormorants during 2017, indicating an increase from 5 AON during Seabird 2000 to 15 AON. The most recent seabird census in 2015 recorded 185 AON, an increase of 61% compared to Seabird 2000[11].

Productivity

No systematic data on the productivity of great cormorants on the Channel Islands have been submitted to the SMP.

UK phenology, diet, survival rates

No data have been collected as part of the Seabird Monitoring Programme.

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European Shag *Phalacrocorax aristotelis*

Description

The following has been adapted from original text by Sarah Wanless and Mike P. Harris in Seabird Populations of Britain and Ireland (with permission from A&C Black, London).

The European shag is endemic to the northeast Atlantic and the Mediterranean. An inshore species that is almost never observed out of sight of land, it takes a wide range of small fish that it catches on or near the seabed over both sandy and rocky substrates. The species nests on offshore islands or on cliffs and colonies range in size from a few to several thousand pairs.

Conservation status

European shag is currently identified as a conservation priority in the following:

EC Birds Directive - migratory species
Red listed in Birds of Conservation Concern 4 (2015 update
further information on Conservation Designations for UK Taxa)
Amber listed in Birds of Conservation Concern in Ireland 2014-2019

International importance

UK Population	% Biogeographic Population	% World Population
26,600 AON*	38.3 (ssp. *aristotelis*)	34.1

*AON = Apparently Occupied Nests

The UK population figure (rounded to the nearest hundred) was derived from data in Mitchell, P.I., Newton, S.F., Ratcliffe, N. and Dunn, T.E. (eds.) 2004. *Seabird Populations of Britain and Ireland.* Poyser, London. This was also the source of figures for the Biogeographic and World populations.

UK population estimates and change 1969-2002 (census data)

European shags build large conspicuous nests which superficially appear straightforward to count, but there are, however, several major problems associated with a widespread survey of this species: i) detection of nests - these can be hidden among boulders and in caves, or can easily be overlooked when present at low densities among other species in large cliff nesting colonies; ii) a prolonged and variable breeding season - in Britain eggs have been laid in every month of the year except September and October; iii) occasional years when many adults do not breed - however, such events tend to be localised and did not appear to be a problem during census years. Seabird 2000 aimed to overcome the second problem by conducting a single count in the period of maximum nest occupancy (1 May-25 June). Previous censuses probably suffered from similar problems, so these will all have led to the underestimation of the absolute size of the breeding population.

	Operation Seafarer (1969-70)	Seabird Colony Register (1985-88)	Seabird 2000 (1998-2002)
UK Population estimate (AON*)	29,956	36,276	26,565
% change since previous census	n/a	+21	-27

*AON = Apparently Occupied Nests

For census results for individual countries and Ireland, the Channel Islands and the Isle of Man see under relevant sections below.

Distribution/abundance

The Seabird 2000 census provides the most comprehensive recent assessment of the distribution and abundance of breeding seabirds

The locations sampled during the annual Seabird Monitoring Programme provide some information on distribution and are accessible via the Seabird Monitoring Programme online database.

Annual abundance and productivity by geographical area

With reference to the regional accounts below please note the following.

Breeding abundance: graphs of abundance index with 95% CLs are only shown for a region where the trend produced has been deemed accurate (see methods of analysis). Where a trend was thought to be inaccurate, graphs of abundance at major colonies in a region may be shown instead, particularly if such colonies hold greater than 10% of the regional population, are monitored frequently and may thus help illustrate regional population fluctuations outwith national censuses. Occasionally, too few data have been collected regionally to produce either of these.

Productivity: graphs of productivity are only shown if analysis of breeding success data produced a significant result for regional and/or year effects (again see methods of analysis). If results were not significant, then a regional mean productivity value is given. However, on some occasions too few data are available from which to provide a meaningful average. Furthermore, for 11 species where the quality of monitoring data available was considered high, population viability analysis was undertaken at the UK level and the results of this are also reported.

United Kingdom

Breeding abundance

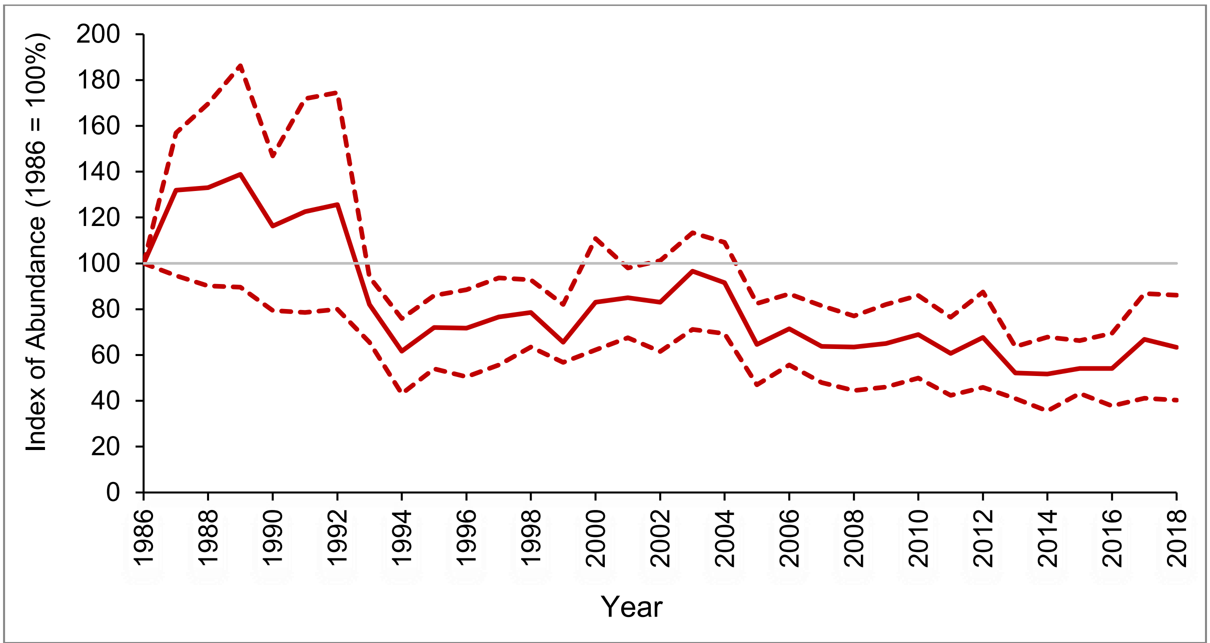

Figure 1. Trend in UK abundance index (solid line) of European shag 1986-2018 with 95% confidence limits (dotted lines). Based on SMP data; view the methods of analysis.

The UK shag population increased slightly from 30,000 pairs in 1969-70 to 36,000 pairs in 1985-88, possibly as a result of better coverage of previously inaccessible coastlines through the use of inflatable boats, increased legal protection (e.g. under the Wildlife and Countryside Act 1981) and reduced persecution. However, numbers had fallen by 27% by the time of Seabird 2000. Annual sample data collected by the SMP also recorded an overall decrease between the mid-1980s and 2000 but the decline wasn't consistent during that period with several fluctuations. At the beginning of the monitoring period, an initial steep rise in the index up to 1987 was probably due to many adults choosing not to breed in 1986 (e.g. on Canna and the Isle of May); thus, counts at many colonies were low that year. The trend also shows how breeding abundance is heavily affected by the incidence of mass mortality events – or 'wrecks' – which occur during prolonged periods of onshore gales, when species such as shag find it hard to forage. Severe events, such as those in the winters of 1993/1994[1] (also preceded by a year when many pairs skipped breeding) and 2004/2005, considerably affected populations on the east coast of the UK. Subsequent recovery from the 1993/1994 'wreck' was slow, with breeding numbers not fully restored before the next 'wreck' occurred in 2004/2005. There appears to have been no recovery before the 'wreck' during the winter of 2012/13, when over 650 corpses were found between Orkney and Suffolk[2]. It is, therefore, not surprising that index values for 2013 and

2014 (approximately 50% below the baseline) were the lowest yet recorded. By 2018, the index had increased slightly to 37% below the baseline. Measures of the return rates of shags to the Isle of May show the impact of such 'wrecks' (Figure 4, below). Predictions of increased storminess due to climate change suggest such mortality events may become more frequent and have significant effects on population size[3]. European shag has recently been added to the UK Red list[4] because of severe population decline, hence continued (indeed enhanced) monitoring and ringing of the species is to be encouraged.

Table 1 shows how numbers have changed at some of the most important UK colonies (those in the SPA network) in the period since they were surveyed for Seabird 2000. Numbers have fallen in most SPAs, except on Mingulay and Berneray, and Puffin Island, with some particularly large declines recorded on Foula and Fair Isle.

Area	**SPA Name**	**Seabird 2000**	**Count (Year)**	**Change (%)**	**% *per annum***
Shetland	Foula	2,300 (2000)	48 (2015)	-98	-22.7
Shetland	Fair Isle	663 (2001)	204 (2013)	-69	-9.4
East Coast	Buchan Ness to Collieston Coast	408 (2001)	363 (2013)	-11	-1.0
East Coast	Forth Islands	1,289 (2001)	824 (2018)	-36	-2.6
East Coast	St Abb's Head NNR	233 (2000)	95 (2018)	-59	-4.9
East Coast	Farne Islands	1,287 (2000)	688 (2016)	-47	-3.9
The Minch	Canna and Sanday	740 (1999)	282 (2018)	-62	-5.0
The Minch	Mingulay and Berneray	281 (1998)	294 (2014)	+5	+0.3
Irish Sea	Lambay Island	1,122 (1999)	469 (2017)	-58	-4.7
Irish Sea	Calf of Man	220 (2000)	107 (2017)	-51	-4.2
Irish Sea	Puffin Island	220 (1999)	356 (2018)	+62	+2.7
South-West Coast	Isles of Scilly	1,092 (1999)	998 (2015)	-9	-0.5

Table 1. Recent counts of the number of European shag (AON) recorded in SPAs in Britain and Ireland compared to the number recorded in them during Seabird 2000. The percentage that each colony has changed by, and the *per annum* change, is also provided. (Note: data for St Abb's Head relates to only part of the SPA).

Productivity

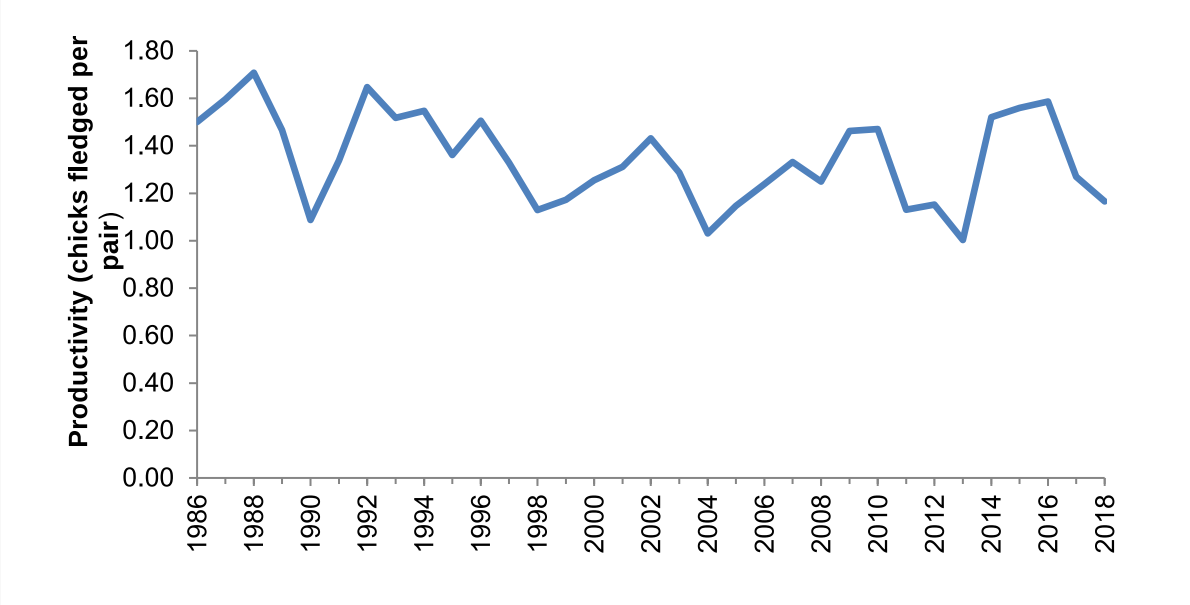

Figure 2. Trend in UK productivity (no. of chicks fledged per pair) of European shag 1986-2018. Based on SMP data; view the methods of analysis.

Sandeels are a component of shag diet[5] and shortages may have contributed to periodic low productivity (Figure 2) at some colonies. However, on the Isle of May, although sandeel abundance has declined in recent years[6,7], the link between sandeel abundance and breeding success may not be as strong as previously thought (see 'Diet' section below for more information). Sandeel abundance is thought to have declined as a result of increases in sea surface temperature[8] leading to changes in the abundance and composition of plankton[,9,10] and reduced sandeel recruitment [11,12,13]. Shag productivity in 2009, 2010, 2014, 2015 and 2016, which were comparatively better years for sandeels than many during the last decade, was high, in common with other sandeel specialists[14,15]. In addition to the steep increase in 2014 (1.52 chick fledged per pair), productivity increased marginally in 2016 to 1.56. In 2018, an average of 1.16 shag chicks fledged per pair in the UK.

Analysis of the SMP dataset found mean breeding success of European shags at monitored colonies was 1.21 chicks per nest per year between 1986 and 2008, and was relatively stable throughout the period[16]. The quality of the dataset meant a decline in breeding success of 5% or greater could be detected with confidence. Where existing levels of breeding success were maintained, population viability analysis (using available life history information such as population size, clutch size, age at first breeding and survival rates of different age classes) suggests the national population may decline by a 9% over 25 years. Breeding success would need to fall to 1.10 for a decline in abundance of 25% over 25 years to occur. For the UK population to decline by over 50% in 25 years, breeding success would need to fall to 0.90. It should be noted that the population viability analysis did not consider climate change and predicted increases in severe weather events which can effect European shag survival rates.

Scotland

Population estimates and change 1969-2002 (census data)

	Operation Seafarer (1969-70)	Seabird Colony Register (1985-88)	Seabird 2000 (1998-2002)
Population estimate (AON*)	27,077	31,560	21,487
% change since previous census	n/a	+17	-32

* AON = Apparently Occupied Nests

Breeding Abundance

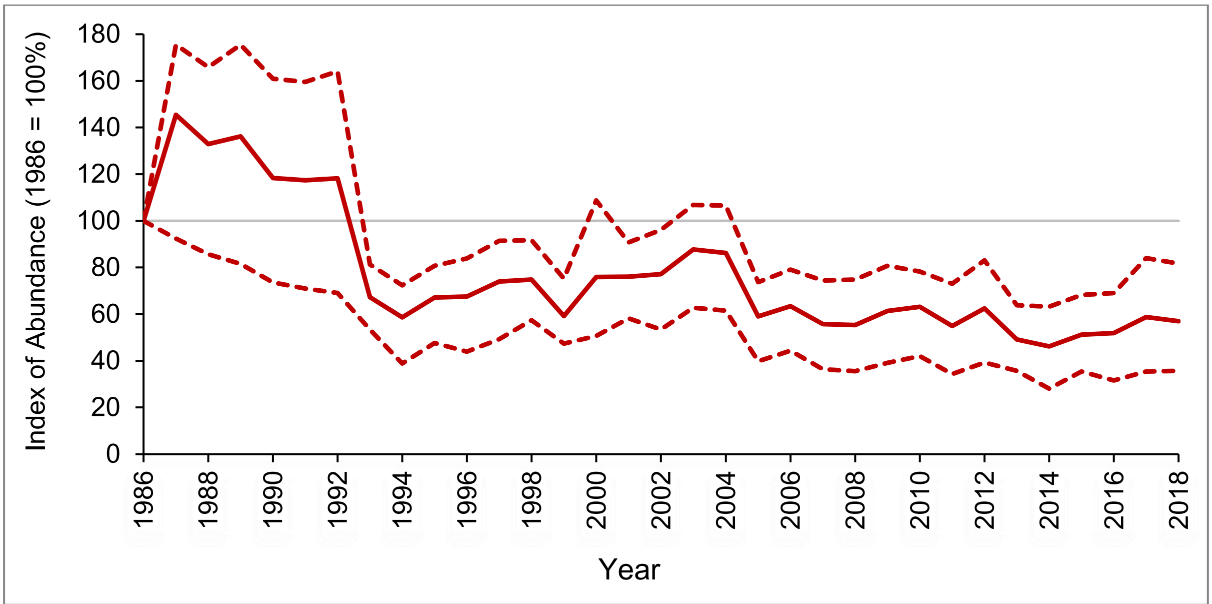

Figure 3. Trend in abundance index (solid line) of European shag in Scotland, 1986-2018 with 95% confidence limits (dotted lines). Based on SMP data; view the methods of analysis.

In Scotland, long-term census data show an increase in shag abundance of 17% between Operation Seafarer and the Seabird Colony Register, after which numbers fell by nearly one-third by Seabird 2000. Scotland holds approximately 80% of European shags found nesting in the UK, so it is not surprising that the post-1986 trends shown for both are similar. Common features are the initial steep rise to 1987 due to many adults choosing not to breed in 1986 (e.g. on Canna and the Isle of May) and dips in abundance in 1994 and 2005 due to 'wrecks' along the east coast in the preceding winters, from which numbers have been slow to recover (1994-2004) or appear to have not recovered at all (2005 to present). Yet another 'wreck' during the 2012-13 winter, centred on Aberdeenshire and the Firth of Forth, further lowered numbers breeding in east coast colonies. Fourteen east coast colonies between Orkney and Berwickshire counted in 2013 held a total of 1,872 AON compared to 3,433 AON in 2004, when abundance was at its highest during the last 20 years (Figure 3), representing a fall of 45% over that period. As a result of these 'wrecks' and non-breeding events, the abundance index value for Scotland in 2014 was almost 100% lower than its peak in 1987. The index has remained relatively stable since 2014.

In 2015, shag breeding numbers at three major SPA colonies in Shetland (Fair Isle, Foula and Sumburgh Head) had declined by c. -87% since Seabird 2000. A study of the European shag population and breeding dynamics at these colonies suggested that the majority of the decline could be accounted for by high mortality associated with prolonged gales in the late winters of 2003, 2011 and 2014[17].

Productivity

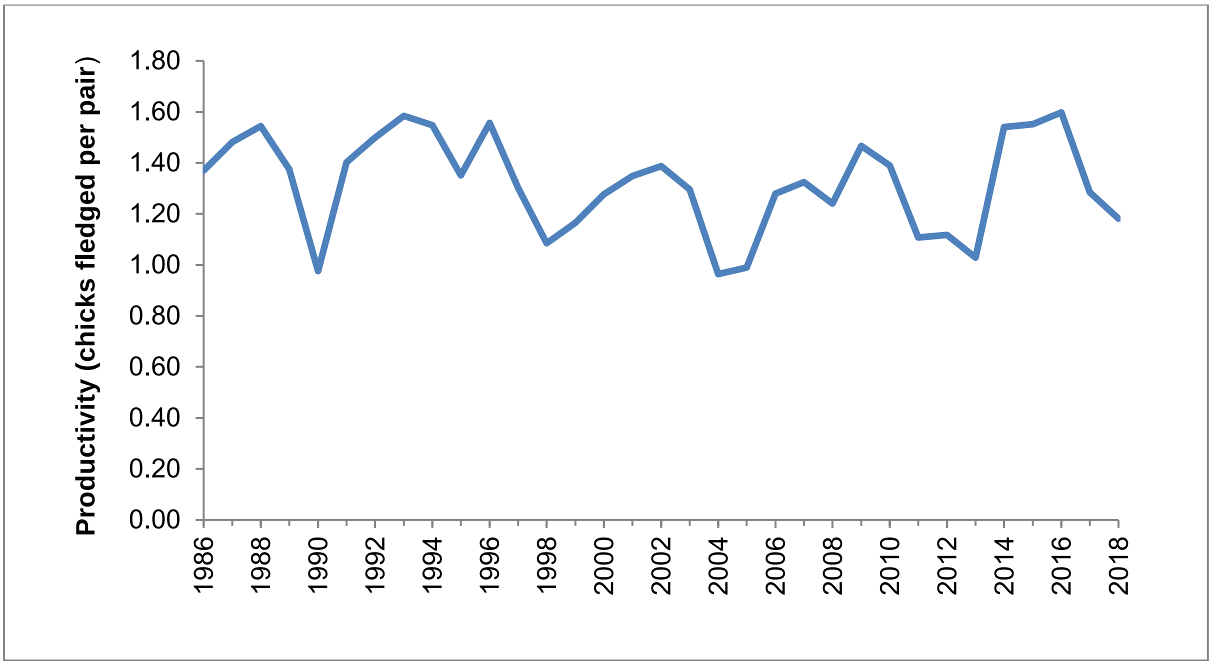

Figure 4. Trend in productivity (no. of chicks fledged per pair) of European shag in Scotland, 1986-2018. Based on SMP data; view the methods of analysis.

Shag productivity in Scotland has averaged 1.28 chicks fledged per pair over the study period (1986-2018), which is lower than in England (1.32) and Wales (1.93). Productivity peaked at Scottish colonies at 1.60 chicks fledged per pair in 2016 but then declined to 1.18 chicks per pair in 2018.

Productivity at Sumburgh Head in 2018 (1.07) was higher than in 2017 (0.85) but was below the average for all monitored years (1.12 for 1988–2017). In 2018, many pairs failed to lay but those that did were successful in fledging young. For a high proportion of adults, severe storms and low temperatures in March that year may have reduced body condition to a level where laying was not possible. The long-term trend since 1986 has been a gradual decline in productivity, with particular poor productivity recorded in 2008, 2009, 2011, 2017 and 2018. In 2017 and 2018, on average European shags in Scotland fledged 1.29 and 1. 18 chicks per pair respectively.

European shags of both sexes can be partially migratory, meaning that a proportion of individuals remain resident at the breeding colony throughout the year, while the remainder migrate to other locations in the non-breeding season. A recent study showed resident shag pairs produced an average of 0.7 chicks per year more than those that contained one or two migrants. Resident individuals and pairs will therefore have higher breeding success and may contribute more recruits to the population per year, depending on whether survival of immatures is related to the migration strategy of their parents. If extreme events effect resident shags more on average, this could lead to a decline in the population that produces the majority of young[18].

England

Population estimates and change 1969-2002 (census data)

	Operation Seafarer (1969-70)	Seabird Colony Register (1985-88)	Seabird 2000 (1998-2002)
Population estimate (AON*)	2,111	3,491	3,863
% change since previous census	n/a	+65	+11

* AON = Apparently Occupied Nests

Breeding Abundance

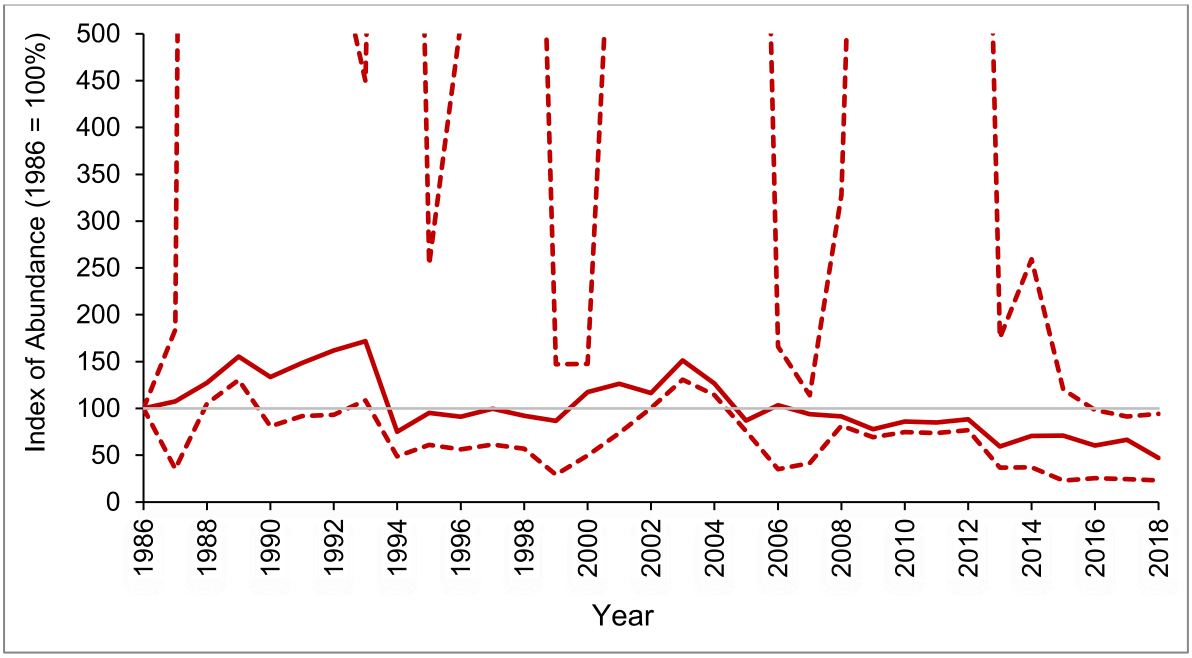

Figure 5. Trend in abundance index (solid line) of European shag in England, 1986-2018 with 95% confidence limits (dotted lines; drawing of upper limit restricted to preserve detail in the abundance index). Based on SMP data; view the methods of analysis.

National census data indicate a large increase in European shag breeding numbers occurred between 1969-70 and 1985-88 but numbers were then stable between 1985-88 and 1998-2002. Detail provided by data collected for the SMP shows the effects of winter 'wrecks' in the abundance indices for England; 'wrecks' occurred in the winter preceding the 1994, 2005 and in 2013 breeding seasons. Prior to the first two events, the index had been rising, although had remained stable in the years immediately before the most recent 'wreck'. However, recovery from the 1994 crash was slow and still incomplete before the next crash in 2005. For example, on the Farne Islands, the largest and most frequently monitored colony in England, numbers fell from 1,948 to 771 AON between 1993 and 1994. Partial recovery saw numbers increase to 1,678 AON in 2003 before another sharp decline to 937 AON by 2005. There had been no further recovery up to 2012 when 965 AON were recorded. Since then, numbers have been fluctuating but decreasing. The net result is that the English index value for 2018 lies 53% below that of 1986, its lowest ever value. On the Farne Islands in 2018, poor weather conditions due to the 'Beast from the East' and subsequent storms in June had taken their toll on European shags, with just 476 AON being recorded, the lowest number of since 1979 (1986-2018 average is 1,126 AON).

Productivity

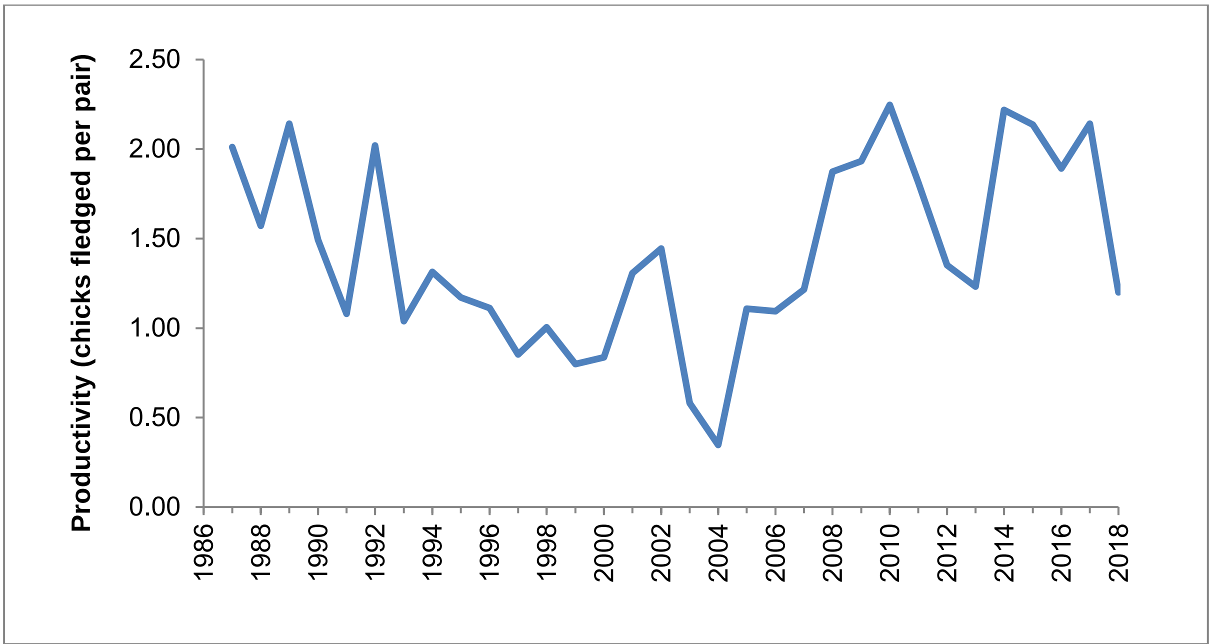

Figure 6. Trend in productivity (no. of chicks fledged per pair) of European shag in England, 1986-2018. Based on SMP data; view the methods of analysis.

Productivity of European shags at English colonies declined after recording began in 1986 and reached a low point in 2004, when an average of only 0.35 chicks were fledged per pair. Since 2004, productivity has increased in most years, with 2010 and 2014 being particularly successful breeding seasons. Almost all data have been collected from the Farne Islands, with few contributions from other colonies. European shags breeding at this colony have an average productivity of 1.12 chicks fledged per nest between 1987-2015. The low productivity recorded on the Farne Islands in 2004 (the effects of which are evident in the graph above) was in response to poor weather and low food availability during the chick rearing stage, combined with predation of nest contents by gulls early in the season, after which few replacement clutches were laid. Poor weather conditions on the Farne Islands due to the 'Beast from the East' in February 2018, and subsequent storms in June of that year, led to the lowest number of AON (476) being recorded since 1979. Despite these losses in AON, productivity was above average at 1.2 chicks fledged per pair, probably assisted by the dry and warm weather that followed in July of that year.

Wales

Population estimates and change 1969-2002 (census data)

	Operation Seafarer (1969-70)	Seabird Colony Register (1985-88)	Seabird 2000 (1998-2002)
Population estimate (AON*)	550	785	914
% change since previous census	n/a	+43	+16

* AON = Apparently Occupied Nests

Breeding Abundance

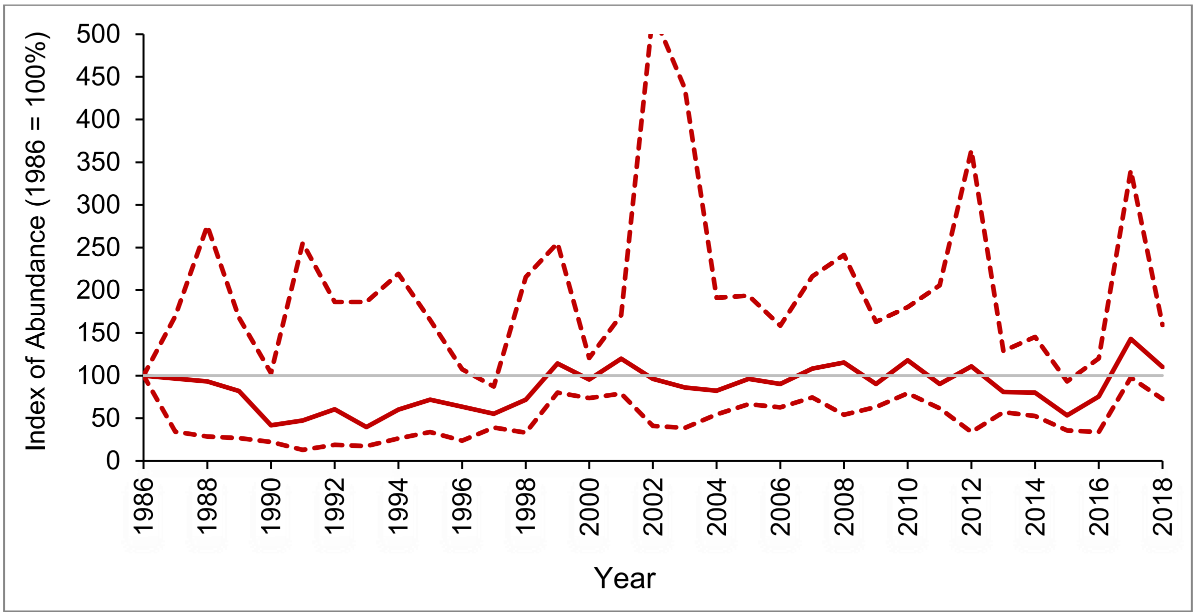

Figure 7. Trend in abundance index (solid line) of European shag in Wales, 1986-2018 with 95% confidence limits (dotted lines; drawing of upper limit restricted to preserve detail in the abundance index). Based on SMP data; view the methods of analysis.

European shag populations in Wales, in common with those in England and Scotland, increased between the first two national censuses. In contrast to England, the abundance index of the Welsh population underwent a steady decline until the early 1990s, as was the case in Scotland. It reached its lowest level in 1993 and, thereafter, the trend was generally upward until 2001, coinciding with the increased numbers recorded by Seabird 2000. Since the last census the trend has been relatively stable. The 'wrecks' preceding the 1994 and 2005 breeding seasons, which reduced breeding numbers and are common to both the Scottish and English indices, do not feature in the Welsh index. However, the 'wreck' during the 2012-2013 winter is likely to have effected numbers, as the index fell to 47% below the baseline in 2015. Since then, the index increased to 43% above the baseline in 2017, the highest index value since monitoring began, although declined in 2018 to almost the same level as 1986.

Productivity

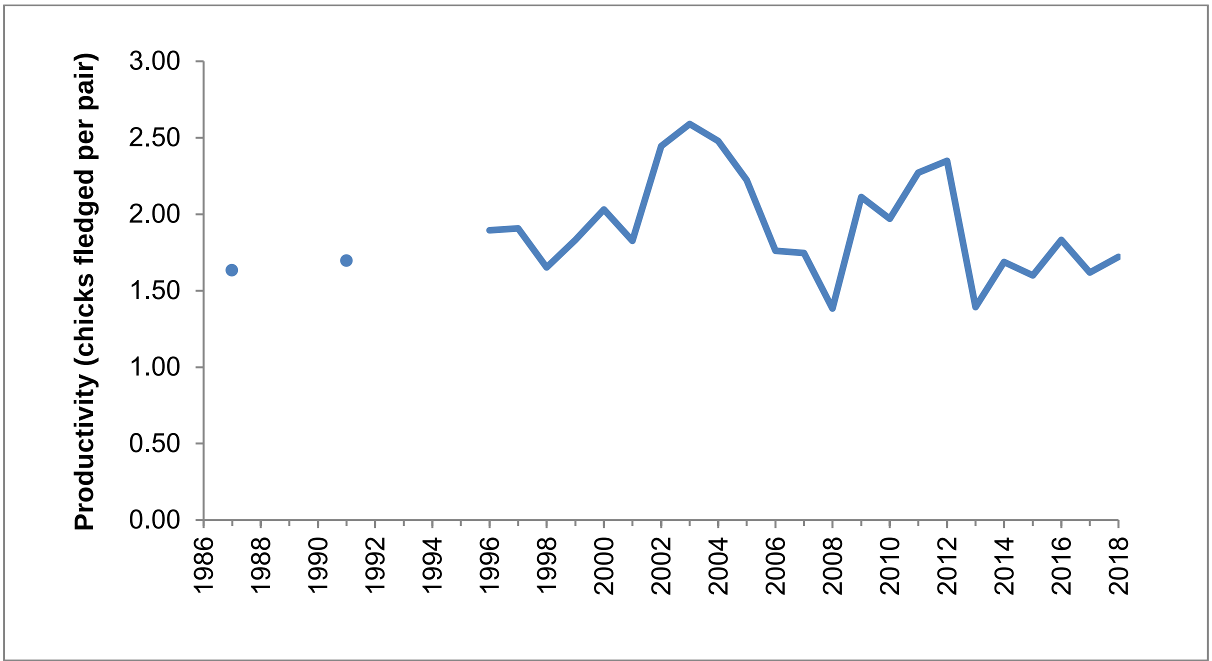

Figure 8. Trend in productivity (no. of chicks fledged per pair) of European shag in Wales, 1986-2018. Based on SMP data; view the methods of analysis.

The productivity of European shags breeding in Wales has consistently been high, with only two years when productivity has fallen below 1.6 chicks fledged per pair. Several colonies have been monitored over the years, although the most frequently monitored colonies are Middleholm, Bardsey and Puffin Island. In 2018, productivity on Bardsey (2.08 chicks fledged per nest) and on Puffin Island (1.80 chicks fledged per nest) were slightly above average (Bardsey, 2.05 between 1987-2018 and Puffin Island 1.72 between 2010-2018); no data were available for Middleholm.

Northern Ireland

Population estimates and change 1969-2002 (census data)

	Operation Seafarer (1969-70)	Seabird Colony Register (1985-88)	Seabird 2000 (1998-2002)
Population estimate (AON*)	218	440	301
% change since previous census	n/a	+102	-32

* AON = Apparently Occupied Nests

Breeding Abundance

Census data show numbers of European shags in Northern Ireland doubled between Operation Seafarer and the Seabird Colony Register but then declined by approximately one-third by Seabird 2000. Very few sites holding European shags in Northern Ireland are monitored regularly, so it is difficult to assess the species' current status. Counts on the Isle of Muck on the west coast of the Larne Lough peninsula, the most frequently monitored colony, show a steady increase from 1987 to 2018 from 3 to 34 AON. On Rathlin Island, only 46 and 47 AON were recorded in 2007 and 2011 respectively, compared to over 100 during the Seabird Colony Register. In 2018, 79 AON were counted at three colonies (Muck Island, Gobbins and The Maidens) which held 115 AON during Seabird 2000. Based on this limited information, it is difficult to predict whether the national population has increased, declined or has been stable since the previous census.

Productivity

Data submitted to the SMP on the productivity of European shags in Northern Ireland are sparse; thus, no meaningful average productivity value can be given.

Republic of Ireland

Population estimates and change 1969-2018 (census data)

	Operation Seafarer (1969-70)	**Seabird Colony Register (1984-85)**	**Seabird 2000 (1998-2002)**	**Republic of Ireland Census (2015-18)**
UK Population estimate (AON)	2,783	4,676	3,426	4,980
% change since previous census	n/a	+68	-36	+45

* AON = Apparently Occupied Nests

Breeding Abundance

Over the long-term, national census data collected during Seabird 2000 indicated numbers had increased since Operation Seafarer in 1969-70, although fewer were found than during the Seabird Colony Register census in 1985-88. Few colonies are monitored frequently, or in any one year. Between 2015 and 2018, the Republic of Ireland Seabird Census recorded 4,980 AON, an increase of 45% since 3,426 AON were recorded during Seabird 2000. The majority of AON (37%) were recorded on Lambay Island, one of the largest colonies in the country, where the population had declined by 58% since Seabird 2000 (1,122 AON)[19]. However, the large decline at Lambay was offset by increases at other nearby east coast sites (e.g. Howth Head and Ireland's Eye) and a significant increase at Inishmurray. There were insufficient data from the Republic of Ireland to allow a trend to be generated for the period 1986 to 2018.

Productivity

Few data on the productivity of European shags at colonies in the Republic of Ireland have been submitted to SMP. On average, productivity was 1.17 chicks per pair per year between 1996 and 2011 (the most recent period when productivity data have been provided).

All Ireland

Population estimates and change 1969-2002 (census data)

	Operation Seafarer (1969-70)	Seabird Colony Register (1985-88)	Seabird 2000 (1998-2002)
Population estimate (AON*)	3,001	5,116	3,727
% change since previous census	n/a	+70	-37

* AON = Apparently Occupied Nests

Breeding Abundance

Over the long-term, national census data collected during Seabird 2000 indicated numbers had increased since Operation Seafarer in 1969-70, although fewer were found than during the Seabird Colony Register census in 1985-88. Very few sites holding European shags in Ireland are monitored regularly. Low numbers of shags breed in Northern Ireland compared to the Republic of Ireland, which holds c. 90% of the All Ireland population. Based on limited information from Northern Ireland, it is difficult to predict whether the national population has increased, declined or has been stable since the previous census. Between 2015 and 2018, the Republic of Irealnd Seabird Census recorded 4,980 AON, an increase of 45% since 3,426 AON were recorded during Seabird 2000. The majority of AON (37%) were recorded on Lambay Island, one of the largest colonies in the country, where the population had declined by 58% since Seabird 2000 (1,122 AON)[19]. However, the large decline at Lambay was offset by increases at other nearby east coast sites (e.g. Howth Head and Ireland's Eye) and a significant increase at Inishmurray.

Productivity

Very few sites are monitored for productivity of European shags in Northern Ireland and few data have been submitted to the SMP from colonies in the Republic of Ireland. On average, monitored colonies fledged 1.75 chicks per pair per year between 1996 and 2018.

Isle of Man

Population estimates and change 1969-2018 (census data)

	Operation Seafarer (1969-70)	Seabird Colony Register (1984-85)	Seabird 2000 (1998-2002)	Isle of Man Census (2017-18)
Population estimate (AON)	567	575	912	376
% change since previous census	n/a	+1	+59	-41

* AON = Apparently Occupied Nests

Breeding Abundance

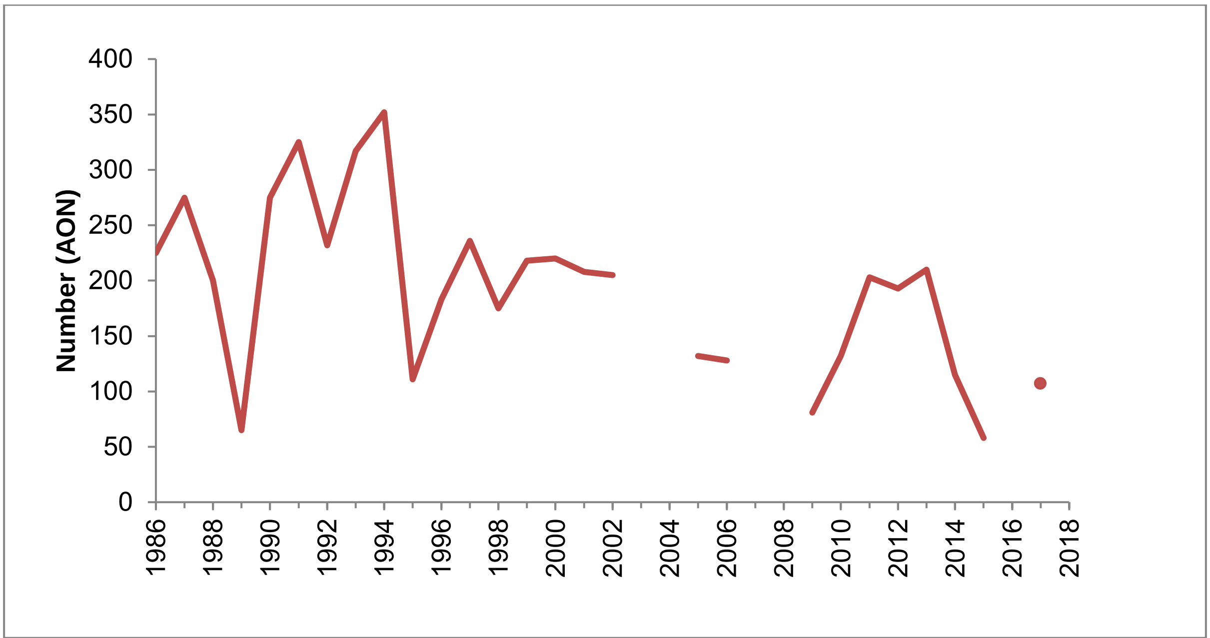

Figure 9. Abundance of European shag on the Calf of Man, 1986-2017. Data was not collected in 2003, 2004, 2007, 2008, 2016 and 2018.

Long-term national census data show little change in numbers of European shags on the Isle of Man between 1969-70 and 1985-88 but an increase of 60% thereafter by the time of Seabird 2000 (1998-2002). Few colonies are monitored regularly as part of the SMP. During 2017-18, a seabird census was carried out on the Isle of Man and recorded 376 AON, a 41% decline since Seabird 2000 (912 AON)[20]. The most frequently counted and largest colony is on the Calf of Man (Figure 9), where 225 AON were recorded during the SCR in 1986. Numbers increased up to 1994 when 352 AON were counted. During Seabird 2000, 218 AON were recorded, although counts were only done from land (land and sea during 1986 and 1994). Other land-based counts immediately after Seabird 2000 suggested numbers remained stable at this colony; 220 AON counted in 2000, 208 AON in 2001 and 205 AON in 2002. Similar numbers were recorded between 2011 and 2013 but either side of this period counts in 2005, 2010 and 2014 were far lower, in the range of 115-132 AON (with the lowest count recorded since 1986, 58 AON in 2015). In 2017, the European shag population at the

Calf of Man colony was 107 AON. Clearly, such fluctuations mask any apparent trend at the colony.

Productivity

Data submitted to the SMP on the productivity of European shags on the Isle of Man are sparse; thus, no meaningful average productivity value can be given.

Channel Islands

Population estimates and change 1969-2016 (census data)

	Operation Seafarer (1969-70)	Seabird Colony Register (1984-85)	Seabird 2000 (1998-2002)	Channel Island Census (2015-16)
Population estimate (AON*)	570	1,443	1,403	707
% change since previous census	n/a	+153	-3	-50

* AON = Apparently Occupied Nests

Breeding Abundance

Seabird 2000 census data (1998-2002) showed that European shags numbers in the Channel Islands had more than doubled since the 1969-70 census, from 570 AON to 1,403, although there was almost no change over the latter half of this period (since the Seabird Colony Register census in 1985-88). During the Channel Islands Seabird Census (2015-16), 707 AON were recorded, a decrease of 14% since Seabird 2000 (818 AON)[21]. In the winter of 2013/14, the islands were struck by a sequence of severe storms and a total of 50,000 seabird deaths were recorded in the Channel Islands and along the coasts of Cornwall, Brittany and Normandy[22]. Shag was one of the worst affected species and declines in breeding numbers were reported during the 2014 season.

Productivity

Data submitted to the SMP on the productivity of European shags in the Channel Islands are sparse; thus, no meaningful average productivity value can be given.

UK phenology, diet, survival rates

Phenology

No systematic data on phenology (timing of life-cycle events) have been collected as part of the SMP.

Diet

Figure 10 shows a marked decline in the proportion by weight of sandeels in the diet of European shag chicks on the Isle of May[14,6,7], although during most of this period there was no clear negative effect on productivity; in fact, 2008 and 2009 were two of the most productive breeding seasons on record (see Figure 4 above). Until the early 2000s, European shags on the Isle of May fed their young mainly sandeels[23,24,25] but, since then, chick diet has changed substantially, with a decline in sandeels and an increase in diet diversity[5]. European shags appear to be able to adjust their foraging behaviour in response to a change in the availability of different prey types within their foraging range[26,27,28,29]. Therefore, although sandeel abundance may still be important, it may be less so when alternative prey are available during poor sandeel years, as appears to be the case around the Isle of May.

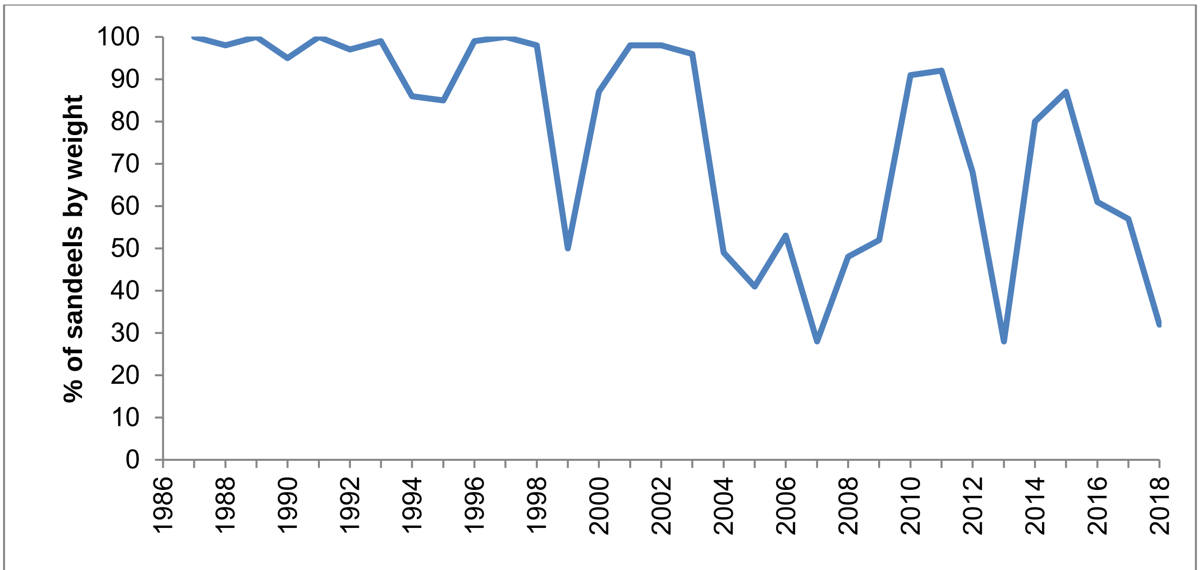

Figure 10. Percentage of sandeels (by weight) in the diet of young shags at the Isle of May, 1987-2018.

Return rates and survival rates

Important notes on interpretation: Estimation of European shag adult return rate is currently only undertaken at one site within the Seabird Monitoring Programme - the Isle of May. Return rates are based on sightings of individually colour-ringed birds and are calculated as the proportion of marked birds present in year one that are seen in the following year. Because not every adult alive is seen each year, the return rates for 2018 presented need to be treated as a minimum estimate of survival of birds seen alive in 2017. In contrast, survival estimates do consider birds that are not seen one year but which re-appear in following years.

No clear trend in return rate is evident from the Isle of May data. In 2018, the return rate was estimated to be 68.0%, which was below the long-term average at the colony (79.6%, 95% CI = 73.0-86.2) and the lowest estimate since 2012. In 2018, the breeding season on the Isle of May commenced late for all species, including European shags, presumably as a consequence of the ‘Beast from the East’ (https:\\en.wikipedia.org/wiki/2018_Great_Britain and Ireland cold wave) which brought cold and windy conditions through much of March[14].

A notable feature of European shag biology is their susceptibility to die from periods of low food availability caused by unusually prolonged periods of strong onshore winds, which makes foraging difficult. Such 'wrecks' occurred around eastern Britain during the winters of 1994/95, 2004/05 and again in 2012/13 and are reflected in the very low return rates in the following breeding seasons (Figure 11). The 'wreck' during winter 2012/13 resulted in over 650 corpses being recovered from beaches between Orkney and Suffolk[2]. It is, therefore, not surprising that the return rate for the Isle of May fell in 2013, although not all corpses recovered would have been from this colony. Measurements of shag return rates on the Isle of May show the impact of such 'wrecks' (Figure 11)[14].

Predictions of increased storminess due to climate change suggest such mortality events may become more frequent and have important impacts on population size[2,30].

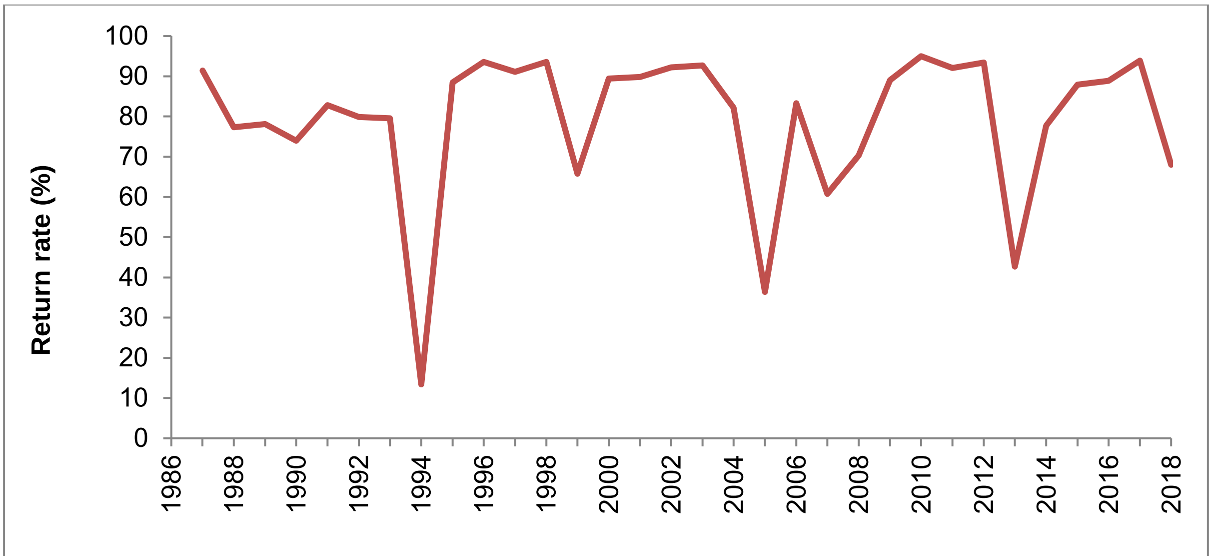

Figure 11. Annual return rate of European shag breeding on the Isle of May, 1987-2018.

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Arctic Skua *Stercorarius parasiticus*

Description

The following has been adapted from original text by Robert W. Furness and Norman Ratcliffe in Seabird Populations of Britain and Ireland (with permission from A&C Black, London).

In Britain, the Arctic skua is confined to breeding in north and west Scotland, at the southern extremity of its circumpolar, high latitude breeding range. In Scotland, most nest in moorland colonies close to aggregations of auks (common guillemots, razorbills and Atlantic puffins), black-legged kittiwakes and Arctic terns from which they obtain food by piracy. In a few places, such as the extensive moors of Caithness, the species can be found further inland in rather scattered breeding territories, where feeding on berries, insects and small birds may be more important. Unlike the larger great skua, Arctic skuas do not normally scavenge behind fishing boats or feed as members in multi-species flocks of seabirds on surface shoals of fish, as their smaller size means they cannot compete in such situations. Although numbers nesting in Scotland increased in the 1970s and 1980s, most of their breeding sites have been established for many decades or centuries with few new colonies formed, resulting in a remarkably static breeding range.

Conservation status

Arctic skua is currently identified as a conservation priority in the following:

Red listed in Birds of Conservation Concern 4 (2015 update)
UK BAP - priority species
further information on Conservation Designations for UK Taxa
Green listed in Birds of Conservation Concern in Ireland 2014-2019
EC Birds Directive - migratory species

International importance

UK Population	% Biogeographic Population	% World Population
2,100 AOT*	8.4 (NE Atlantic)	1.0

*AOT = Apparently Occupied Territories

The UK population figure (rounded to the nearest hundred) was derived from data in Mitchell, P.I., Newton, S.F., Ratcliffe, N. and Dunn, T.E. (eds.) 2004. *Seabird Populations of Britain and Ireland.* Poyser, London. This was also the source of figures for the Biogeographic and World populations.

UK population estimates and change 1969-2002 (census data)

Once they have been recruited into a colony, Arctic skuas usually breed every year returning to the same territory year after year. However, in seasons when food supply is particularly poor, birds may fail to lay. This appears to have been the case during surveys of Arctic skua in Shetland in 2000 and 2001 which may have resulted in an underestimate of the number that would normally be breeding under more favourable conditions. Productivity in Shetland was also poor in 2000 and 2001, and birds that lost eggs early on may have shown low attendance in the territory, possibly resulting in some territories being missed. Counts in Shetland in 2002 were affected by poor weather conditions in some parts, with a considerable area surveyed in fog which may also have contributed to an underestimate of numbers.

	Operation Seafarer (1969-70)	Seabird Colony Register (1985-88)	Seabird 2000 (1998-2002)
UK Population estimate (AOT*)	1,039	3,388	2,136
% change since previous census	n/a	+226	-37

*AOT = Apparently Occupied Territories

For census results for individual countries and Ireland, the Channel Islands and the Isle of Man see under relevant sections below.

Distribution/abundance

The Seabird 2000 census provides the most comprehensive recent assessment of the distribution and abundance of breeding seabirds. Numbers are found in different regions, and a map showing the location and size of colonies, is provided in the Seabird 2000 Arctic skua results page.

The locations sampled during the annual Seabird Monitoring Programme provide some information on distribution and are accessible via the Seabird Monitoring Programme online database

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Annual abundance and productivity by geographical area

With reference to the regional accounts below please note the following.

Breeding abundance: graphs of abundance index with 95% CLs are only shown for a region where the trend produced has been deemed accurate (see methods of analysis). Where a trend was thought to be inaccurate, graphs of abundance at major colonies in a region may be shown instead, particularly if such colonies hold greater than 10% of the regional population, are monitored frequently and may thus help illustrate regional population fluctuations outwith national censuses. Occasionally, too few data have been collected regionally to produce either of these.

Productivity: graphs of productivity are only shown if analysis of breeding success data produced a significant result for regional and/or year effects (again see methods of analysis). If results were not significant, then a regional mean productivity value is given. However, on some occasions too few data are available from which to provide a meaningful average. Furthermore, for 11 species where the quality of monitoring data available was considered high, population viability analysis was undertaken at the UK level and the results of this are also reported.

United Kingdom

Breeding abundance

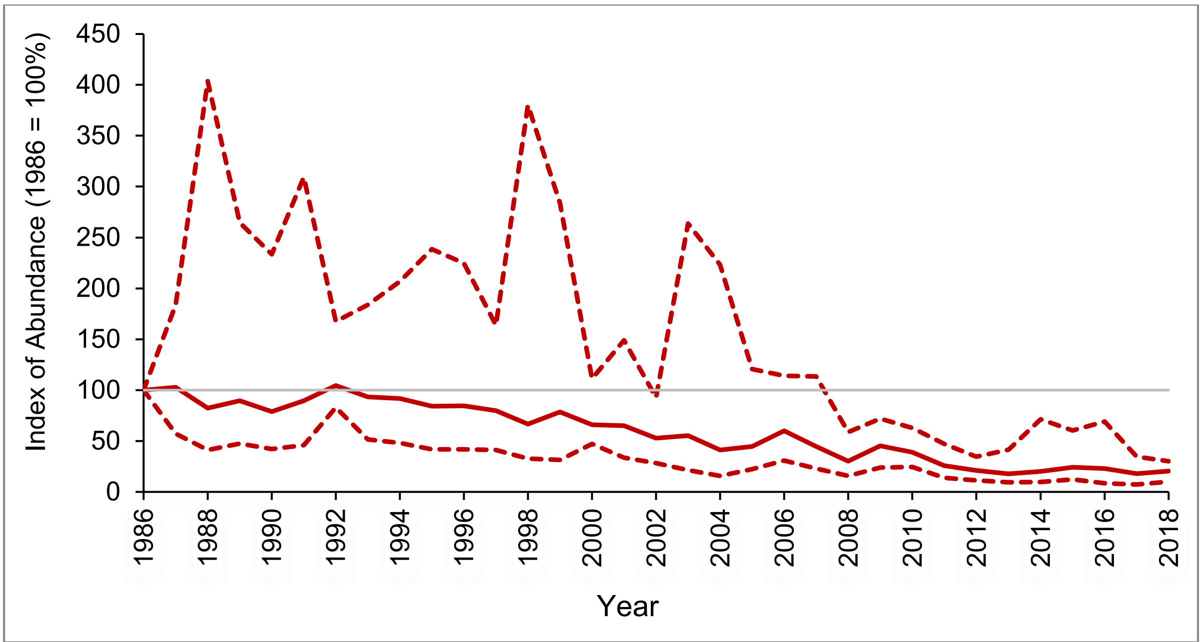

Figure 1. Trend in UK abundance index (solid line) of Arctic skua 1986-2018 with 95% confidence limits (dotted lines). Based on SMP data; view the methods of analysis.

National census data show the population of Arctic skuas increased between 1969-70 (1,000 AOT) and 1985-88 (3,400 AOT) although some of this increase was due to greater coverage during the SCR census. However, Seabird 2000 only recorded 2,100 AOT, 37% fewer than the preceding census. Figure 1 shows the trend was stable until the early 1990s but has declined steadily since; the Arctic skua has probably declined more than any other seabird in the UK during the period from 1986 to 2018, with the lowest population index in 2013 estimated to be 82% lower than in 1986. The current breeding seabird census, Seabirds Count, will provide a more comprehensive assessment of the scale of the decline.
A recent study in 2015 estimated that Artic skuas had declined to approximately 200 AOT in Orkney, Shetland and Handa combined, an 81% decline since 1992 and 71% since Seabird 2000[1]. Arctic skuas in Shetland had already declined by 42% between the SCR and Seabird

2000 censuses, and a small number of well monitored colonies suggest a further fall in the population; (Foula, Fair Isle, Fetlar, Mousa, Hermaness, North Hill, Noss, and Hoy held 78 AOT between them in 2018, 81% fewer than was recorded by Seabird 2000 (403 AOT)). In the west of Scotland, only 15 AOT were recorded on Handa in 2018, a decline of 64% since a peak of 42 AOT in 2001.

In Scotland, Arctic and great skuas breed sympatrically, usually beside large colonies of cliff-nesting seabirds[2]. One of the main factors contributing towards this national decline is likely to be the continuous decrease in their annual productivity (no. chicks fledged per pair) and that of their host species from which they kleptoparasitise food (Arctic tern, kittiwake, common guillemot and puffin). Recent observed alterations in the marine food web in the northeast Atlantic, strongly influenced by fisheries management and climate change, are driving the decline of lesser sandeels *Ammodytes marinus*, a main food source of Arctic skuas and their host species.[3,4,5,6] Another factor contributing to their decline is likely to be competition for nesting territories and predation by great skuas which have increased markedly [2,7,8,9,10].

Productivity

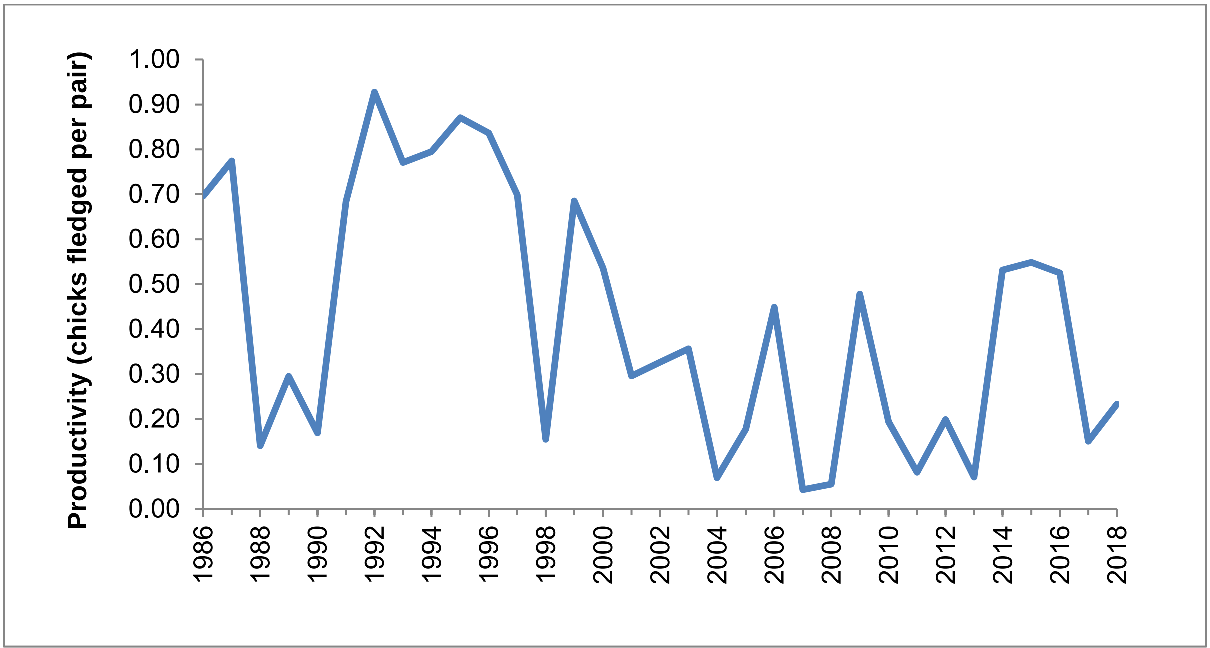

Figure 2. Trend in UK productivity (no. of chicks fledged per pair) of Arctic skua 1986-2018. Based on SMP data; view the methods of analysis.

Arctic skuas periodically experience years of very poor productivity (chicks fledged per pair), which often coincide with periods of presumed low sandeel abundance[2]; such periods have become more frequent since the late 1990s, with several years of very low productivity since 2003, although 2015 was the most productive breeding seasons since 1999.
Annual data from the six most frequently monitored Arctic skua colonies in Shetland (85 data points between 2003-2018 from Fair Isle, Fetlar, Foula, Hermaness, Mousa and Noss) illustrate just how bad breeding seasons have become. Complete failure was recorded 43 times, with productivity below 0.20 chicks fledged per pair on a further 16 occasions; only on ten occasions did productivity climb above 0.80. Arctic skuas rely on stealing fish caught by other seabirds, especially Arctic terns, black-legged kittiwakes, common guillemots and Atlantic puffins; declines in the abundance and chick provisioning of these host species has reduced feeding opportunities for Arctic skuas.[1,2] Recent sandeel scarcity around Shetland

is attributed to low recruitment in most years since the mid-1980s, linked to hydro-climatic changes affecting hatching dates, survival and transport of larvae from major spawning areas north and west of Orkney[11,12]. More significantly, environmental conditions for sandeels appear to be worsening, with sea temperature increases and oceanographic changes affecting their physiology, food supply, phenology and survival, leading to trophic mismatch and less food for seabirds[13,14,15] Predation of Arctic skua chicks, and sometimes displacement or killing of adults during territory disputes by great skuas (also ultimately linked to a scarcity of alternative fish prey for great skuas), is also known to be reducing productivity in some regions[3,9,11].

Scotland

Breeding abundance

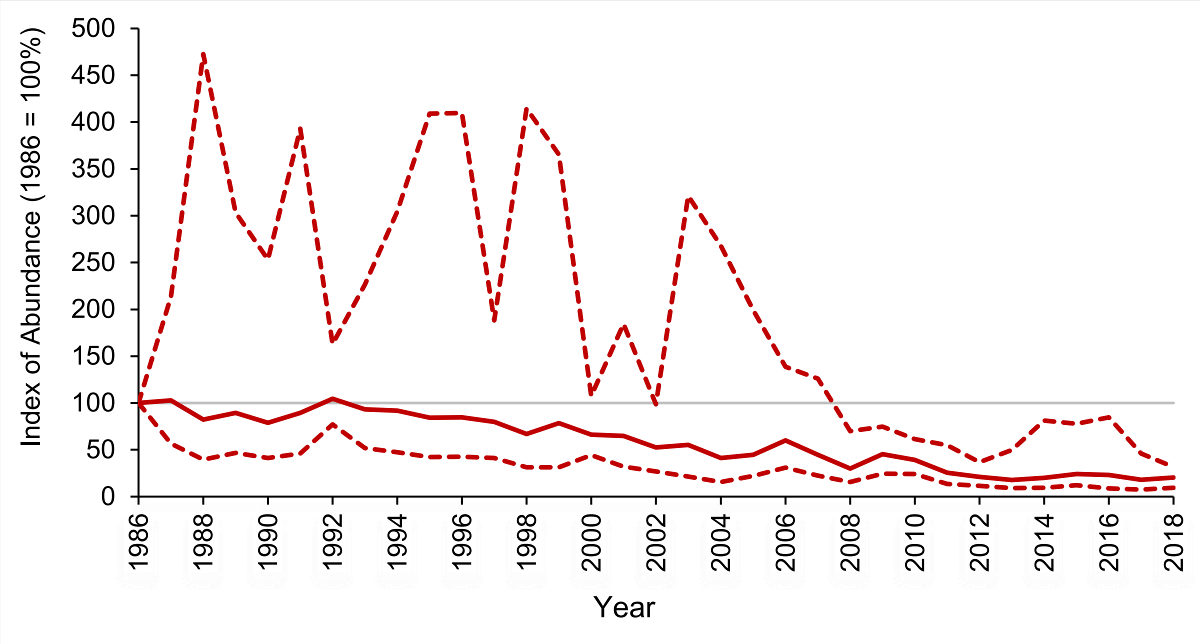

Figure 3. Trend in abundance index (solid line) of Arctic skua in Scotland, 1986-2018 with 95% confidence limits (dotted lines). Based on SMP data; view the methods of analysis.

National census data show the Scottish Arctic skuas population increased between 1969-70 (1,000 AOT) and 1985-88 (3,400 AOT) although some of this increase was due to greater coverage during the SCR census. However, Seabird 2000 only recorded 2,100 AOT, 37% fewer than the preceding census. Figure 3 shows the trend was stable until the early 1990s but has declined steadily since; the Arctic skua has probably declined more than any other seabird in the UK during the period from 1986 to 2018, with the lowest population index in 2013 estimated to be 82% lower than in 1986.

A survey of the Orkney population in 2010 found just 380 AOT compared to 720 AOT in 2000, so numbers there alone declined by 47% during that decade (and by 64% since 1992 when 1,043 AOT were recorded). In addition, a study in 2015 estimated Artic skua to have declined to approximately 200 AOT in Orkney, Shetland and Handa combined, a 81% decline since 1992 and a 71% decline since Seabird 2000[1]. However, to fully ascertain the scale of the current decline, extensive survey work is still needed in Shetland where over half of the UK (and Scottish) population has bred in the past. Arctic skuas in Shetland had already declined by 42% between the SCR and Seabird 2000, and a small number of well monitored colonies suggest a further large fall in numbers; (Foula, Fair Isle, Fetlar, Mousa, Hermaness, North Hill, Noss, and Hoy held 78 AOT between them in 2018, 81% fewer than was recorded by Seabird 2000 (403 AOT)). In the west of Scotland, only 15 AOT were recorded on Handa in 2018 with numbers there having declined fairly steadily since 2001 when a peak of 42 AOT was recorded.

In Scotland, Arctic and great skuas breed sympatrically, usually beside large colonies of cliff-nesting seabirds[2]. One of the main factors contributing towards this national decline is likely to be the continuous decrease in their annual productivity (no. chicks fledged per pair) and that of their host species from which they kleptoparasitise food (Arctic tern, kittiwake, common guillemot and puffin). Recent observed alterations in the marine food web in the northeast Atlantic, strongly influenced by fisheries management and climate change are driving the decline of lesser sandeels *Ammodytes marinus* a main food source of Arctic skuas and their host species[3,6,7,8,9,10]. Another factor contributing to their decline is likely to be competition for nesting territories and predation by great skuas which have increased markedly[2,9,11,12,13].

Productivity

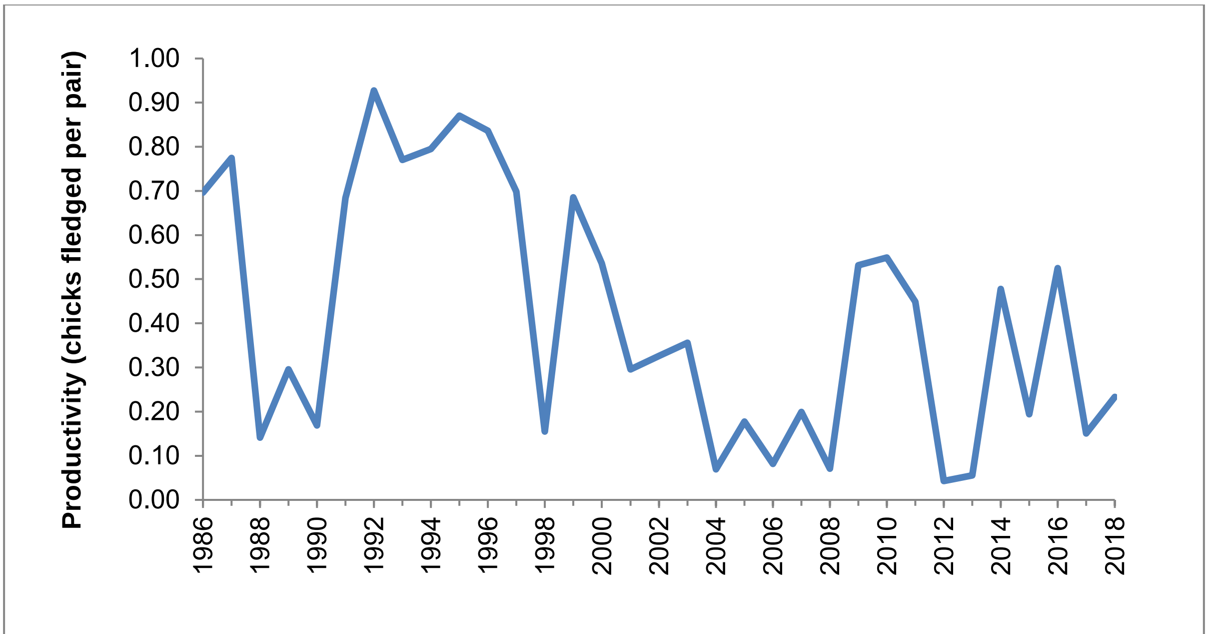

Figure 4. Trend in productivity (no. of chicks fledged per pair) of Arctic skua in Scotland, 1986-2018. Based on SMP data; view the methods of analysis.

Arctic skuas periodically experience years of very poor productivity (no. of chicks fledged per pair), which often coincide with periods of presumed low sandeel abundance[2]; such periods have become more frequent since the late 1990s, with several years of very low success since 2003, although 2015 was the most productive breeding seasons since 1999. A recent study found that annual productivity declined, from a five-year mean of 0.91 in 1992 to 1996 to 0.29 in 2011 to 2015. During 1992–2000, it fell below 0.5 fledged per pair just once (1998), whereas it reached this level only three times since (2006, 2014, 2015)[1].
Annual data from the six most frequently monitored Arctic skua colonies in Shetland (85 data points between 2003-2018 from Fair Isle, Fetlar, Foula, Hermaness, Mousa and Noss) illustrate just how bad breeding seasons have become. Complete failure was recorded 43 times, with productivity below 0.20 chicks fledged per pair on a further 16 occasions; only on 10 occasions did productivity climb above 0.80. Arctic skuas rely on stealing fish caught by other seabirds, especially Arctic terns, black-legged kittiwakes, common guillemot and Atlantic puffins; declines in the abundance and chick provisioning of these host species has

reduced feeding opportunities for Arctic skuas[1,2]. Recent sandeel scarcity around Shetland is attributed to low recruitment in most years since the mid-1980s, linked to hydro-climatic changes affecting hatching dates, survival and transport of larvae from major spawning areas north and west of Orkney[14,15]. More significantly, environmental conditions for sandeels appear to be worsening, with sea temperature increases and oceanographic changes affecting their physiology, food supply, phenology and survival, leading to trophic mismatch and less food for seabirds.[6,7,8] Predation of Arctic skua chicks and sometimes displacement or killing of adults during territory disputes by great skuas (also ultimately linked to a scarcity of alternative fish prey for great skuas) is also known to be reducing productivity in some regions[3,9,11,12].

England

Arctic skua does not breed in England.

Wales

Arctic skua does not breed in Wales.

Northern Ireland

Arctic skua does not breed in Northern Ireland.

Republic of Ireland

Arctic skua does not breed in the Republic of Ireland.

All Ireland

Arctic skua does not breed in Ireland.

Isle of Man

Arctic skua does not breed on the Isle of Man.

Channel Islands

Arctic skua does not breed on the Channel Islands.

UK Phenology, diet, survival rates

No data have been collected as part of the Seabird Monitoring Programme.

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Great Skua *Stercorarius skua*

Description

The following has been adapted from original text by Robert W. Furness and Norman Ratcliffe in Seabird Populations of Britain and Ireland (with permission from A&C Black, London).

The great skua, or bonxie, is famous for its aggressive defence of territory against human intruders. The species has a very restricted breeding range – confined to the northeast Atlantic, the World population is only around 16,000 apparently occupied territories (AOTs), of which 60% are in Scotland, concentrated in Shetland and Orkney. However, its population has been increasing since 1900, and it has progressively extended its breeding range both northeast into the Barents Sea, and south into the islands of west Scotland. Closely related species breed in the Antarctic and sub-Antarctic, and show strong adaptations to cold conditions and a predatory life-style. In Scotland, great skuas nest on coastal moorland, often in loose groups of scattered nests, but with some colonies numbering thousands of pairs. When nesting at low density in small colonies, most birds in the colony feed by killing seabirds. However, when nesting in large colonies, the majority feed on fish, including fishery discards, and only a small proportion specialise in killing seabirds. Ringing has shown that great skuas from Shetland have emigrated to form colonies in many other areas as far away as north Russia, but the majority of chicks return to their natal colony to try to establish a breeding territory.

Conservation status

Great skua is currently identified as a conservation priority in the following:

Amber listed in Birds of Conservation Concern 4 (2015 update)
(further information on Conservation Designations for UK Taxa)
Amber listed in Birds of Conservation Concern in Ireland 2014-2019
EC Birds Directive - migratory species

International importance

UK Population	% Biogeographic Population	% World Population
9,600 AOT*	n/a	60.0

*AOT = Apparently Occupied Territories

The UK population figure (rounded to the nearest hundred) was derived from data in Mitchell, P.I., Newton, S.F., Ratcliffe, N. and Dunn, T.E. (eds.) 2004. *Seabird Populations of Britain and Ireland.* Poyser, London. This was also the source of figures for the Biogeographic and World populations.

UK population estimates and change 1969-2002 (census data)

Coverage of great skua breeding areas in the Seabird 2000 survey was good in most regions, although small areas of possible breeding habitat in parts of west and central mainland Shetland and Caithness were not surveyed. Coverage of nesting areas during the SCR Census (1985-88) was complete although surveys in Orkney were conducted in 1982 and counts subsequently adjusted using observed trends to estimate population size. Counts from all other areas used in the SCR Census were conducted during 1985-88. Operation Seafarer (1969-70) did not attempt to find all inland nesting skuas so will have underestimated numbers by a small amount.

Great skuas are relatively easy to census as throughout the breeding season, and especially during incubation and early chick-rearing (from early May to late June), they show very high territory attendance. Pairs that have lost eggs or young chicks almost invariably remain on territory and those that fail early (when most clutches are lost) will lay a replacement clutch. During Seabird 2000 not all colonies were counted in the same year, but this should not have affected population size estimates, as great skuas show high fidelity to breeding sites.

	Operation Seafarer (1969-70)	**Seabird Colony Register (1985-88)**	**Seabird 2000 (1998-2002)**
UK Population estimate (AOT*)	3,079	7,645	9,634
% change since previous census	n/a	+148	+26

*AOT = Apparently Occupied Territories

For census results for individual countries and Ireland, the Channel Islands and the Isle of Man see under relevant sections below.

Distribution/abundance

The Seabird 2000 census provides the most comprehensive recent assessment of the distribution and abundance of breeding seabirds. Numbers are found in different regions, and a map showing the location and size of colonies, is provided in the Seabird 2000 great skua results page.

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Annual abundance and productivity by geographical area

With reference to the regional accounts below please note the following.

Breeding abundance: graphs of abundance index with 95% CLs are only shown for a region where the trend produced has been deemed accurate (see methods of analysis). Where a trend was thought to be inaccurate, graphs of abundance at major colonies in a region may be shown instead, particularly if such colonies hold greater than 10% of the regional population, are monitored frequently and may thus help illustrate regional population fluctuations outwith national censuses. Occasionally, too few data have been collected regionally to produce either of these.

Productivity: graphs of productivity are only shown if analysis of productivity data produced a significant result for regional and/or year effects (again see methods of analysis). If results were not significant, then a regional mean productivity value is given. However, on some occasions too few data are available from which to provide a meaningful average. Furthermore, for 11 species where the quality of monitoring data available was considered high, population viability analysis was undertaken at the UK level and the results of this are also reported.

United Kingdom

Breeding abundance

Census results show an increase, from 3,079 pairs in 1969-70 to 7,645 pairs in 1985-88 and 9,634 pairs in 1998-2002, which suggests that although the population was increasing, the growth rate was slowing down. The annual sample of great skua colonies is insufficient to produce reliable trend information because only few major colonies are surveyed frequently, or in the same year, so the trend since the last census is largely unknown. However, numbers are decreasing in some areas. In Shetland, four colonies (Hermaness, Noss, Mousa and Fair Isle) held 1,476 AOT in 2018, a decrease of 49% since 2007 (the last common year all were surveyed). On Fair Isle, great skuas have been steadily increasing from 84 AOT in 1986 to 520 AOT in 2018. Though, since 2014, the colony shows strong fluctuation with numbers increasing one year and decreasing the next (range 188-520 AOT). In the west of Scotland, four colonies (Priest Island, Canna, Fladda and Lunga and Sgeir a' Chaisteil) held 19 AOT in 2013 and 21 AOT in 2018. However, at the west coast colony of Handa, numbers had been fluctuating; falling from 266 to 135 AOT between 2009 and 2013, and increasing to 256 AOT in 2015 and 283 AOT in 2018. A complete survey of the Orkney population in 2010 found only 1,710 AOT, almost 23% less than what were recorded during Seabird 2000. A study of abundance data in Scotland from 1992 to 2015 indicated that great skuas increased at most sites, with some very large increases at smaller colonies. However, declines at the two largest colonies (Foula and Hoy) resulted in little overall change in AOTs across all colonies combined.

The above data present a complicated picture with no clear trend; surveys at the remaining UK colonies, especially in other parts of Shetland and the Western Isles, are required to accurately assess the current population status of the great skua.

Great skua diet varies geographically; in the Northern Isles, where about 94% of the UK breeding population occurs, great skua is a scavenger largely feeding on fisheries discards and sandeels[1,2,3,4]. Increasingly, since the 1980s, it has become a major predator of seabirds, particularly in smaller colonies, such as those in the Western Isles (where approximately 6% of the population occur)[5,6]. The population increase during the 1970s is likely to have been supported by high availability of discards from fishing boats, although a reduction in discards associated with decreased stocks of cod, haddock and whiting in the 1980s[7] and a reduction in sandeel stocks[8] led to reduced productivity and adult survival, resulting in reduced rates of population increase. It appears that density dependent competition for food and/or breeding territories are likely to limit further population growth. Indeed, analysis of the decline in Orkney in 2010 indicates the driver of population change was competition for food at a local (i.e. colony) level[9]. In addition, the great skua is a cold-adapted species which suffers heat stress during warm weather[5]. This currently limits their southerly extent and it is likely that climate change will further reduce available breeding habitat and their distribution in the UK.

Productivity

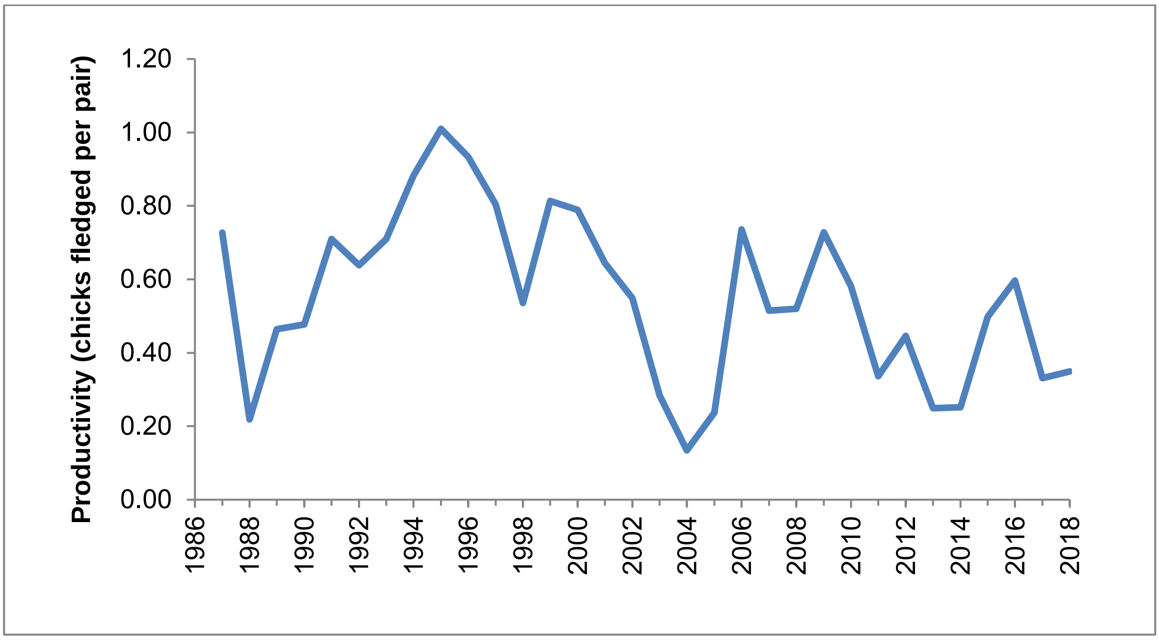

Figure 2. Trend in UK productivity (no. of chicks fledged per pair) of great skua 1986-2018. Based on SMP data; view the methods of analysis.

Periods of low productivity occurred during the late 1980s, the early 2000s and from 2011 to 2014. In the large Shetland colonies, this was probably due to decreased sandeel availability[8] and low levels of discards[7]. These declines in productivity may have been mitigated to an extent by the ability of great skuas to switch to alternative food sources, often becoming cannibalistic and also preying on the chicks and adults of other seabird species including kittiwake, auks and fulmar [10,11,12,13,14,15,16].

Unlike Arctic skua, great skua colonies rarely suffer complete breeding failure. Annual monitoring data from six Arctic skua colonies in Shetland (Fair Isle, Fetlar, Foula, Hermaness, Mousa and Noss) between 2003 and 2018 recorded 43 cases of complete colony failure out of a possible 85 colony-years, not one instance of complete failure for the great skua occurred over the same period. Great skuas do not breed until they are at least 5 years old, so reductions in productivity and subsequent impacts on recruitment will only be manifested in breeding numbers many years afterwards. Therefore, we should expect further decreases in their population in the coming decade.

Scotland

Breeding abundance

Census results show an increase, from 3,079 pairs in 1969-70 to 7,645 pairs in 1985-88 and 9,634 pairs in 1998-2002, which suggests that although the population was increasing, the growth rate was slowing down. The annual sample of great skua colonies is insufficient to produce reliable trend information because only few major colonies are surveyed frequently, or in the same year, so the trend since the last census is largely unknown. However, numbers are decreasing in some areas. In Shetland, four colonies (Hermaness, Noss, Mousa and Fair Isle) held 1,476 AOT in 2018, a decrease of 49% since 2007 (the last common year all were surveyed). On Fair Isle, great skuas have been steadily increasing from 84 AOT in 1986 to 520 AOT in 2018. However, since 2014, the colony has shown strong fluctuation with numbers increasing one year and decreasing the next (range 188-520 AOT). In the west of Scotland, four colonies (Priest Island, Canna, Fladda and Lunga and Sgeir a' Chaisteil) held 19 AOT in 2013 and 21 AOT in 2018. However, at the west coast colony of Handa, numbers had been fluctuating; falling from 266 to 135 AOT between 2009 and 2013, and increasing to 256 AOT in 2015 and 283 AOT in 2018. A complete survey of the Orkney population in 2010 found only 1,710 AOT, almost 23% fewer than what were recorded during Seabird 2000[9]. A study of abundance data in Scotland from 1992 to 2015 indicated that great skuas increased at most sites, with some very large increases at smaller colonies. However, declines at the two largest colonies (Foula and Hoy) resulted in little overall change in AOTs across all colonies combined[17].

The above data present a complicated picture with no clear trend; surveys across the remaining UK distribution of the species, especially in other parts of Shetland and the Western Isles, are required to accurately assess the current population status of the great skua.

Great skua diet varies geographically; in the Northern Isles, where about 94% of the UK breeding population occurs, great skua is a scavenger largely feeding on sandeels *Ammodytes spp* during the 1970s and on fisheries discards from the 1980s to the present day[1,2,3,4]. Increasingly, since the 1980s, it has become a major predator of seabirds, particularly in smaller colonies, such as those in the Western Isles (where approximately 6% of the population occur)[5,6]. The population increase during the 1970s is likely to have been supported by high availability of discards from fishing boats, although a reduction in discards associated with decreased stocks of cod, haddock and whiting in the 1980s[7] and a reduction in sandeel stocks[8] led to reduced productivity and adult survival, resulting in reduced rates of population increase. It appears that density dependent competition for food and/or breeding territories are likely to limit further population growth. Indeed, analysis of the decline in Orkney in 2010 indicates the driver of population change was competition for food at a local (i.e. colony) level[9]. In addition, the great skua is a cold-adapted species which suffers heat stress during warm weather[5]. This currently limits their southerly extent and it is likely that climate change will further reduce available breeding habitat and their distribution in the UK.

Productivity

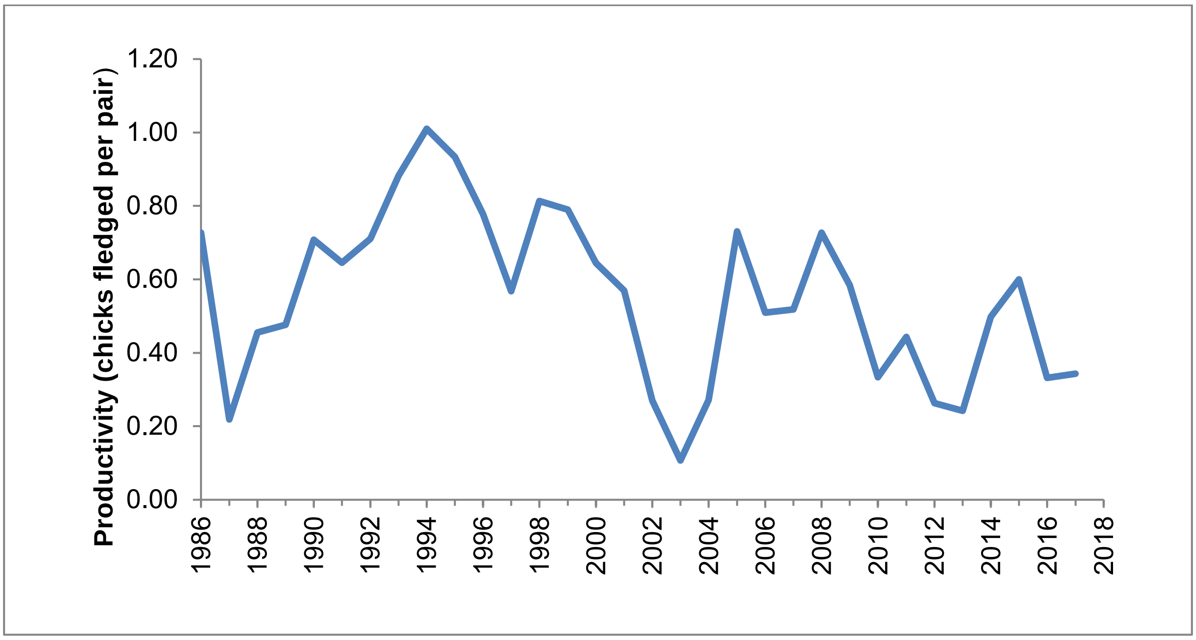

Figure 2. Trend in productivity (no. of chicks fledged per pair) of great skua in Scotland, 1986-2018. Based on SMP data; view the methods of analysis.

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England

Great skua does not breed in England.

Wales

Great skua does not breed in Wales.

Northern Ireland

Breeding abundance

In Northern Ireland, great skuas are a recent colonist, first nesting on Rathlin Island in 2010. A single pair bred there successfully in 2011, 2014, 2015 and 2016[21,22].

Productivity

The productivity of the recent colonists has been closely monitored. In 2011, a single pair nested, laying two eggs, one of which hatched and the chick subsequently fledged. This was the first successful breeding attempt by this species in Northern Ireland. Since then, breeding attempts have been made by this single pair in most years, but they have only fledged chicks in 2014, 2015, 2016. On average, productivity measures 1.67 chicks fledged per pair per year.

Republic of Ireland

Breeding abundance

In the Republic of Ireland, great skuas first bred in the late 1990s in Co. Mayo[23]. Numbers have increased slowly since then. During the recent Republic of Ireland Seabird Census the population of great skua was recorded to be at least 13 pairs, an increase of at least 1,200% since Seabird 2000[23].

Productivity

No systematic data on the productivity of great skuas in the Republic of Ireland have been submitted to the SMP.

All Ireland

Breeding abundance

Great skuas are a recent colonist in Ireland. First nesting in the late 1990s in the Republic of Ireland and colonising Northern Ireland in 2010. It is thought there are now in excess of 13 pairs[23].

Productivity

Data on the productivity of great skuas in Ireland are scarce, although the recent colonists in Northern Ireland have been closely monitored, where productivity measures an average of 1.67 chicks fledged per pair per year. The productivity of great skuas nesting in the Republic of Ireland, where as many as 15 pairs are thought to be present, is unknown or unreported.

Isle of Man

Great skua does not breed on the Isle of Man.

Channel Islands

Great skua does not breed on the Channel Islands.

UK Phenology, diet, survival rates

No data have been collected as part of the Seabird Monitoring Programme.

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Black-legged kittiwake *Rissa tridactyla*

Description

The following has been adapted from original text by Martin Heubeck in Seabird Populations of Britain and Ireland (with permission from A&C Black, London).

As well as being the most numerous species of gull in the world, the black-legged kittiwake is the most oceanic in its habits and most adapted to nesting on vertical rocky sea-cliffs. In Britain and Ireland, the largest and most numerous colonies are found along the North Sea coasts of Britain, around Orkney and Shetland, and off north-west Scotland. Colony size varies from less than ten pairs to tens of thousands, but the locations of colonies tend to be traditional over many decades. Although most colonies are on sheer cliffs, in a few instances man-made structures such as buildings, bridges, sea walls and even offshore oil installations have been utilised. During the breeding season, black-legged kittiwakes feed mainly on small pelagic shoaling fish; around Britain and Ireland these consist of energy-rich species such as sandeels, sprats and young herring. However, kittiwakes will also scavenge for offal and discards around fishing boats, which can be an important food source in years when their preferred prey species are less abundant. Outside the breeding season the species is essentially oceanic, and it is probable that populations from many different breeding localities mix together in the North Atlantic and North Sea during winter, with some birds from British and Irish colonies (especially first-winter and immature birds) spending time off the eastern seaboard of North America.

Conservation status

Black-legged kittiwake is currently identified as a conservation priority in the following:

Red listed in Birds of Conservation Concern 4 (2015 update).
further information on Conservation Designations for UK Taxa
Amber listed in Birds of Conservation Concern in Ireland 2014-2019
OSPAR List of Threatened and/or Declining Species and Habitats
EC Birds Directive - migratory species

International importance

UK Population	% Biogeographic Population	% World Population
378,800 AON*	13.8 (ssp. *tridactyla*)	8.0

*AON = Apparently Occupied Nests

The UK population figure (rounded to the nearest hundred) was derived from data in Mitchell, P.I., Newton, S.F., Ratcliffe, N. and Dunn, T.E. (eds.) 2004. *Seabird Populations of Britain and Ireland.* Poyser, London. This was also the source of figures for the Biogeographic and World populations.

UK population estimates and change 1969-2008

Geographical coverage of black-legged kittiwake colonies in the UK was complete during all three national censuses. In some years, in response to a scarcity of food in spring, nest building can be delayed by 2-3 weeks. Under such conditions a high proportion of pairs (up to 40%) may begin nest building but not complete a structure which qualifies as an apparently occupied nest (AON), the preferred count unit, or progress to laying. This phenomenon was documented for Shetland in 2002 but did not affect counts for Seabird 2000. Counts outwith the recommended count period (June) may also underestimate figures but, as this applied to only approximately 5% of UK counts, it is unlikely that such 'out-of-season' counts had much influence on gross estimates of population change.

	Operation Seafarer (1969-70)	Seabird Colony Register (1985-88)	Seabird 2000 (1998-2002)
UK Population estimate (AON*)	407,417	504,055	378,847
% change since previous census	n/a	+24	-25

*AON = Apparently Occupied Nests

Distribution/abundance

The Seabird 2000 census provides the most comprehensive recent assessment of the distribution and abundance of breeding seabirds.

The locations sampled during the annual Seabird Monitoring Programme provide some information on distribution and are accessible via the Seabird Monitoring Programme online database.

Annual abundance and productivity by geographical area

With reference to the regional accounts below please note the following.

Breeding abundance: graphs of abundance index with 95% CLs are only shown for a region where the trend produced has been deemed accurate (see methods of analysis). Where a trend was thought to be inaccurate, graphs of abundance at major colonies in a region may be shown instead, particularly if such colonies hold greater than 10% of the regional population, are monitored frequently and may thus help illustrate regional population fluctuations outwith national censuses. Occasionally, too few data have been collected regionally to produce either of these.

Productivity: graphs of productivity are only shown if analysis of breeding success data produced a significant result for regional and/or year effects (again see methods of analysis). If results were not significant, then a regional mean productivity value is given. However, on some occasions too few data are available from which to provide a meaningful average. Furthermore, for 11 species where the quality of monitoring data available was considered high, population viability analysis was undertaken at the UK level and the results of this are also reported.

United Kingdom:

Breeding abundance

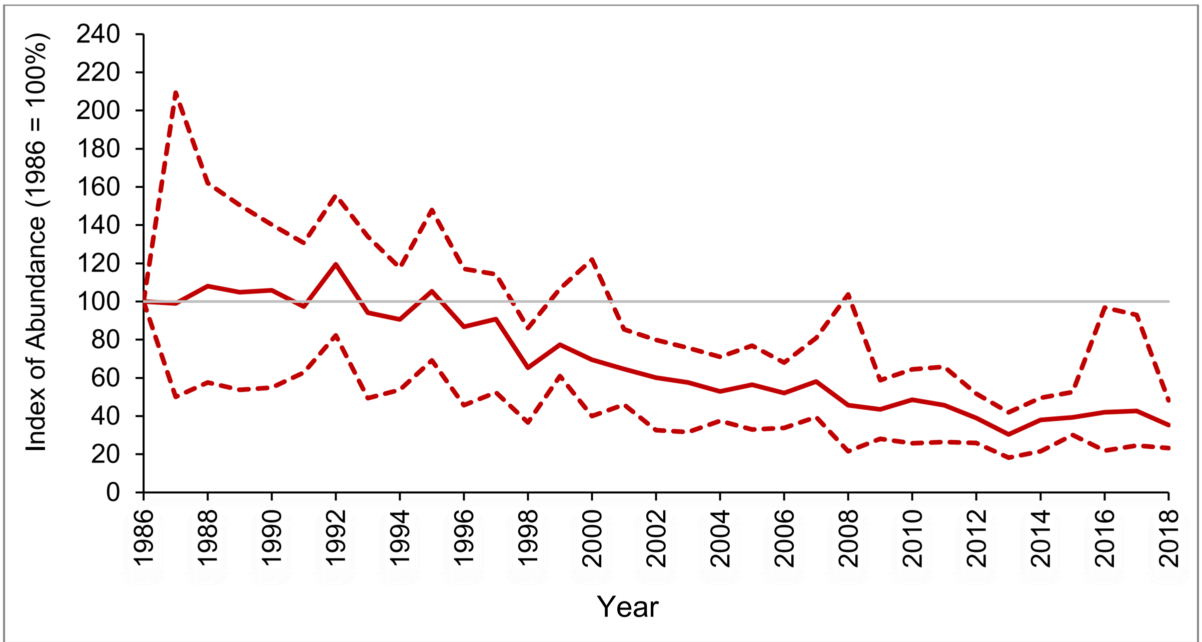

Figure 1. Trend in UK abundance index (solid line) of black-legged kittiwake 1986-2018 with 95% confidence limits (dotted lines). Based on SMP data; view the methods of analysis.

Over the longer term, combining census results with the SMP sample indicates that, while black-legged kittiwake numbers increased by around 24% between the late 1960s and the mid-1980s (see UK population estimate table above), there are probably now around 50% fewer than in the late 1960s (Figure 1). The UK kittiwake abundance index has declined rapidly since the early 1990s, such that by 2004 the index was 47% below what it was in 1986. By 2013, it had decreased to 70% below the 1986 baseline but appears to have been more stable since then. In 2018, the index was located at 65% below the baseline.

Table 1 shows how numbers have changed at some of the most important UK colonies (those in the SPA network) in the period since they were surveyed for Seabird 2000. Some of the largest declines recorded since Seabird 2000 have been at colonies in the north and north-west. Colonies in Shetland have been declining at an average rate of 16.0% *per annum*, those in Orkney at 9.7% and those in the North West at 11.9%. Along the east coast of the UK, and in the Minch and Irish Sea, the average rate of decline is much slower at an estimated 2.3%, 3.8% and 3.7% *per annum,* respectively.

Area	SPA Name	Seabird 2000	Count $^{(Year)}$	Change (%)	% *per annum*
Shetland	Noss	2,395 ^{2000}	44 ^{2017}	-98	-21.0
Shetland	Foula	1,934 ^{2000}	277 ^{2015}	-86	-12.2
Shetland	Fair Isle	8,204 ^{2001}	859 ^{2015}	-90	-14.9
Orkney	West Westray Cliffs	33,281 ^{1999}	12,055 ^{2007}	-64	-11.9
Orkney	Copinsay	4,256 ^{1999}	955 ^{2015}	-78	-8.9
Orkney	Marwick Head	5,573 ^{1999}	906 ^{2018}	-84	-9.1
East Coast	Troup, Pennan and Lion's Heads	18,482 ^{2001}	10,503 ^{2017}	-43	-3.5
East Coast	Buchan Ness to Collieston Coast	14,091 ^{2001}	12,542 ^{2007}	-11	-1.9
East Coast	Fowlsheugh	18,800 ^{1999}	14,039 ^{2018}	-25	-1.5
East Coast	Forth Islands	6,632 ^{2000}	3,514 ^{2018}	-47	-3.5
East Coast	St Abb's Head NNR	11,077 ^{2000}	3,244 ^{2018}	-71	-6.6
East Coast	Farne Islands	5,096 ^{2000}	5,327 ^{2016}	4	0.2
East Coast	Flamborough Head and Bempton Cliffs	42,582 ^{2000}	45,504 ^{2017}	7	0.4
North West	North Rona and Sula Sgeir	4,119 ^{1998}	1,253 ^{2012}	-70	-8.1
North West	St Kilda	4,268 ^{1999}	276 ^{2015}	-94	-15.7
The Minch	Handa	7,013 ^{1999}	3,749 ^{2018}	-47	-3.2
The Minch	Shiant Isles	2,006 ^{1999}	1,075 ^{2015}	-46	-3.8

Area	SPA Name	Seabird 2000	Count (Year)	Change (%)	% *per annum*
The Minch	Canna and Sanday	1,274 1999	1,069 2018	-16	-0.9
The Minch	Mingulay and Berneray	5,511 1998	1,627 2014	-70	-7.3
Irish Sea	Ailsa Craig	1,675 2001	275 2018	-84	-10.1
Irish Sea	Skomer and Skokholm	2,257 2000	1,336 2017	-41	-3.0
Irish Sea	Rathlin Island	9,917 1999	313 2018	-97	-16.6
Irish Sea	Lambay Island	4,091 1999	3,320 2009	-19	-1.2

Table 1. Recent counts of the number of black-legged kittiwake (AON) recorded in Special Protection Areas (SPAs) in Britain and Ireland compared to the number recorded in them during Seabird 2000. The percentage that each colony has fallen by, and the *per annum* change, is also provided. Note: data at St Abb's Head relate to only part of the SPA
Given the magnitude of the fall in the abundance index (Figure 1) between 1999 and 2013, and the fact that during Seabird 2000 these SPAs held over 50% of the black-legged kittiwakes nesting in the UK, it is possible that the national population now lies between 150,000 and 250,000 AON - far below the figure recorded during Operation Seafarer in 1969-70. A more accurate estimate will be provided when the results from the current census, 'Seabirds Count', are published. Given the declining trend in productivity recorded for much of the period since 1986 (Figure 2), coupled with low survival and return rates (see below), it is likely that declines will continue.

Productivity

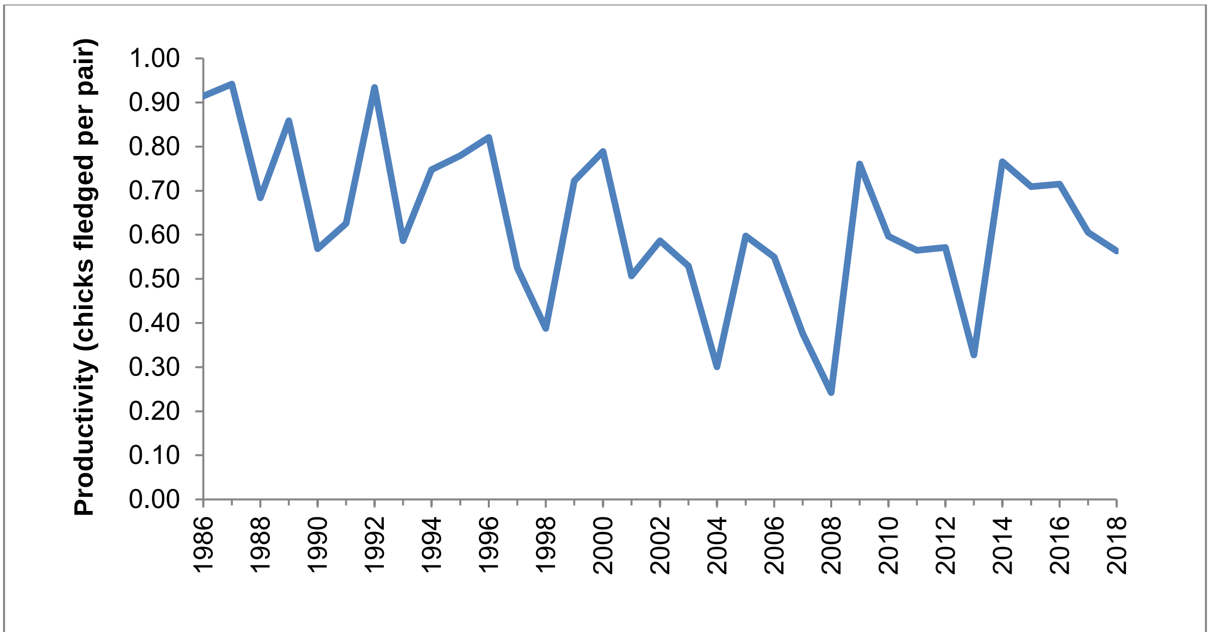

Figure 2. Trend in UK productivity (no. of chicks fledged per pair) of black-legged kittiwake 1986-2018. Based on SMP data; view the methods of analysis (PDF 158 kb).

Black-legged kittiwake productivity in the UK has declined and then stabilised over the course of the SMP (Figure 2). This would appear to be related to declines in abundance of their sandeel prey which in certain regions is negatively correlated with sea surface temperatures[1] that have risen due to climate change. Productivity (and adult survival) has also been negatively affected by the presence of a sandeel fishery that operated off SE Scotland from 1990 to 2000[2,3,4]. Species such as kittiwakes are particularly vulnerable to food shortages as they can take prey only when it occurs at or near the surface of the sea, unlike diving species such as auks which have access to a greater variety of prey in the water column. This has exacerbated the effects of low prey abundance[5].

Lesser sandeels *Ammodytes marinus* constitute a significant proportion of kittiwake diet during the breeding season[2,4,6,7,8,9,10]. Consequently, kittiwakes are highly sensitive to fluctuations in sandeel abundance. Warming of waters around the UK over the last three decades (between 0.1 and 0.5℃ per decade[11]) has led to substantial changes in species composition and abundance at lower trophic levels[12,13,14,15,16], with detrimental effects on sandeels[14,16]. Lesser sandeels are sensitive to changes in SST[1,14] and have restricted capacity to shift distribution[17,18]. In the North Sea, significant changes in the timing of key life history events of sandeels and their copepod prey[19] have resulted in changes in their length, and therefore energy value[16,20,21,22]. Kittiwakes and other seabirds have not kept pace with these changes and, as a result, are now relying on prey of lower calorific value during the chick rearing period when energy demands are highest[16,23]. This trophic mismatch appears to be prevalent within the North Sea pelagic food web, however, important regional differences are apparent, with these effects appearing stronger in the North Sea than the Irish Sea, the Celtic Sea and the English Channel[24,25,26]. In addition, over-winter survival of adult black-legged kittiwakes breeding in eastern Scotland was lower following winters with higher SST, and breeding success one year later was reduced[2,27,28,29]. This relationship, though varying greatly between colonies, has also been demonstrated at other kittiwake colonies along the North Sea coast[30,31]. There is evidence that breeding success is positively related to sandeel abundance[32,33]. Effects of climate on these bottom-up processes is likely to intensify if warming continues.

In addition to kittiwake productivity being correlated with sandeel availability[23,34], diet composition can also impact on chick growth and survival. A study in Norway showed that whilst adult black-legged kittiwakes are foraging on energy rich prey items in both the oceanic habitat and the fjords, a diet dominated by sandeel *Ammodytes spp.* resulted in higher growth and survival of chicks compared to a diet consisting of mesopelagic fish (i.e. glacier lantern fish *Benthosema glaciale*, spotted barracudina *Arctozenus risso* and silvery lightfish *Maurolicus muelleri*)[35]. Data collected at the Isle of May (one of the SMP key sites) also show a correlation between the proportion of sandeels in the diet of black-legged kittiwake chicks and breeding success[5,28,36,37].

SMP sample data show that average productivity between 2014 and 2018 (0.63 chicks fledged per pair) was higher than it had been for a number of years. This increase in productivity could contribute to a larger number birds being recruited to the breeding population in future years.

Scotland

Population estimates and change 1969-2002 (census data)

	Operation Seafarer (1969-70)	Seabird Colony Register (1985-88)	Seabird 2000 (1998-2002)
Population estimate (AON*)	346,097	359,425	282,213
% change since previous census	n/a	+4	-21

* AON = Apparently Occupied Nests

Breeding Abundance

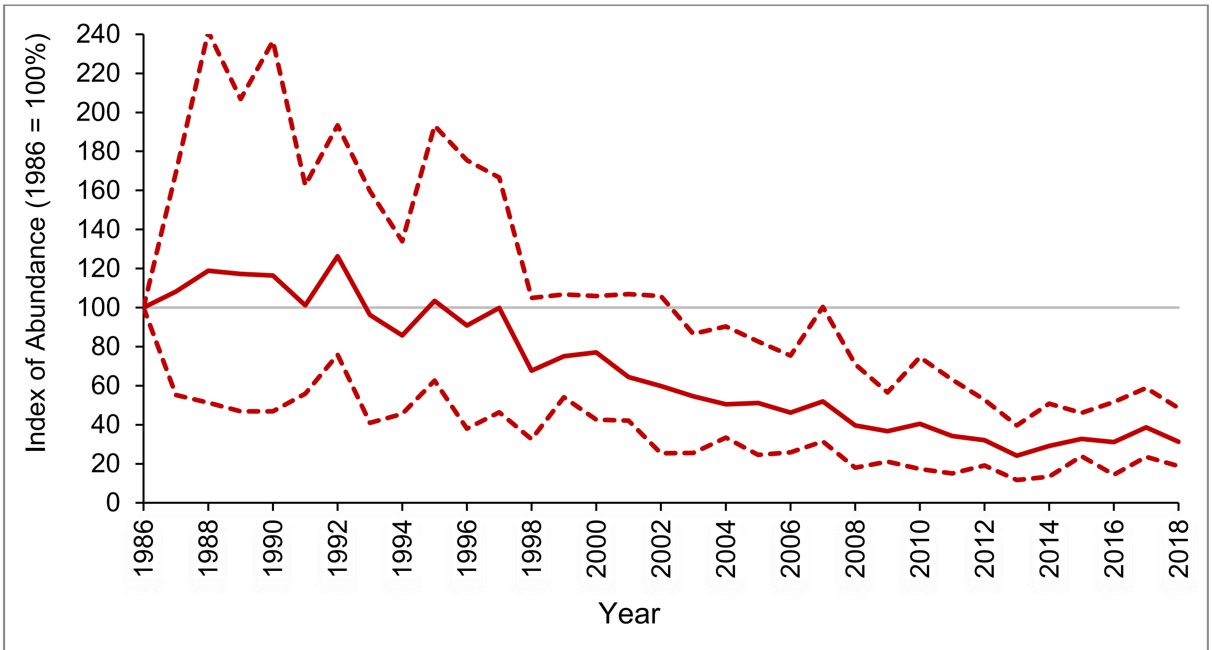

Figure 3. Trend in abundance index (solid line) of black-legged kittiwake in Scotland, 1986-2018 with 95% confidence limits (dotted lines). Based on SMP data; view the methods of analysis.

Census results indicate black-legged kittiwake numbers in Scotland changed little between Operation Seafarer and the Seabird Colony Register (SCR), but fell thereafter so that Seabird 2000 recorded 21% fewer AON than the SCR. Data collected by the SMP indicate a steady decline since the late 1980s, with the index in 2018 69% below the 1986 baseline (a slight rise compared to its lowest point in 2013 at 76% below).

Productivity

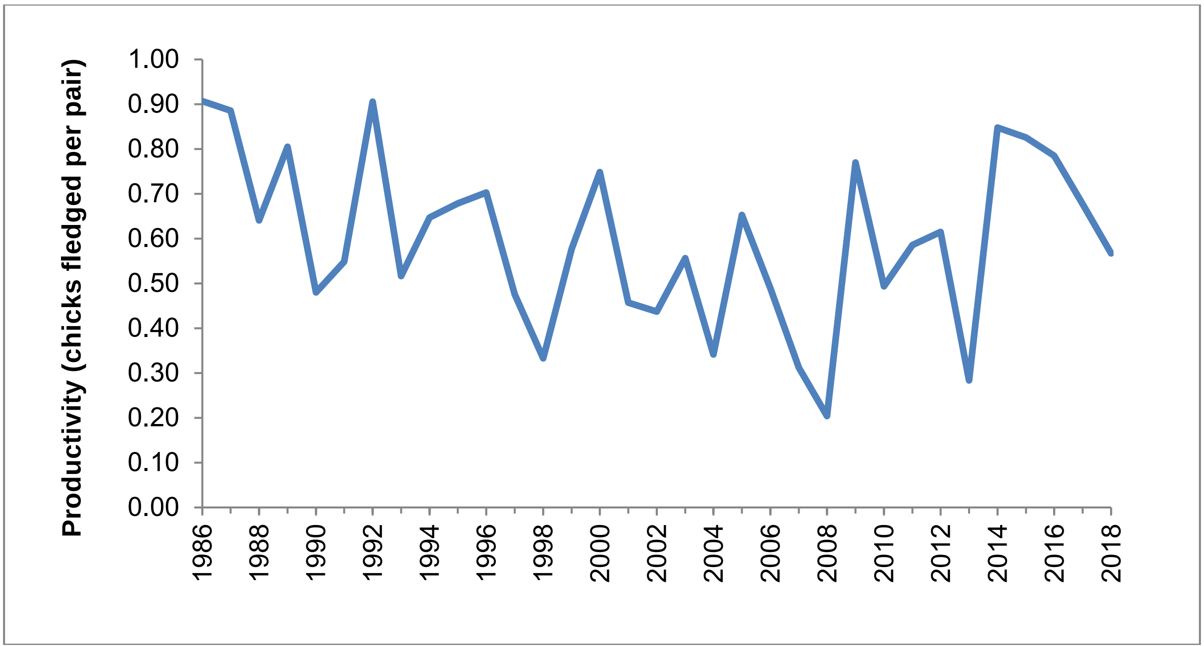

Figure 4. Trend in productivity (no. of chicks fledged per pair) of black-legged kittiwake in Scotland, 1986-2018. Based on SMP data; view the methods of analysis.

Black-legged kittiwakes breeding in Scotland underwent a sustained decline in productivity from 1986, culminating in a very poor breeding season in 2008 when very few chicks fledged. Productivity between 2009 and 2018 was higher than it had been for a number of years, possibly due to increased availability of sandeels in those years. However, this increased production was not sustained in 2013 which was again a poor breeding season.

Between 1980 and 2010, Sea Surface Temperature (SST) in the Forth and Tay region increased significantly, however, in the last decade cooler conditions have led to a decrease in SST. This decrease in SST is thought to have had a direct positive effect on the number of black-legged kittiwake chicks that were fledged on the east coast of Scotland from 2009 to 2017 (average 0.98)[10] which is apparent in Figure 4.

England

Population estimates and change 1969-2002 (census data)

	Operation Seafarer (1969-70)	**Seabird Colony Register (1985-88)**	**Seabird 2000 (1998-2002)**
Population estimate (AON*)	49,676	125,819	76,281
% change since previous census	n/a	+153	-39

* AON = Apparently Occupied Nests

Breeding Abundance

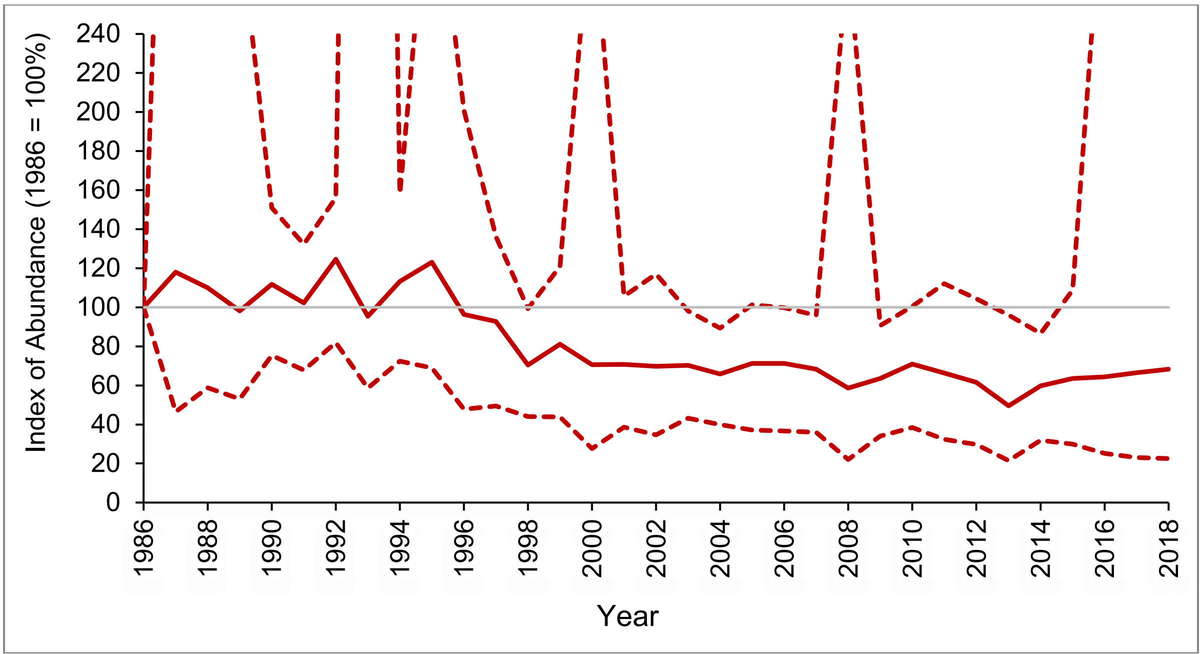

Figure 5. Trend in abundance index (solid line) of black-legged kittiwake in England, 1986-2018 with 95% confidence limits (dotted lines; drawing of upper limit restricted to preserve detail in the abundance index). Based on SMP data; view the methods of analysis.

In England, the peak in abundance index was reached in 1992 (*cf.* 1989 in Scotland). A gradual decline is apparent after 1995, but over much of the last decade the index has been relatively stable. The abundance index has not fallen to the extent seen in Scotland but - in 2018 - lay at 32% below the 1986 baseline. Another difference between the two countries is that, between Operation Seafarer and the Seabird Colony Register, the English population more than doubled, as opposed to showing little change, but the proportional size of decline from the Seabird Colony Register to Seabird 2000 was nearly twice that recorded to the north. Causes of change are probably the same for both countries (see UK section) but are clearly now having a greater impact in Scotland where the estimated rate of decline is greater.

Recent studies have indicated that regional variation in the effects of climate change on seabirds is apparent. In particular, there is growing evidence that the climate impacts recorded in the North Sea are not replicated elsewhere. The negative effect of winter SST on black-legged kittiwake productivity outlined in the Scotland section above is not apparent throughout the UK[30] and analyses of the Irish Sea, the Celtic Sea and the English Channel have found only weak climate effects on seabird demography[25,26].

Productivity

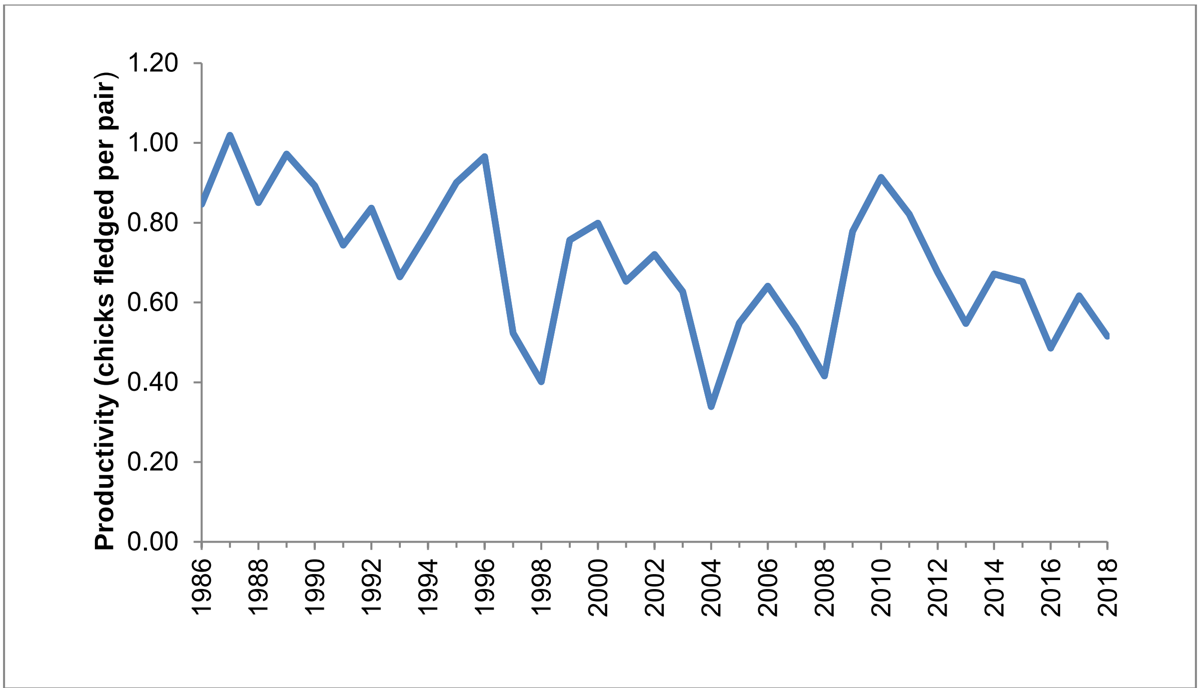

Figure 6. Trend in productivity (no. of chicks fledged per pair) of black-legged kittiwake in England, 1986-2018. Based on SMP data; view the methods of analysis.

Productivity at English colonies, usually more successful than those in Scotland, has been generally decreasing since 1986. The lowest point was reached in 2004, when productivity averaged just 0.34 chicks per nest fledged but has improved since. Monitored colonies were least productive in 1998, 2004 and 2008 and to some extend in 2016. However, 2009 to 2012 inclusive were four of the more successful breeding seasons in the last decade. After an increase the previous year, productivity fell again in 2018 (0.51 chicks fledged per pair). The relatively high productivity in England compared to Scotland, despite a declining trend, may explain why the species' abundance has not fallen to the same extent. The reasons for higher mean productivity in English colonies could be related to recent findings about weaker climate effects on seabird demography which is not apparent throughout the UK[25,26,28].

Wales

Population estimates and change 1969-2002 (census data)

	Operation Seafarer (1969-70)	Seabird Colony Register (1985-88)	Seabird 2000 (1998-2002)
Population estimate (AON*)	6,891	8,771	7,293
% change since previous census	n/a	+27	-20

* AON = Apparently Occupied Nests

Breeding Abundance

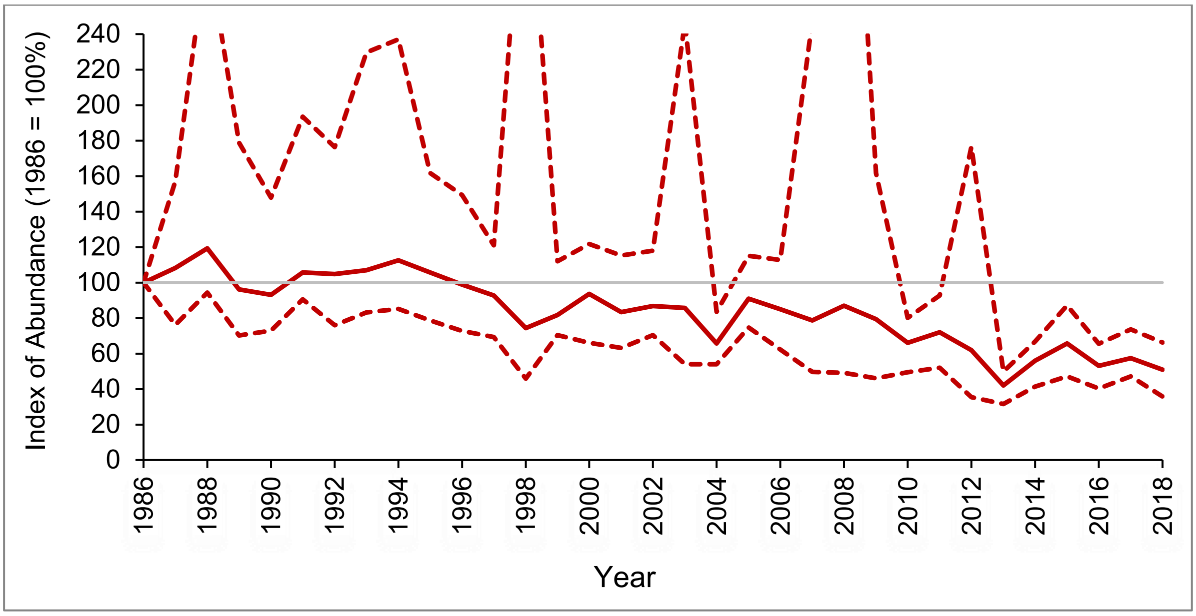

Figure 7.: Trend in abundance index (solid line) of black-legged kittiwake in Wales, 1986-2018 with 95% confidence limits (dotted lines; drawing of upper limit restricted to preserve detail in the abundance index). Based on SMP data; view the methods of analysis.

National censuses found that black-legged kittiwake numbers in Wales had changed little between Operation Seafarer and Seabird 2000, but recent measures of abundance suggest the current population is lower than in 1969-70. Factors affecting colonies in other countries in the UK, appear to have had less impact in Wales but the reasons for this are not well understood. Compared with Scotland, the abundance index for black-legged kittiwakes in Wales has been relatively stable since 1986 but is similar to that shown for England with a slow decline since the mid-1990s. However, in recent years, the index has fallen below the previous low point of 2004. Currently, the index is 49% below the 1986 baseline; 15 colonies surveyed in 2018 held 3,377 AON, 43% fewer than was recorded during Seabird 2000 (4,965 AON).

Productivity

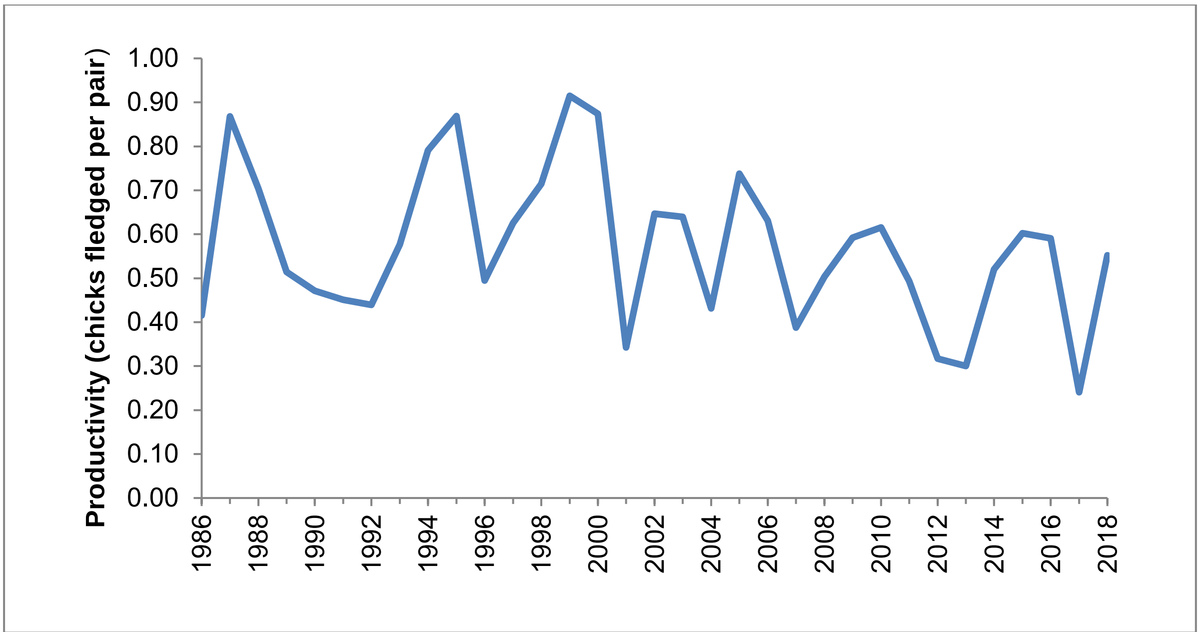

Figure 8. Trend in productivity (no. of chicks fledged per pair) of black-legged kittiwake in Wales, 1986-2018. Based on SMP data; view the methods of analysis.

The productivity of black-legged kittiwakes in Wales has fluctuated widely over the recording period with no clear trend, although productivity appears to have been depressed over much of the last decade. In general, Welsh colonies are less productive than those in England and there are more years when productivity falls below 0.50 chicks per pair compared with both England and Scotland. Productivity in 2017 was particularly low in Wales, although details as to why are limited. On Skomer, one of four colonies regularly monitored, low breeding success of 0.33 chicks fledged per pair in 2017 was partly attributed to above average rainfall (twice the normal amount for Pembrokeshire in June). All of the study plots had a lower productivity than reported in 2016, with the greatest reduction recorded at High Cliff, where only one chick fledged. Similar low productivity values have been reported previously in 2001 (0.34) and 2012 (0.33). In 2013, 132 fewer black-legged kittiwake nests were built in study plots on the island compared to 2012 (632), with the breeding season described as disrupted, unusually extended and unsynchronised. In 2018, productivity had increased to 0.55 chicks fledged per pair.

Northern Ireland

Population estimates and change 1969-2002 (census data)

	Operation Seafarer (1969-70)	Seabird Colony Register (1985-88)	Seabird 2000 (1998-2002)
Population estimate (AON*)	4,753	10,040	13,060
% change since previous census	n/a	+111	+30

* AON = Apparently Occupied Nests

Breeding Abundance

There are approximately 13 colonies of black-legged kittiwake in Northern Ireland, but few are monitored regularly. The largest colony is Rathlin Island which held 76% of the national population, some 9,917 AON, during Seabird 2000. In 2007, numbers there were similar, with 9,896 AON recorded. However, numbers had declined to 7,922 AON in 2011 (a fall of 20%)[38]. In 2017, four smaller colonies (The Gobbins, Muck, Portrush and Maggie's Leap) held 1,592 AON compared to 1,250 AON during Seabird 2000. In 2018, the same four colonies held 1,358 AON, a decline of 15% since 2017. There was, however, considerable fluctuation between colonies, e.g. The Gobbins held just 64% of the 2017 total but numbers at Portrush had increased by 24% (although one less site was surveyed there); this may have been in response to local feeding conditions. A new survey of Rathlin Island will, however, be required to gain a better understanding of the current status the Northern Ireland black-legged kittiwake population.

Productivity

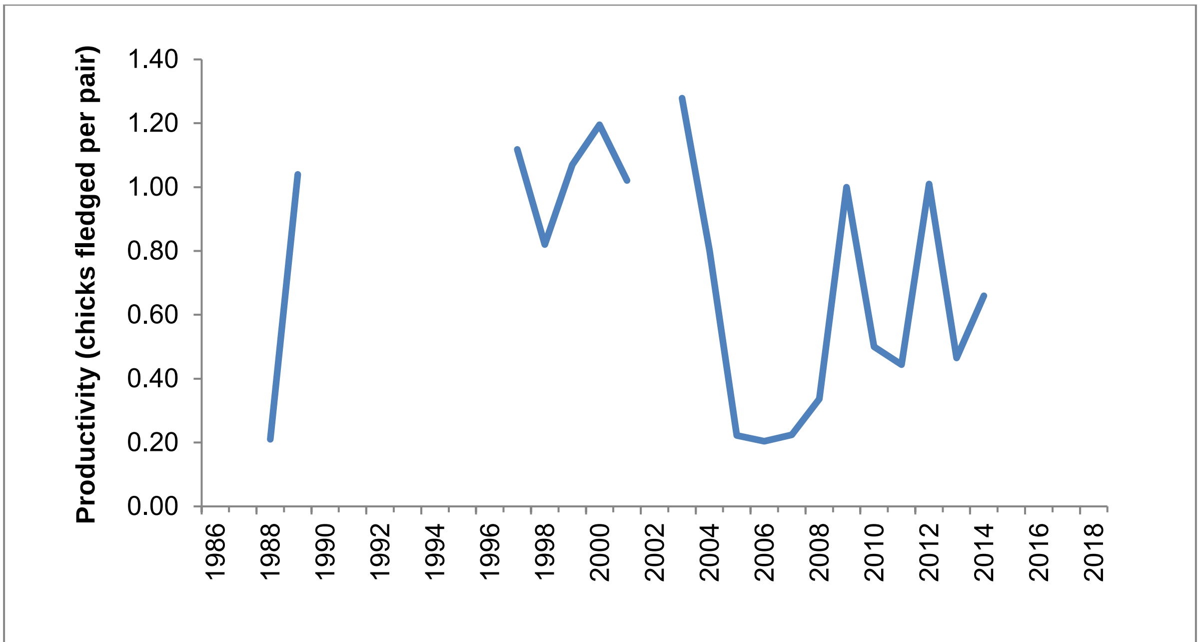

Figure 9. Trend in productivity (no. of chicks fledged per pair) of black-legged kittiwake in Northern Ireland, 1986-2018. Based on SMP data; view the methods of analysis.

In Northern Ireland, few data on the productivity of black-legged kittiwake have been collected as part of the SMP since 2014. Data were sparse before 1997, with productivity thereafter extremely variable, so no clear trend was visible. In 2018, breeding success at The Gobbins was 0.57 chicks fledged per pair, the lowest since 2014. This was due to predation by a mixed pair of hooded *Corvus cornix* and carrion crows *Corvus corone*[5]. Only 29 chicks fledged from 121 monitored nests at this colony. Muck Island also had a low productivity with 0.62 chicks fledged per nest, the lowest since 2013. Counter to the poor breeding season at The Gobbins and Muck Island, breeding success at Maggy's Leap (0.79 chicks fledged per pair) was higher than in 2017. Productivity was even higher on the north coast, where Rathlin Island produced 1.28 chicks fledged per pair and Portrush produced 1.01 chicks fledged per pair[39].

Breeding Abundance

Republic of Ireland

Population estimates and change 1969-2002 (census data)

	Operation Seafarer (1969-70)	Seabird Colony Register (1984-85)	Seabird 2000 (1998-2002)	Republic of Ireland Census (2015-18)
Population estimate (AON)	39,630	34,180	36,100	24,728
% change since previous census	n/a	-14	+6	-32

* AON = Apparently Occupied Nests

Breeding Abundance

In the Republic of Ireland, Operation Seafarer found 39,630 AON of black-legged kittiwake. Numbers had decreased slightly by the second national census, but Seabird 2000 recorded similar numbers to the Seabird Colony Register. The recent Republic of Ireland Seabird Census (2015-2018) recorded a total of 24,728 AON, a decrease of 32% compared to Seabird 2000[40]. At the Cliffs of Moher and Lambay Island (the largest colonies in the country), only 7,698 AON and 3,320 AON were recorded, a decline of 48% and 19%, respectively since Seabird 2000. There were insufficient data from the Republic of Ireland to allow trends to be generated.

Productivity

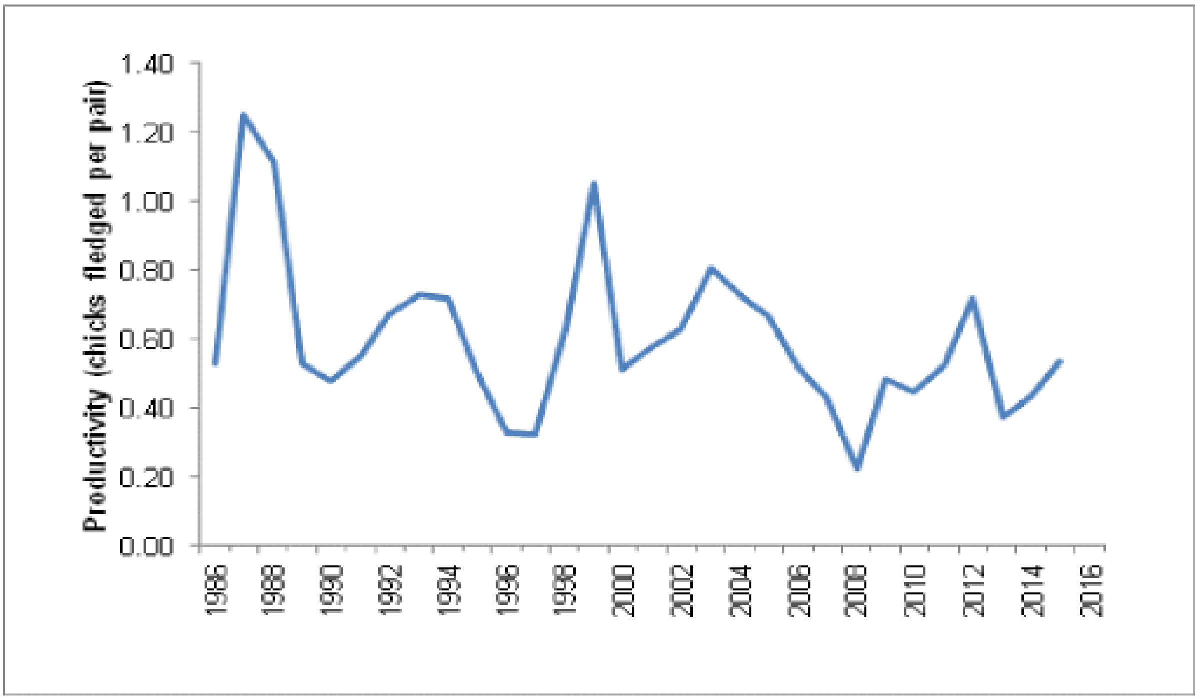

Figure 10. Trend in productivity (no. of chicks fledged per pair) of black-legged kittiwake in the Republic of Ireland, 1986-2015. Based on SMP data; view the methods of analysis.

Black-legged kittiwakes in the Republic of Ireland have had few years with high levels of productivity. In most years, productivity was below 0.80 chicks fledged per pair and often below 0.60. Productivity was lowest in 2008, which was a very wet summer in Ireland that is likely to have impacted on young birds in nests. Annual black-legged kittiwake productivity estimates at Rockabill fell from 1.2 chicks per pair (1999-2007) to 0.61 chicks per pair in 2018. The practice of pair-trawling of spawning inshore sprat has increased in recent years and a herring fishery is operating in the Irish and Celtic Seas. The existence of these fisheries, operating within the foraging areas of black-legged kittiwakes, may have an impact on the productivity of this species along these coasts, particularly if the fisheries target young sprat[41]. No black-legged kittiwake productivity data have been submitted to the SMP since the 2015.

All Ireland

Population estimates and change 1969-2002 (census data)

	Operation Seafarer (1969-70)	**Seabird Colony Register (1985-88)**	**Seabird 2000 (1998-2002)**
Population estimate (AON*)	44,383	44,220	49,160
% change since previous census	n/a	<-1	+11

* AON = Apparently Occupied Nests

Breeding Abundance

In the whole of Ireland, Operation Seafarer and the Seabird Colony Register both recorded a little over 44,000 black-legged kittiwake AON. Numbers had increased by 11% to 49,160 AON by the time of Seabird 2000. The largest colony on Rathlin Island held 76% of the national population, some 9,917 AON, during Seabird 2000. In 2007, numbers there were similar, with 9,896 AON recorded. However, numbers had declined to 7,922 AON in 2011 (a fall of 20%)[38]. In 2018, four smaller colonies (The Gobbins, Muck, Portrush and Maggie's Leap) held 1,358 AON combined, an increase of 9% AON compared to 1,250 AON during Seabird 2000. In contrast, in the Republic of Ireland, all black-legged kittiwake colonies were counted between 2015 and 2018. A total of 24,728 compared to 36,100 AON during Seabird 2000 were recorded, representing a decline of 32%[40]. In the whole of Ireland, it is highly likely that black-legged kittiwake numbers have declined since Seabird 2000, although a survey of Rathlin Island is required to allow a robust estimate of the size of this decline to be made. There were insufficient data from all-Ireland to allow trends to be generated.

Productivity

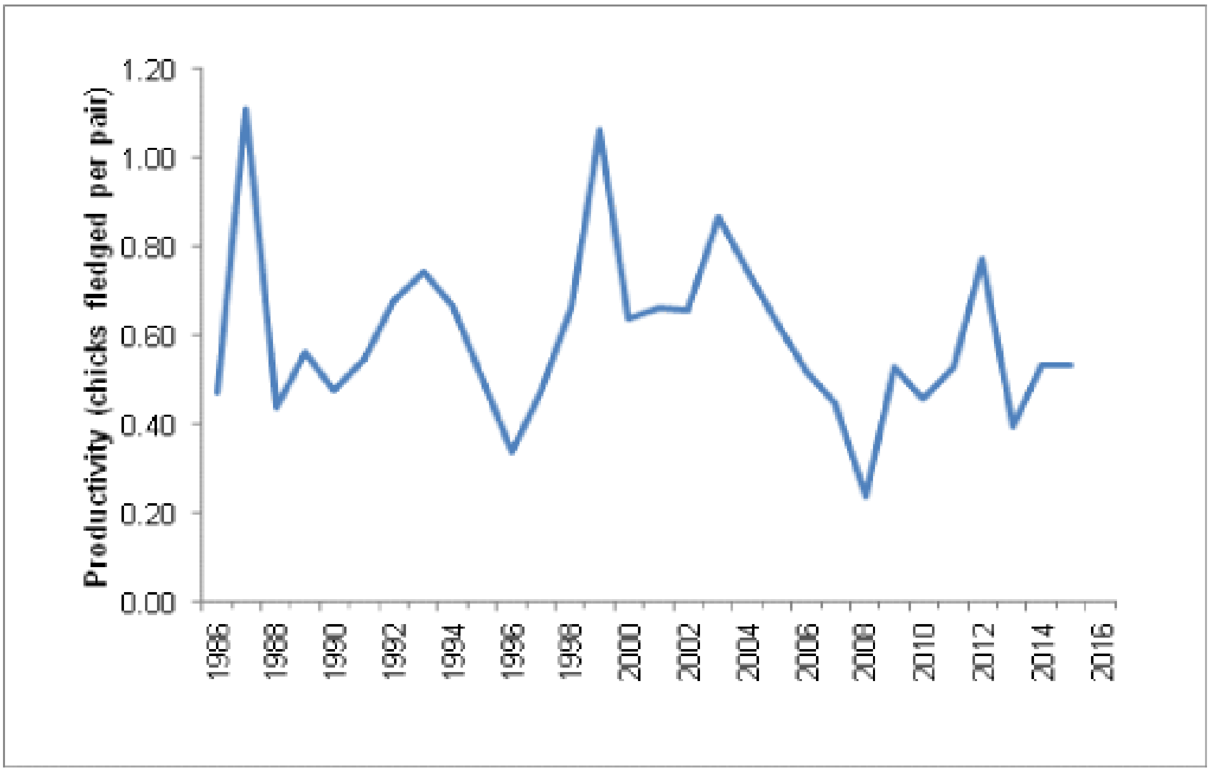

Figure 11. Trend in productivity (no. of chicks fledged per pair) of black-legged kittiwake throughout Ireland, 1986-2015. Based on SMP data; view the methods of analysis.

The trend in productivity of black-legged kittiwakes throughout Ireland is similar to that shown for the Republic of Ireland where most data have been collected. There are few years when productivity is higher than 0.80 chicks fledged per pair. A particularly poor breeding season was recorded in 2008, probably due to the very wet summer that year impacting on young birds in nests. Such low levels of productivity may now be having an effect on abundance. Annual productivity estimates at Rockabill Island fell to 0.61 chicks per pair in 2018 compared to an average of 1.2 chicks from 1999-2007. The practice of pair-trawling of spawning inshore sprat has increased in recent years and a herring fishery is operating in the Irish and Celtic Seas. The existence of these fisheries, operating within the foraging areas of black-legged kittiwakes, may have an impact on the productivity of this species along these coasts, particularly if the fisheries target young sprat[41]. There were insufficient data from all-Ireland to allow trends to be generated.

Isle of Man

Population estimates and change 1969-2018 (census data)

	Operation Seafarer (1969-70)	Seabird Colony Register (1984-85)	Seabird 2000 (1998-2002)	Isle of Man Census (2017-18)
Population estimate (AON)	908	1,376	1,045	672

	Operation Seafarer (1969-70)	Seabird Colony Register (1984-85)	Seabird 2000 (1998-2002)	Isle of Man Census (2017-18)
% change since previous census	n/a	+51	-24	-36

* AON = Apparently Occupied Nests

Breeding Abundance

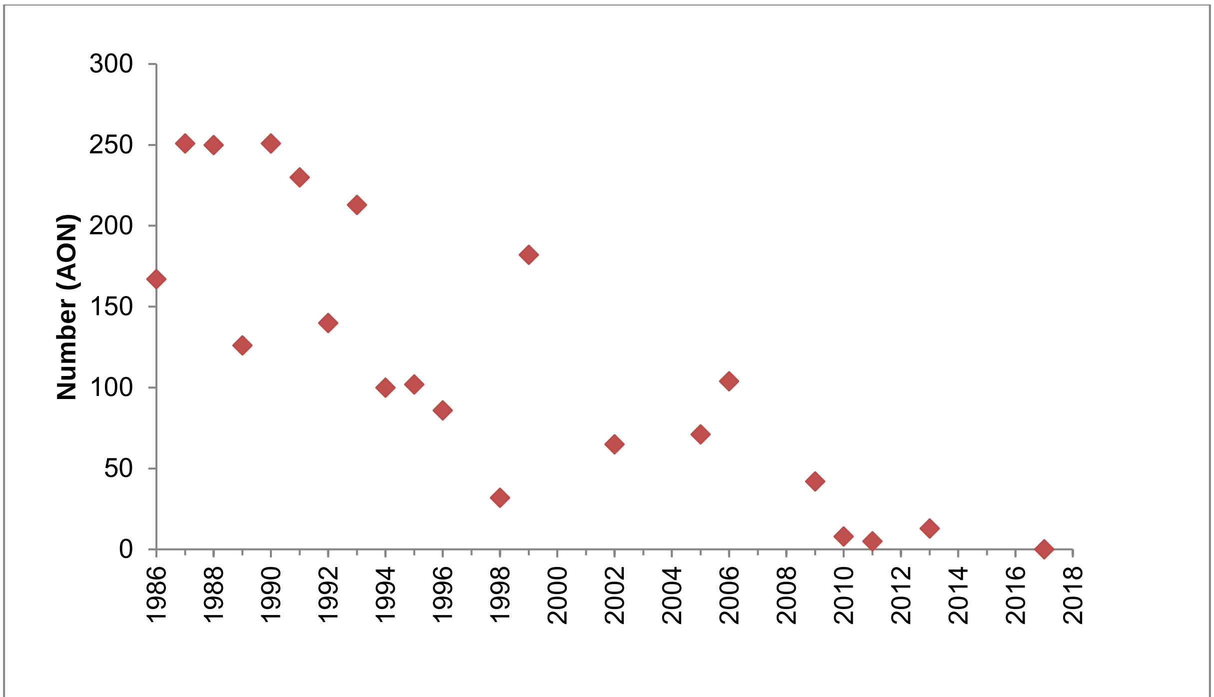

Figure 12. Abundance of black-legged kittiwake on the Calf of Man, 1986-2017.

Black-legged kittiwake shows a steady declining trend on the Isle of Man. Full censuses recorded 908 AON during Operation Seafarer, increasing by 50% to 1,376 AON during the Seabird Colony Register. A decline then occurred with Seabird 2000 recording 1,045 AON. In 2017, a census of the Isle of Man recorded 672 AON, a decline of 36% since Seabird 2000. During Seabird 2000, 182 black-legged kittiwake AON were recorded on the Calf of Man, declining to 104 in 2006, then 8 in 2010, and by 2017 the colony was extirpated (Figure 12). The stronghold of birds, however, is located at the Sugar Loaf, which held 580 AON during Seabird 2000 and had it increased by 5% in 2017 to 553 AON[42].

Productivity

No data have been submitted to the SMP recently, but between 1986 and 2005 there was no statistically significant effect of year in the productivity of black-legged kittiwakes nesting on the Isle of Man; an average of 0.27 chicks were fledged per nest each year.

Channel Islands

Population estimates and change 1969-2016 (census data)

	Operation Seafarer (1969-70)	Seabird Colony Register (1984-85)	Seabird 2000 (1998-2002)	Channel Islands Census (2015-16)
Population estimate (AON*)	12	34	3	0
% change since previous census	n/a	+183	-91	0

* AON = Apparently Occupied Nests

Breeding Abundance

The black-legged kittiwake had only a small breeding presence in the Channel Islands during the last three censuses. Three AON were recorded during Seabird 2000, 34 during the Seabird Colony Register when the population was at its peak and 12 nests during Operation Seafarer. Further to the decline noted during Seabird 2000, no breeding was recorded during a seabird census in 2015-16, and local populations are now believed to be extinct[43].

Productivity

No systematic data on the productivity of black-legged kittiwakes on the Channel Islands have been submitted to the SMP.

UK phenology, diet, return rates and survival rates

Phenology

No systematic data on phenology (timing of life-cycle events) have been collected as part of the SMP.

Diet

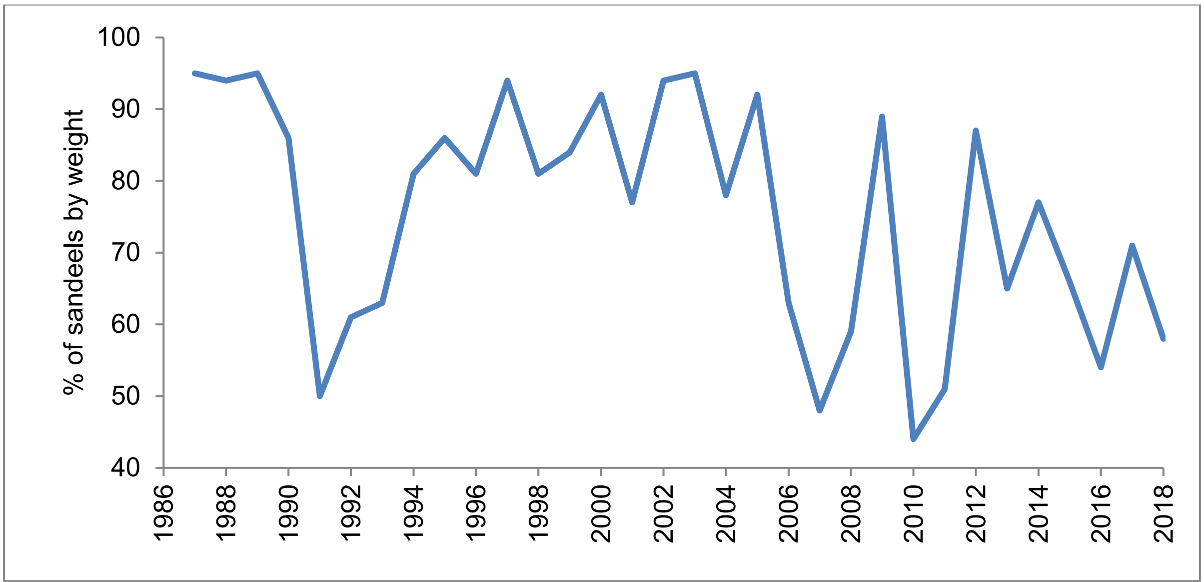

Figure 13. Percentage of sandeels (by weight) in the diet of young black-legged kittiwakes at the Isle of May, 1987-2018.

Sandeels are an energy-rich food source compared with some alternative prey and the proportion of sandeels by weight can be used as a measure of 'diet quality'. Figure 13 shows that the percentage of sandeels in the diet of black-legged kittiwakes on the Isle of May has been high for the majority of years but since 2012 has declined considerably (from 87% to 58%). A recent study on the seabirds of the Isle of May found that the proportion of sandeels in their diet has declined in both the summer and winter over the last three decades, linked to trends in SST[5]. The amount of sandeels fed to chicks, (particularly the size 1+ group fish) has decreased, and a shift from size 1+ group to 0 group sandeels has occured[5] . Black-legged klittiwake chicks were fed clupeids, predominantly sprat *Sprattus sprattus*, indicating a potential reduction in their reliance on sandeels and a diet composition shift[5]. Therefore, sandeel abundance might be still important to black-legged kittiwakes but less so when there are alternative prey in poor sandeel years, as appears to be the case around the Isle of May.

Return rates and survival rates

Estimation of kittiwake adult return rate and survival rate is currently undertaken at two sites within the SMP - the Isle of May (south-east Scotland) and Skomer (south-west Wales). Return rates are based on sightings of individually colour-ringed birds and calculated as the proportion of marked birds present in year one that are seen the following year. As not every adult alive is seen each year, return rates for 2018 presented here for Isle of May need to be treated as minimum estimates of survival of birds seen in 2017. In contrast, survival estimates - as presented here for Skomer - do consider birds that are not seen one year but which re-appear in following years.

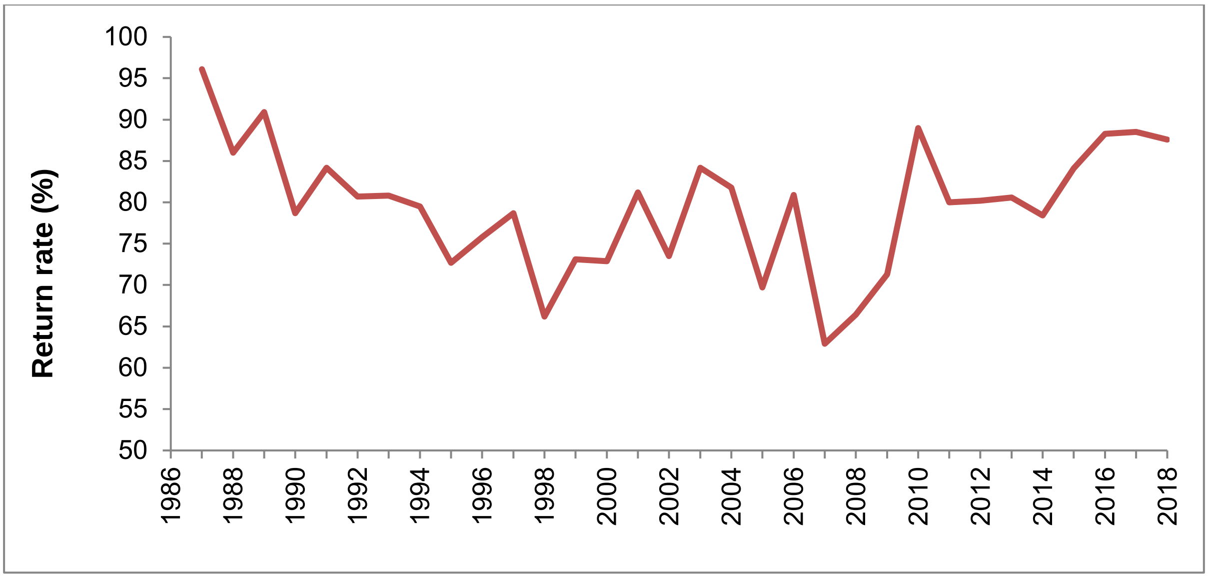

Figure 14. Annual return rate of black-legged kittiwakes breeding on the Isle of May, 1987-2018.

The return rate of black-legged kittiwakes on the Isle of May (Figure 14) declined between 1986 and 1998 and then typically fluctuated at a low level until 2009, however, return rate has improved since then. Particularly low rates occurred in 2007-2009 but in 2010 the return rate (89.0%), the highest since 1989 and well above the average for the period prior to this (77.7, 95% CI =74.5-81.0). In 2018, the return rate of black-legged kittiwakes (87.6%) was above average (1986-2017 average = 79.3%). Adult survival was likely to have been negatively affected by the presence of a sandeel fishery that operated off south-east Scotland[1] between 1990 and 1999[2].

The new EU Common Fisheries Policy came into effect in 2014. It included the obligation that all catches of regulated commercial species had to be landed and counted against quota. From 2015 to 2019, the landing obligation was phased in across the majority of EU fisheries. This is likely to impact on seabird populations that feed on discards. Species native to the north-east Atlantic that are currently extensively exploiting fishery discards are kittiwake, herring gull, lesser black-backed gull, great black-backed gull, great skua, northern fulmar and the northern gannet[44].

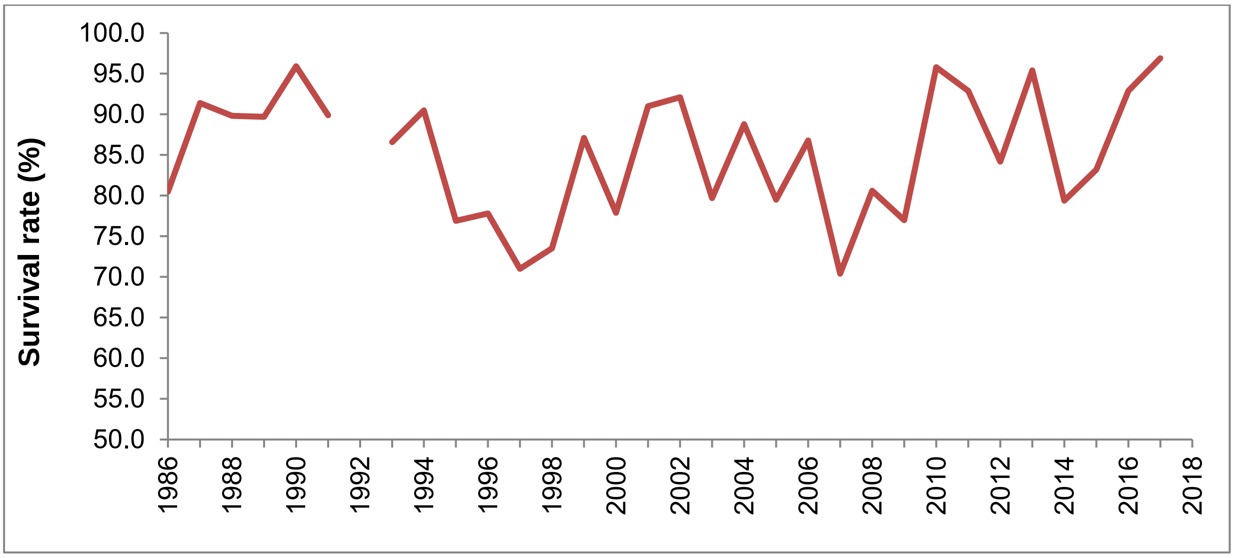

Figure 15. Estimated adult survival rate of black-legged kittiwakes on Skomer, 1986-2017.

Survival rate of kittiwakes on Skomer (Figure 5) declined between 1991 and 1997 and then increased up to 2002, after which another decline is evident. The survival rate in 2007 was particularly low (70.4). Over the period of the long-term study (1978-2017), survival of breeding adults averages 0.85.There continues to be a cyclic fluctuation in adult breeding survival over the course of the study, despite a consistently high probability of re-sighting live birds (>90% encounter probability in the last ten years). The survival rate of breeding adult black-legged kittiwakes in 2016-17 was 0.96, a continued recovery in recent years. An upturn that may indicate the continuation of the apparently decadal cycles of adult survival since 1978, rather than a consistent decline in adult survival[45].

The waters around the UK have been warming since the 1980s, and recent studies have demonstrated links between kittiwake adult survival and climate[46,47,48,49]. Adult survival is largely affected by winter mortality, and additionally by the carry-over effects of the previous breeding season. These effects may become increasingly important for all seabirds since most climate models predict that future warming will be associated with increasing climate variability and hence frequency of extreme weather events[50,51]. A recent study using geolocation data loggers to examine the non-breeding season distribution of kittiwakes found tagged birds from Skomer (and Rathlin) remained relatively near the colony but those from the Isle of May migrated more widely with the main areas of use split between the North Sea and the Central and West Atlantic[52]. Based on the longer distance to the breeding grounds, black-legged kittiwakes may, therefore, be at higher risk of winter mortality and lower adult survival based on environmental conditions in the West Atlantic. Any major changes in food availability in this part of the west Atlantic (e.g. projected changes in distribution of *C. finmarchicus*; could affect the entire Atlantic population[53].

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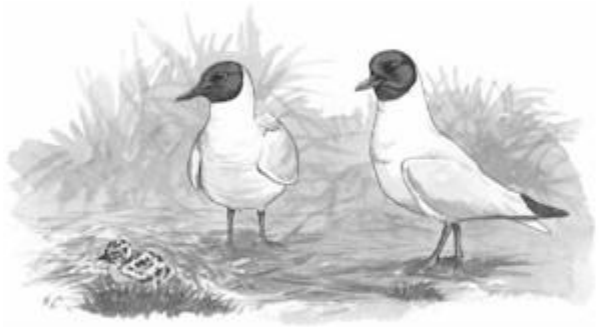
Black-headed Gull *Chroicocephalus ridibundus*

Description



The following has been adapted from original text by Timothy E. Dunn in Seabird Populations of Britain and Ireland (with permission from A&C Black, London).

The black-headed gull is the most widely distributed seabird breeding in the UK, with similar numbers breeding inland as on the coast. The majority of the breeding population are resident throughout the year, with numbers being greatly bolstered during the winter months by birds from northern and eastern Europe, especially in the east and southeast of England. Black-headed gulls breed throughout the middle latitudes of the Palaearctic and have recently formed a breeding outpost in north eastern North America. The UK holds approximately 6% of the world breeding population. Black-headed gulls tend to nest on open ground and occasionally in low trees and bushes, in colonies of anywhere from a few to over 10,000 apparently occupied nests (AON). Habitats such as wetlands, bogs, marshes and artificial ponds are favoured breeding sites, but dry areas adjacent to water are also used.

Conservation status

Black-headed gull is currently identified as a conservation priority in the following:

Amber listed in Birds of Conservation Concern 4 (2015 update)
further information on Conservation Designations for UK Taxa
Red listed in Birds of Conservation Concern in Ireland 2014-2019 (2014 update)
EC Birds Directive - migratory species

International importance

UK Population	% Biogeographic Population	% World Population
138,000 AON*	n/a	5.6

*AON = Apparently Occupied Nests

The UK population figure (rounded to the nearest hundred) was derived from data in Mitchell, P.I., Newton, S.F., Ratcliffe, N. and Dunn, T.E. (eds.) 2004. *Seabird Populations of Britain and Ireland.* Poyser, London. This was also the source of figures for the Biogeographic and World populations.

Note: The UK population figure above includes data from both inland and coastal colonies and hence differs from that tabled below.

UK population estimates and change 1969-2002 (census data)

Prior to Seabird 2000, the population of black-headed gulls in Britain and Ireland had only ever been surveyed incompletely. During Operation Seafarer (1969-70) complete coverage of coastal colonies was achieved, but no inland colonies were counted, and these held just under half of the UK breeding population. Both coastal and inland colonies were surveyed during the SCR Census (1985-88), but coverage inland was incomplete and so only provided a minimum estimate of the number nesting away from the coast. During Seabird 2000, coverage of colonies in the UK was comprehensive, with the exception of inland colonies in Durham and in western parts of North Yorkshire, where some may have been missed although the numbers involved are not thought to be large. Surveys at the majority of colonies counted apparently occupied nests (AONs). However, at some colonies, flush counts of individuals attending the colony were made which were then divided by two to provide a rough measure of the number of AONs. This is the least accurate method for counting breeding gulls, as such counts will include an unknown percentage of non-breeders and attendance at the colony by both members of a pair is highly variable throughout the day and throughout the breeding season. During Seabird 2000 only 13% of the total population estimate of AONs was determined from flush counts of individuals, which compares favourably to 18% during the SCR Census.

	Operation Seafarer (1969-70)	Seabird Colony Register (1985-88)	Seabird 2000 (1998-2002)
UK Population estimate (AON*) **Inland** **Total**	73,607	77,119	77,324 60,688 138,012
% change since previous census	n/a	+5	0

*AON = Apparently Occupied Nests

Note: Inland colonies were not counted during the first two national censuses, so, to enable direct comparison, the percentage change refers to coastal colonies only.

For census results for individual countries and Ireland, the Channel Islands and the Isle of Man see under relevant sections below.

Distribution/abundance

The Seabird 2000 census provides the most comprehensive recent assessment of the distribution and abundance of breeding seabirds. Numbers found in different regions, and a map showing the location and size of colonies, is provided in the Seabird 2000 black-headed gull results page.

The locations sampled during the annual Seabird Monitoring Programme provide some information on distribution and are accessible via the Seabird Monitoring Programme online database.

Annual abundance and productivity by geographical area

With reference to the regional accounts below please note the following.

Breeding abundance: graphs of abundance index with 95% CLs are only shown for a region where the trend produced has been deemed accurate (see methods of analysis). Where a trend was thought to be inaccurate, graphs of abundance at major colonies in a region may be shown instead, particularly if such colonies hold greater than 10% of the regional population, are monitored frequently and may thus help illustrate regional population fluctuations outwith national censuses. Occasionally, too few data have been collected regionally to produce either of these.

Productivity: graphs of productivity are only shown if analysis of productivity data produced a significant result for regional and/or year effects (again see methods of analysis). If results were not significant, then a regional mean productivity value is given. However, on some occasions too few data are available from which to provide a meaningful average. Furthermore, for 11 species where the quality of monitoring data available was considered high, population viability analysis was undertaken at the UK level and the results of this are also reported.

United Kingdom

Breeding abundance

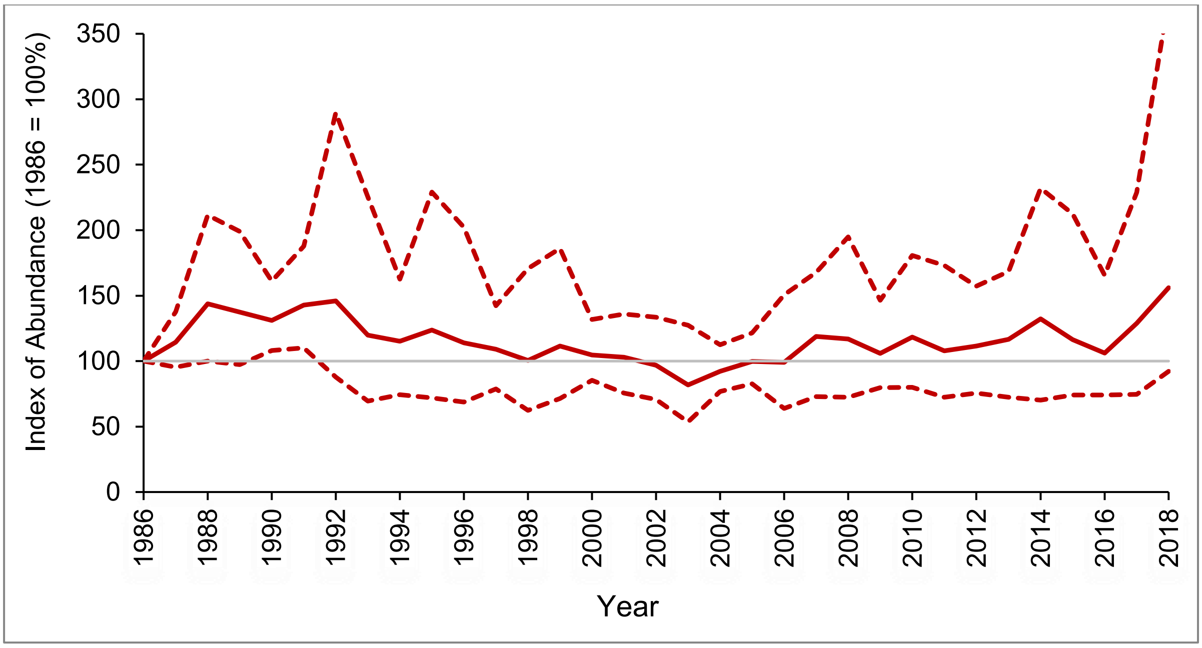


Figure 1. Trend in UK abundance index (solid line) of coastal-nesting black-headed gulls 1986-2018, with 95% confidence limits (dotted lines). Based on SMP data; view the methods of analysis.

National census data indicate the number of coastal nesting black-headed gulls in the United Kingdom was relatively stable between 1969-70 and 1998-2002. However, there are differences within the census data for the constituent countries of the UK (see individual country accounts).

Data submitted to the SMP show an increase in the abundance index to the early 1990's but a decline thereafter until 2003. After this the trend gradually increased until 2014, where it was over 30% above the baseline, but declined back to the baseline value by 2016. By 2018, the abundance index had increased again to 56% above the baseline, the highest value to date.

Productivity

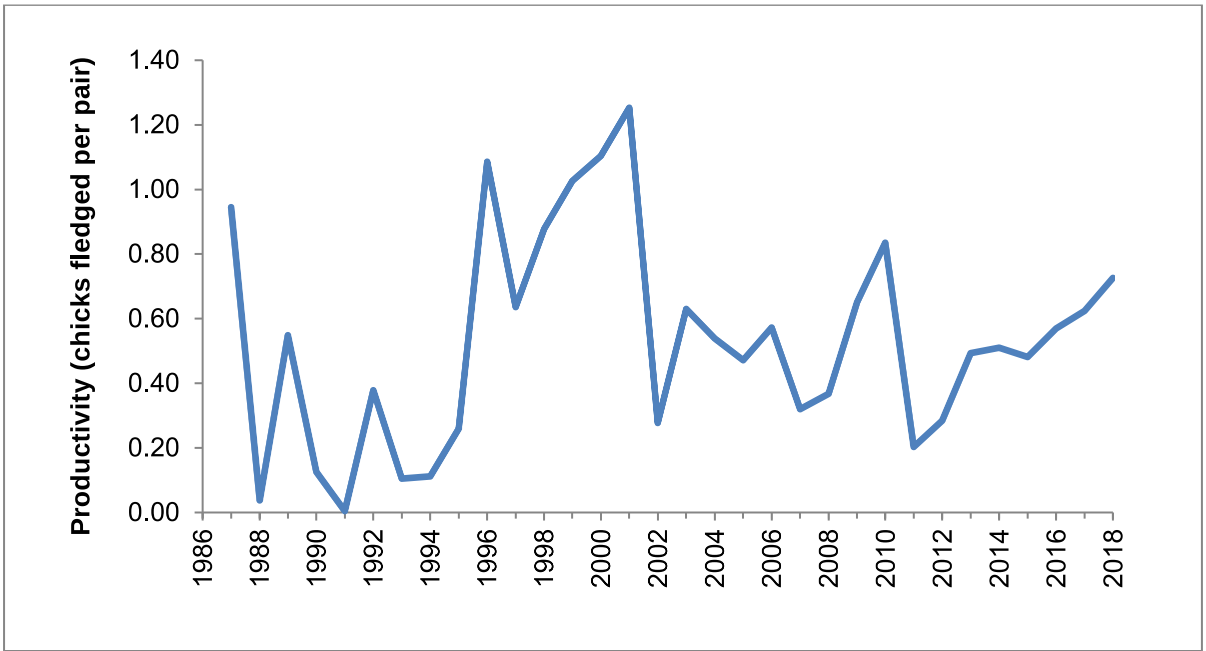


Figure 2. Trend in UK productivity (no. of chicks fledged per pair) of black-headed gull 1987-2018. Based on SMP data; view the methods of analysis .

Over the monitoring period, Black-headed gull productivity has fluctuated markedly and is likely to have been affected by predation by American mink[1,2] (and, to a lesser extent, by rats *Rattus* sp.), as well as changes in food supply and periods of inclement weather during breeding seasons. This fluctuating productivity trend is common to black-headed gull colonies throughout the UK. Very low productivity occurred in 1998 and 1991, although between 1996 and 2001 it was often above one chick fledged per pair. Since 2003, productivity values have generally been lower, although have gradually been increasing since 2011, reaching 0.73 chicks fledged per pair in 2018.

Scotland

Population estimates and change 1969-2002 (census data)

	Operation Seafarer (1969-70)	Seabird Colony Register (1985-88)	Seabird 2000 (1998-2002)
Population estimate (AON*) **Inland** **Total**	18,226	9,554	6,888 36,303 43,191
% change since previous census	n/a	-48	-28

* AON = Apparently Occupied Nests

Note: Inland colonies were not counted during the first two national censuses, so, to enable direct comparison, the percentage change refers to coastal colonies only.

Breeding Abundance

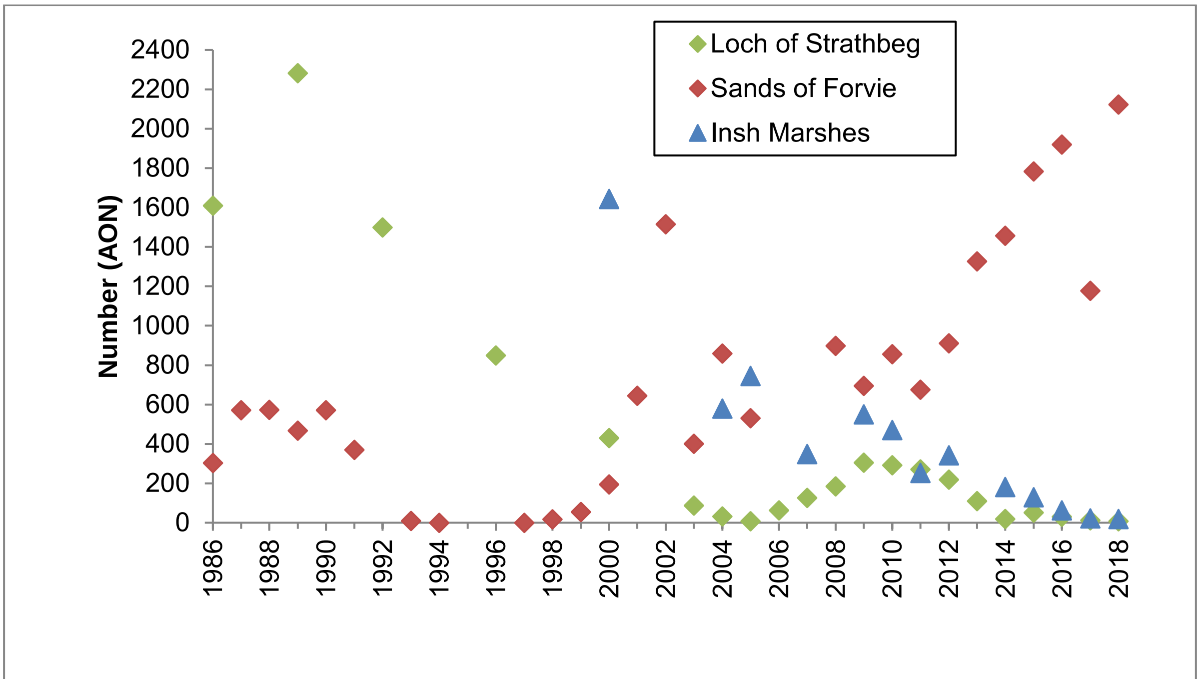


Figure 3. Abundance of black-headed gull at Loch of Strathbeg, Sands of Forvie and Insh Marshes, 1986-2018.

The number of black-headed gulls nesting in coastal areas of Scotland declined severely between 1969-70 and 1998-2002. National census data show almost 50% of the population disappeared between Operation Seafarer and the Seabird Colony Register, with a further decline of 28% by the time of Seabird 2000.

Due to colonies being surveyed infrequently, no trend can be generated from data submitted to the SMP. However, counts at three of the largest and most frequently monitored colonies (Loch of Strathbeg, Sands of Forvie and Insh Marshes) show how numbers have changed at each site over the reporting period (Figure 3, 1986-2018). The Sands of Forvie colony had almost disappeared by the mid-1990s but by 2018 had recovered and held over 2,100 AON. However, Loch of Strathbeg and Insh Marshes have declined considerably over the reporting period, now holding a fraction of the numbers they once did. Data from 19 coastal colonies counted in 2018 totalled 2,195 AON (including Forvie and Strathbeg), an increase of 158% compared to the 850 AON recorded at the same colonies during Seabird 2000. However, drawing definite conclusions about the fortunes of black-headed gulls in Scotland is difficult without extensive coverage of inland colonies which held far greater numbers compared to coastal colonies during the last census.

Productivity

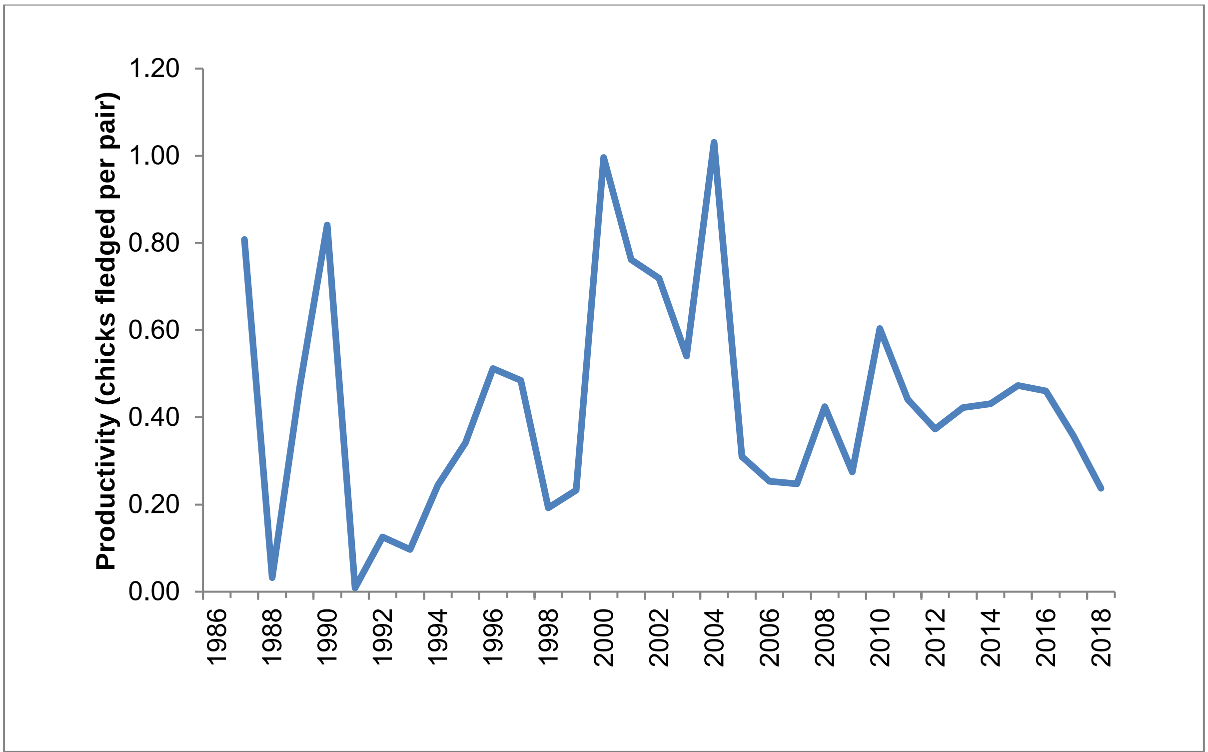


Figure 4. Trend in productivity (no. of chicks fledged per pair) of black-headed gull in Scotland, 1987-2018. Based on SMP data; view the methods of analysis .

The productivity of black-headed gulls in Scotland has fluctuated widely over the years. There is no clear trend, although birds appear to have been more successful overall during the latter half of the recording period. However, in 2018 only 0.24 chicks fledged per pair. Productivity is affected by predation by mammals, especially by American mink[3] at west coast colonies. Comparisons of productivity at colonies where American mink were controlled against those with no mink control, or where control was unsuccessful, found that on average, between 1997 and 2011, American mink lowered success from 0.79 to 0.32 chicks fledged per pair - an estimated reduction of 59%. However, from 2012 to 2014, success at colonies where American mink were controlled (0.06, 0.44 and 0.00 in each year, respectively) was actually lower than at colonies with no, or unsuccessful, control (0.44, 0.65 and 0.69 in each year, respectively), suggesting other factors (e.g. predation by large gulls, predation by otters *Lutra lutra*, or due to inclement weather) were impacting on productivity.

England

Population estimates and change 1969-2002 (census data)

	Operation Seafarer (1969-70)	Seabird Colony Register (1985-88)	Seabird 2000 (1998-2002)
Population estimate (AON*) **Inland** **Total**	53,142	61,968	65,549 17,179 82,728
% change since previous census	n/a	+14	+6

* AON = Apparently Occupied Nests

Note: Inland colonies were not counted during the first two national censuses, so, to enable direct comparison, the percentage change refers to coastal colonies only.

Breeding Abundance

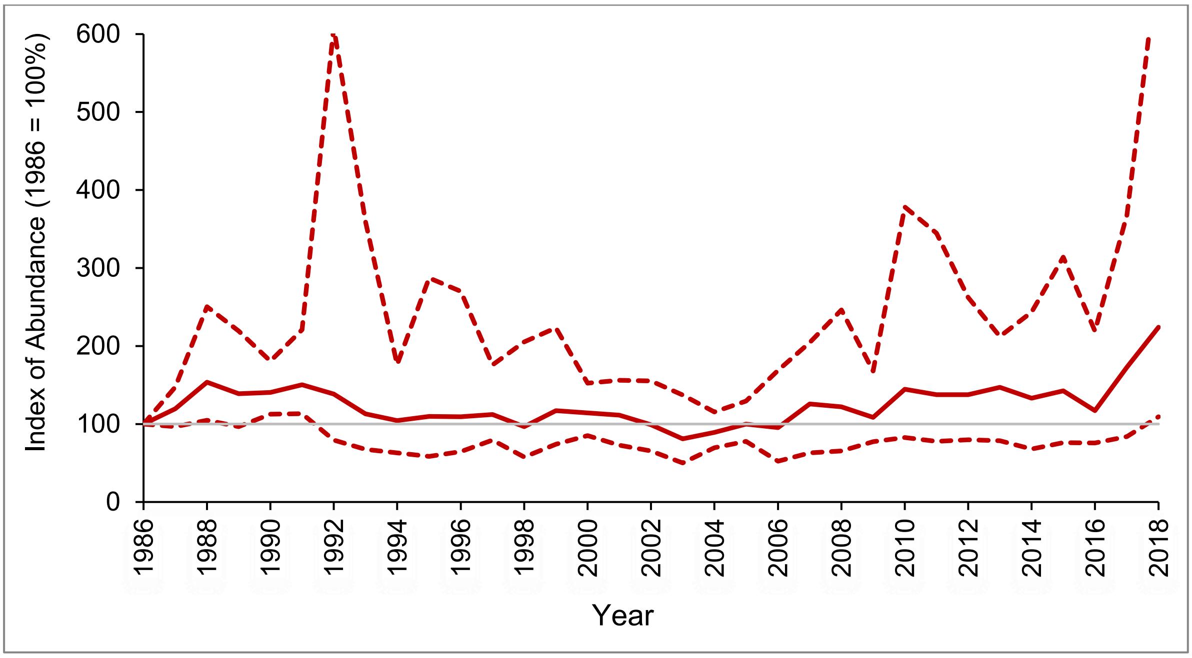


Figure 5. Trend in abundance index (solid line) of coastal-nesting black-headed gulls in England, 1986-2018 with 95% confidence limits (dotted lines; drawing of upper limit restricted to preserve detail in the abundance index). Based on SMP data; view the methods of analysis.

Census results for coastal nesting black-headed gulls in England show an increase of 14% in the number of nests recorded between 1969-70 and 1985-88. Results from Seabird 2000 showed little change took place between 1985-88 and 1998-2002. The abundance trend of black-headed gulls from SMP data indicates increases may have continued up until the early 1990s (Figure 5) before declining. Abundance was then relatively stable until 2003 when the index reached its lowest point since monitoring began. However, abundance has overall increased since then and, between 2010 and 2015, reached values equal to, or above, that recorded in the late 1980s and early 1990s. In 2018, the index was 124% above the 1986 baseline, the highest ever recorded.

The breeding population at inland colonies (about 100 were known at the time of Seabird 2000) may have increased too, although an insufficient number are routinely surveyed to deliver a robust trend. Two inland colonies, Belmont Reservoir and Old Moor, that were surveyed in 2018, held a total of 13,555 AON, a very large increase since Seabird 2000, when each held only 70 AON and 200 AON, respectively. Based on the latest national population estimate of black-headed gull (140,000 pairs[4]), Belmont Reservoir holds *c*.8% of the UK breeding population and is probably the largest, inland black-headed gull colony in the UK.

Productivity

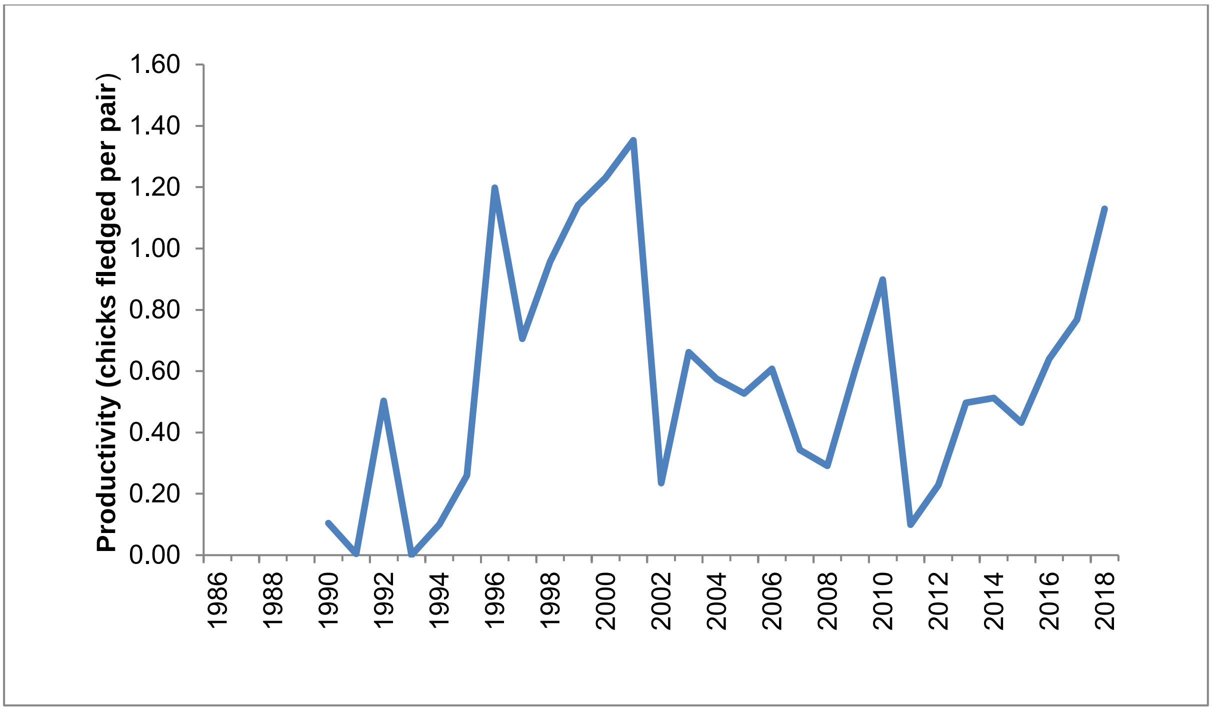


Figure 6. Trend in productivity (no. of chicks fledged per pair) of black-headed gull in England, 1990-2018. Based on SMP data; view the methods of analysis .

The productivity of black-headed gulls breeding in England fluctuates markedly. Particularly low levels of productivity were recorded prior to 1996, often due to high tides washing out nests. Between 1996 and 2001, colonies fledged an average of over one chick per pair per year but this was followed by a reduced productivity of 0.55 chicks per year per pair between 2002 and 2009. In 2010, black-headed gulls at English colonies had a successful breeding season (fledging an average of 0.9 chicks per pair) which was followed by a very poor season in 2011 (0.1 chicks per pair). In 2012, failure at several colonies was caused by flooding or predation leading to another poor season (0.2 chicks fledged per pair). Since then, productivity has continually increased and is now at 1.13 chicks fledged per pair per year, one of the highest values ever recorded.

Wales

Population estimates and change 1969-2002 (census data)

	Operation Seafarer (1969-70)	Seabird Colony Register (1985-88)	Seabird 2000 (1998-2002)
Population estimate (AON*) **Inland** **Total**	800	1,002	850 1,136 1,986
% change since previous census	n/a	+25	-15

* AON = Apparently Occupied Nests

Note: Inland colonies were not counted during the first two national censuses, so, to enable direct comparison, the percentage change refers to coastal colonies only.

Breeding Abundance

Few colonies holding black-headed gulls are monitored regularly in Wales. National census data indicate there was little overall change at coastal colonies between Operation Seafarer and Seabird 2000, although numbers during the Seabird Colony Register were approximately 20% higher. The largest and most frequently monitored colony, at Cemlyn, held 15% of the coastal population during the Seabird Colony Register but 52% during Seabird 2000. Distributional data from Seabird 2000 found fewer but larger colonies than recorded in previous censuses. Four coastal colonies counted in 2018 held 34 AON compared to 450 AON in Seabird 2000, indicating that the coastal black-headed breeding population in Wales may be decreasing. Little is known about the fortunes of inland colonies since Seabird 2000; however, a small sample of seven colonies visited in 2018 held 444 AON compared to 499 AON during Seabird 2000.

Productivity

Data submitted to the SMP on the productivity of black-headed gulls in Wales are sparse; thus, no meaningful average productivity value can be given.

Northern Ireland

Population estimates and change 1969-2002 (census data)

	Operation Seafarer (1969-70)	Seabird Colony Register (1985-88)	Seabird 2000 (1998-2002)
Population estimate (AON*) **Inland** **Total**	1,439	4,595	4,037 6,070 10,107
% change since previous census	n/a	+219	-12

* AON = Apparently Occupied Nests

Note: Inland colonies were not counted during the first two national censuses, so, to enable direct comparison, the percentage change refers to coastal colonies only.

Breeding Abundance

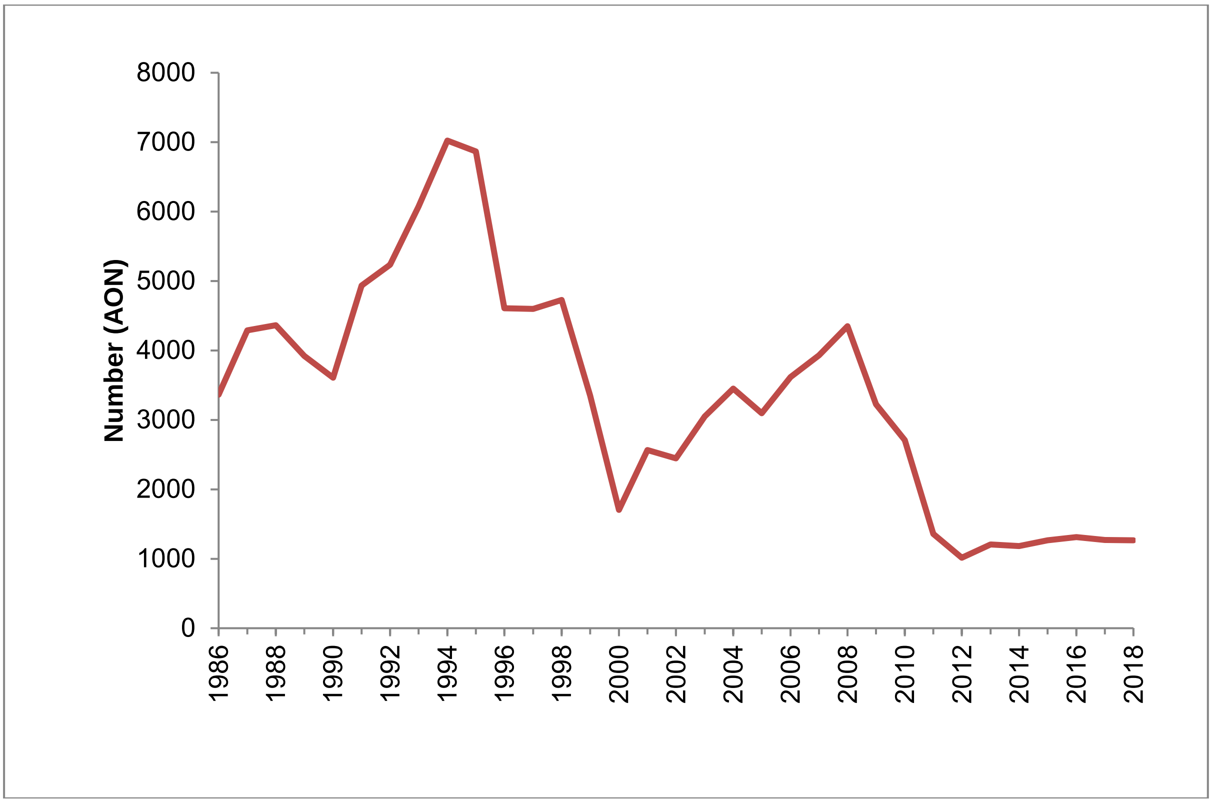


Figure 7. Abundance of black-headed gull at Strangford Lough, 1986-2018.

Seabird 2000 recorded just over 4,000 pairs of black-headed gulls nesting around the Northern Ireland coastline. This was 12% fewer than recorded by the SCR but almost three times that found by Operation Seafarer. However, the national population must have been far higher between the SCR and Seabird 2000 censuses, as numbers at Strangford Lough (Figure 7), climbed above 7,000 AON at the colonies peak in the mid-1990s, before declining prior to Seabird 2000. Numbers then increased again but, from 2008 to 2012 declined considerably (from 4351 to 1015 AON respectively). Since 2013 numbers have stabilised to between 1,200 and1,300 AON each year. The colonies at Carlingford Lough, Copeland Island and Rathlin need to be counted to better understand the status of the coastal-nesting population of black-headed gulls in Northern Ireland.

Few inland colonies are regularly monitored, although those at Lower Lough Erne and Portmore Lough held 1,517 AON in 2018 compared to 1,033 AON during Seabird 2000. On Lough Neagh, which held 30,000 breeding AON of black-headed gulls on 12 islands in the 1980s, counts of the main breeding islands estimated 11,595 individuals in 2016, 8,120 in 2017 and 8,906 in 2018[5]. In addition, black-headed gulls have abandoned breeding on Shallow Flat and Coney Island Flat, and have decreased in number on Padian Island, Owen Roe and Scaddy Island[6].

Productivity

Data submitted to the SMP on the productivity of black-headed gulls in Northern Ireland are sparse. At Portmore Lough, 124 AONs produced 159 chicks (1.28 chicks fledged per pair), almost identical to 2017. In 2018, productivity was approximately 1.50 chicks fledged per pair at Blue Circle Island and Swan Island in Larne Lough.

Republic of Ireland

Population estimates and change 1969-2002 (census data)

	Operation Seafarer (1969-70)	Seabird Colony Register (1984-85)	Seabird 2000 (1998-2002)	Republic of Ireland Census (2015-18)
Population estimate (AON*) **Inland** **Total**	1,320	376	2,066 1,810 3,876	7,810**
% change since previous census	n/a	-71	+449	+102

* AON = Apparently Occupied Nests
** This population estimate figure is a combination of inland and coastal as information on the split were not available[5].

Note: Inland colonies were not counted during the first two national censuses, so, to enable direct comparison, the percentage change refers to coastal colonies only.

Breeding Abundance

The number of black-headed gulls in the Republic of Ireland was very low during the Seabird Colony Register, at 376 pairs. Numbers had declined by 71% since Operation Seafarer, possibly due to birds deserting coastal colonies in favour of inland ones. However, by the time of Seabird 2000, coastal black-headed gulls were more numerous than they had been during the first census, at 2,066 pairs with a further 1,810 pairs nesting inland. The recent Republic of Ireland Seabird Census (2015-2018) recorded a total of 7,810 pairs, an increase of 102% compared to 3,876 AON recorded during Seabird 2000[7]. The two coastal lakes of Inch in Donegal and Lady’s Island Lake in Wexford currently host over half of the national population, increasing from 949 AON and 800 AON during Seabird 2000 to 2,526 AON (+166%) and 1,450 AON (+81%), respectively. Inland colonies at Lough Carra (556%), Lough Mask (63%) and Lough Corrib (57%) have been increasing and an additional colony emerged on Lough Derg[7].

Productivity

Data submitted to the SMP on the productivity of black-headed gulls in the Republic of Ireland are sparse; thus, no meaningful average productivity value can be given.

All Ireland

Population estimates and change 1969-2002 (census data)

	Operation Seafarer (1969-70)	Seabird Colony Register (1985-88)	Seabird 2000 (1998-2002)
Population estimate (AON*) **Inland** **Total**	2,759	4,971	6,103 7,880 13,983
% change since previous census	n/a	+80	+23

* AON = Apparently Occupied Nests

Note: Inland colonies were not counted during the first two national censuses, so, to enable direct comparison, the percentage change refers to coastal colonies only.

Breeding Abundance

During Seabird 2000, 6,103 AON of black-headed gull were recorded around the coast of Ireland. This was higher than during both of the previous censuses, with numbers having more than doubled since Operation Seafarer.

Numbers at Strangford Lough, one of the largest coastal colonies in Northern Ireland have stabilised to between 1,200 and 1,300 AON each year since 2013. Other colonies such as Carlingford Lough, Copeland Island and Rathlin Island need to be counted to better understand the status of the coastal-nesting population of black-headed gulls in Northern Ireland. The recent Republic of Ireland Seabird Census (2015-2018) recorded a total of 7,810 pairs, an increase of 102% compared to 3,876 AON recorded during Seabird 2000[7]. Over half of the coastal-nesting population of black-headed gulls is currently located at two coastal lakes (Lough Inch and Lady's Island Lake).

Few inland colonies are regularly monitored in Northern Ireland and the Republic of Ireland therefore, it is unclear whether the black-headed gull population is stable or decreasing.

Productivity

Data submitted to the SMP on the productivity of black-headed gulls throughout Ireland are sparse; thus, no meaningful average productivity value can be given.

Isle of Man

Population estimates and change 1969-2018 (census data)

	Operation Seafarer (1969-70)	Seabird Colony Register (1984-85)	Seabird 2000 (1998-2002)	Isle of Man Census (2017-18)
Population estimate (AON) **Inland** **Total**	n/a	78	2 0 2	6 0 6
% change since previous census	n/a	n/a	-97	+200

* AON = Apparently Occupied Nests

Note: Inland colonies were not counted during the first two national censuses so, to enable direct comparison, the percentage change refers to coastal colonies only.

Breeding Abundance

Only two pairs of black-headed gull were recorded during Seabird 2000, numbers having declined by 97% since the Seabird Colony Register. The first data received for this species since the last national census was in 2017, when an island census found six AON at the Point of Ayres Gravel Pits[8]. No data were submitted to the SMP in 2018.

Productivity

No systematic data on the productivity of black-headed gulls on the Isle of Man have been submitted to the SMP.

Channel Islands

Black-headed gull does not breed on the Channel Islands.

UK phenology, diet, survival rates

No data have been collected as part of the Seabird Monitoring Programme.

References

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5 Booth Jones, K. and Wolsey, S. 2019. Northern Ireland Seabird Report 2018. British Trust for Ornithology, Thetford.
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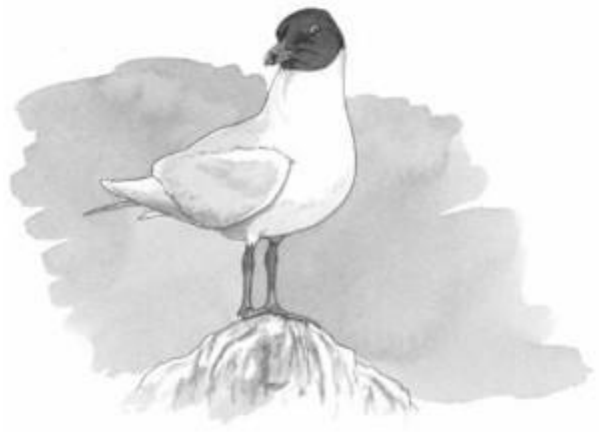
8 Hill, R.W., Morris, N. G., Bowman, K. A., and Wright, D. 2019. The Isle of Man Seabird Census: Report on the census of breeding seabirds in the Isle of Man 2017-18. Manx BirdLife. Laxey, Isle of Man.

Mediterranean Gull *Larus melanocephalus*

Description



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The Mediterranean gull is the most recent addition to the species of seabirds breeding in the UK. It has increased as a breeding species in recent decades, but as recently as Seabird 2000, its population in these islands numbered little more than 100 pairs. However, by 2010, there were over 600-700 nesting pairs, mostly on the south and south-east coasts of England.

The range of the Mediterranean gull has expanded markedly over the last 50 years. A westward expansion started in Hungary, where it was breeding regularly by 1953, then into Germany and Belgium during the 1960s and the Netherlands by 1970. Range expansion also occurred in an eastward direction during the 1970s and 1980s. The first breeding occurrence in Britain was in 1968, at Needs Ore Point (Hampshire). Thereafter, a pair bred at Dungeness (Kent), in 1979, increasing to two pairs by 1985. A site in north Kent was colonised in 1983, which later became established as one of the major colonies in England. Also during this period, a handful of other breeding attempts were made, including pairings with black-headed gulls. The first recorded breeding attempt in Northern Ireland was in Antrim in 1995.

Conservation status

Mediterranean gull is currently identified as a conservation priority in the following:

Amber listed in Birds of Conservation Concern 4 (2015 update)
Wildlife and Countryside Act 1981 - protected under Schedule 1
further information on Conservation Designations for UK Taxa
Amber listed in Birds of Conservation Concern in Ireland 2014-2019 (2014 update)
EC Birds Directive - listed in Annex 1 and as a migratory species

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International importance

UK Population	% Biogeographic Population	% World Population
110 AON*	0.1 (Europe excl. Russia & Turkey)	0.1

*AON = Apparently Occupied Nests

The UK population figure was derived from data in Mitchell, P.I., Newton, S.F., Ratcliffe, N. and Dunn, T.E. (eds.) 2004. *Seabird Populations of Britain and Ireland.* Poyser, London. This was also the source of figures for the Biogeographic and World populations.

UK population estimates and change 1969-2002 (census data)

	Operation Seafarer (1969-70)	Seabird Colony Register (1985-88)	Seabird 2000 (1998-2002)
UK Population estimate (AON*)	0	1	110
% change since previous census	n/a	n/a	+11,000

*AON = Apparently Occupied Nests

For census results for individual countries and Ireland, the Channel Islands and the Isle of Man see under relevant sections below.

Distribution/abundance

The Seabird 2000 census provides the most comprehensive recent assessment of the distribution and abundance of breeding seabirds. Numbers found in different regions, and a map showing the location and size of colonies, are provided in the Seabird 2000 Mediterranean gull results page.

The locations sampled during the annual Seabird Monitoring Programme provide some information on distribution and are accessible via the Seabird Monitoring Programme online database.

Annual abundance and productivity by geographical area

With reference to the regional accounts below please note the following.

Breeding abundance: graphs of abundance index with 95% CLs are only shown for a region where the trend produced has been deemed accurate (see methods of analysis). Where a trend was thought to be inaccurate, graphs of abundance at major colonies in a region may be shown instead, particularly if such colonies hold greater than 10% of the regional population, are monitored frequently and may thus help illustrate regional population fluctuations outwith national censuses. Occasionally, too few data have been collected regionally to produce either of these.

Productivity: graphs of productivity are only shown if analysis of productivity data produced a significant result for regional and/or year effects (again see methods of analysis). If results were not significant, then a regional mean productivity value is given. However, on some occasions too few data are available from which to provide a meaningful average. Furthermore, for 11 species where the quality of monitoring data available was considered high, population viability analysis was undertaken at the UK level and the results of this are also reported.

United Kingdom

Breeding abundance

Mediterranean gull is the most recent addition to the breeding seabird fauna of the Britain and Ireland. The species first bred in the UK in 1968, but numbers remained very low until the late 1980s. In 2018, data were submitted to the SMP from 15 colonies, including the largest sites throughout the UK. At these, a total of 1,781 AON were recorded, compared to 110 AON during Seabird 2000, an increase of 1,519%. However, taking smaller colonies and those not counted recently (of which there are at least 38 in total) into account, it is thought that the UK population lies closer to 2,350-2,400 AON (Mark Holling pers. comm). Most large colonies are located in south and south-east England, although the distribution is expanding northward with smaller colonies becoming established elsewhere. The colonisation of the UK was a result of the expansion in population size and range from the species' core population around the Black Sea and into other European countries in the 1950s and 1960s[1]. There is no evidence that the colonisation is related to climate change. Some colonies are prone to desertion after tidal flooding and predictions of increased storminess due to climate change may increase the incidence of tidal inundation of nests. This may potentially be affecting reproductive output, but there is much uncertainty about how this, and predicted increases in sea level, will affect the population size of Mediterranean gull and other species that nest close to the tidal mark.

Productivity

Relatively few data on productivity are available but, in recent years, one of the larger colonies in Langstone Harbour has decreased in productivity from 1.04 chicks fledged per pair in 2015 to 0.36 in 2018.

Scotland

This species does not yet breed in Scotland, although there have been several instances of single birds summering in Scottish gull colonies and pairing with both black-headed gull and common gull.

England

Population estimates and change 1969-2002 (census data)

	Operation Seafarer (1969-70)	Seabird Colony Register (1985-88)	Seabird 2000 (1998-2002)
Population estimate (AON*)	0	1	108
% change since previous census	n/a	n/a	+10,700

* AON = Apparently Occupied Nests

Breeding Abundance

The Seabird Colony Register recorded only one Mediterranean gull pair breeding in England. However, breeding was first confirmed in 1968 in Hampshire and was sporadic until the late 1980s. Thereafter, colonisation spread outwards from southern and south-east England so that, by Seabird 2000, there were 108 AON recorded, some as far north as Lancashire and West Yorkshire. However, the main population was still centred in the south. Between 1,390 -1,415 AON were reported to the Rare Breeding Birds Panel in 2017[2].

Productivity

Relatively few data on Mediterranean gull productivity are available but, in recent years, one of the larger colonies in Langstone Harbour has decreased in productivity from 1.04 chicks fledged per pair in 2015 to 0.36 in 2018.

Wales

Breeding Abundance

The Mediterranean gull is a recent colonist in Wales, although data submitted are sparse. However, one colony in Anglesey is known to be fluctuating with one breeding AON in 2009 and 2010; two in 2011 (although breeding was only confirmed for one); and five in 2014 and 2017, however, no further nesting has been recorded since.

Productivity

Data submitted to the SMP on the productivity of Mediterranean gulls in Wales are sparse; however, at least two young fledged from three AON in 2013 and three from five nests in 2014. Since then, no productivity data have been available.

Northern Ireland

Population estimates and change 1969-2002 (census data)

	Operation Seafarer (1969-70)	Seabird Colony Register (1985-88)	Seabird 2000 (1998-2002)
Population estimate (AON*)	0	0	2
% change since previous census	n/a	n/a	n/a

* AON = Apparently Occupied Nests

Breeding Abundance

Mediterranean gull is a recent colonist in Northern Ireland, first breeding in 1995 and between one to three AON being recorded annually between 1995 and 2010. Numbers have increased since then, particularly since they began breeding at Belfast Lough in 2016. In 2018, a total of 14 AONs were recorded in Northern Ireland[3].

Productivity

From 2016 to 2018, Larne Lough and Belfast Lough fledged an average of 2.35, 1.00 and 1.98 chicks per pair. In 2018, Mediterranean gulls at the same colonies had an average productivity of 1.75 and 2.17 chicks fledged per pair respectively.

Republic of Ireland

Population estimates and change 1969-2002 (census data)

	Operation Seafarer (1969-70)	Seabird Colony Register (1984-85)	Seabird 2000 (1998-2002)	Republic of Ireland Census (2015-18)
Population estimate (AON)	0	0	3	54
% change since previous census	n/a	n/a	n/a	+1,700

* AON = Apparently Occupied Nests

Breeding Abundance

The first breeding record for the Republic of Ireland occurred in 1996, when one AON was found at a site in County Wexford and by Seabird 2000, three AON were known. Numbers have increased since then; for example, 18 and 16 AON were reported at just one site in 2012 and 2013 respectively This site has continued to increase, holding 23 AON in 2014 and 28 AON in 2015. A Republic of Ireland Seabird Census (2015-2018) recorded a total of 54 AON at three sites across the country[4]. This represents a 1700% increase since Seabird 2000, when only three pairs were recorded. Almost 95% of the total number of pairs breed at

Lady's Island, County Wexford, which is also an important tern and black-headed gull colony[4].

Productivity

Data submitted to the SMP on the productivity of Mediterranean gulls in the Republic of Ireland are sparse; thus, no meaningful average productivity value can be given.

All Ireland

Population estimates and change 1969-2002 (census data)

	Operation Seafarer (1969-70)	**Seabird Colony Register (1985-88)**	**Seabird 2000 (1998-2002)**
Population estimate (AON*)	0	0	5
% change since previous census	n/a	n/a	n/a

* AON = Apparently Occupied Nests

Breeding Abundance

Mediterranean gull colonised Ireland in the mid-1990s, with breeding first occurring in Northern Ireland in 1995 and the Republic of Ireland in 1996. The population increased slowly with five pairs counted during Seabird 2000. Numbers have increased since then, particularly since they began breeding at Belfast Lough in 2016 (Northern Ireland) and Lady's Island (Republic of Ireland). In 2018, a total of 14 AON were recorded in Northern Ireland[3] and 54 AON in the Republic of Ireland[4], giving a total of 72 AON for the whole of Ireland.

Productivity

Data submitted to the SMP on the productivity of Mediterranean gulls from colonies throughout Ireland are sparse, however, between 2016 and 2018, two colonies in Northern Ireland fledged an average of 2.35, 1.00 and 1.98 chicks per pair each year. In 2018, Mediterranean gulls at Larne Lough and Belfast Lough had an average productivity of 1.75 and 2.17 chicks fledged per pair respectively. No data from the Republic of Ireland on Mediterranean gull productivity has been submitted to the SMP.

Isle of Man

Mediterranean gull does not breed on the Isle of Man.

Channel Islands

Mediterranean gull does not breed on the Channel Islands.

UK phenology, diet, survival rates

No data have been collected as part of the Seabird Monitoring Programme.

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Common Gull *Larus canus*

Description

The following has been adapted from original text by Mark L. Tasker in [Seabird Populations of Britain and Ireland] (with permission from A&C Black, London).

The common gull breeds across the Palaearctic and in North America. They breed on coasts and at inland sites, and spend the winter inland, on estuaries and at sea. Terrestrial foods include earthworms, beetles and other insects, while discarded fishery wastes supplements natural food at sea. In the UK their breeding distribution is virtually confined to Scotland and Northern Ireland. It is a colonial breeder, but will also nest solitarily. During Seabird 2000, over half of the total population in the UK was breeding inland. Despite the inland bias in the distribution, this was the first time that all inland-breeding common gulls had been censused. There is no reason to suggest that the coastal and inland nesting populations are in anyway separate. Therefore, it is essential that inland colonies are surveyed as thoroughly as those on the coast if an accurate assessment of the current status of the species is to be made.

Conservation status

Common gull is currently identified as a conservation priority in the following:

Amber listed in Birds of Conservation Concern 4 (2015 update)
(further information on Conservation Designations for UK Taxa)
Amber listed in Birds of Conservation Concern in Ireland 2014-2019 (2014 update)
EC Birds Directive - migratory species

International importance

UK Population	% Biogeographic Population	% World Population
48,700 AON*	9.3 (ssp. *canus*)	9.1

*AON = Apparently Occupied Nests

The UK population figure (rounded to the nearest hundred) was derived from data in Mitchell, P.I., Newton, S.F., Ratcliffe, N. and Dunn, T.E. (eds.) 2004. *Seabird Populations of*

Britain and Ireland. Poyser, London. This was also the source of figures for the Biogeographic and World populations.

Note: The UK population figure above includes data from both inland and coastal colonies hence differs from that tabled below.

UK population estimates and change 1969-2002 (census data)

Only coastal-nesting common gulls were counted fully during both Operation Seafarer (1969-70) and the SCR Census (1985-88), so comparison between Seabird 2000 population estimates and the previous censuses are based only on coastal colonies. During the SCR Census (1985-88) the total inland population was estimated to be 60,000 pairs. This was based largely on the fact that in 1988-89 some 40,000 pairs were nesting at just a few colonies in the Mortlach and Correen Hills. Common gulls nest in many inland areas of Scotland and in more remote areas of England and Northern Ireland. Given the relatively small number of observers involved, coverage of such areas during Seabird 2000 was difficult to assess but it is likely that all areas were covered at least once during the census period. If, however, the species is mobile between sites within this count period, some breeding sites could have been missed and other groups of birds double-counted. There has never been a census of this species over one year to enable this possibility to be assessed.

	Operation Seafarer (1969-70)	**Seabird Colony Register (1985-88)**	**Seabird 2000 (1998-2002)**
UK Population estimate (AON*) **Inland** **Total**	12,295	15,357	20,883 27,831 48,714
% change since previous census	n/a	+25	+36

*AON = Apparently Occupied Nests

Note: Inland colonies were not counted during the first two national censuses, so, to enable direct comparison, the percentage change refers to coastal colonies only.
For census results for individual countries and Ireland, the Channel Islands and the Isle of Man see under relevant sections below.

Distribution/abundance

The Seabird 2000 census provides the most comprehensive recent assessment of the distribution and abundance of breeding seabirds. Numbers found in different regions, and a map showing the location and size of colonies, is provided in the Seabird 2000 common gull results page.

The locations sampled during the annual Seabird Monitoring Programme provide some information on distribution and are accessible via the Seabird Monitoring Programme online database.

Annual abundance and productivity by geographical area

With reference to the regional accounts below please note the following.

Breeding abundance: graphs of abundance index with 95% CLs are only shown for a region where the trend produced has been deemed accurate (see methods of analysis). Where a trend was thought to be inaccurate, graphs of abundance at major colonies in a region may be shown instead, particularly if such colonies hold greater than 10% of the regional population, are monitored frequently and may thus help illustrate regional population fluctuations outwith national censuses. Occasionally, too few data have been collected regionally to produce either of these.

Productivity: graphs of productivity are only shown if analysis of productivity data produced a significant result for regional and/or year effects (again see methods of analysis). If results were not significant, then a regional mean productivity value is given. However, on some occasions too few data are available from which to provide a meaningful average. Furthermore, for 11 species where the quality of monitoring data available was considered high, population viability analysis was undertaken at the UK level and the results of this are also reported.

United Kingdom

Breeding abundance

The annual sample of common gull colonies is insufficient to produce reliable trend information for the UK as a whole. Note that the only comparable data from national censuses relate to coastal-nesting common gulls. Coastal nesting birds increased by 24% between 1969-70 and 1985-88, with a further increase of 36% to Seabird 2000. The reason for this increase in coastal nesters is not known; it is, however, possible that it may have been an artefact due to less complete survey coverage during the earlier censuses. With Scotland holding approximately 98% of the UK population, the trend there can be used as a proxy for the UK situation post Seabird 2000 and suggests that numbers have declined since the then. In 2018, 139 coastal sites held 1,550 AON, 48% less than during Seabird 2000. This number comprises only 10% of the total coastal breeding sites counted during Seabird 2000, although does give an indication of the current status of the UK coastal common gull breeding population. However, drawing definite conclusions about the fortunes of common gulls in the UK is difficult without extensive coverage of inland colonies which held far greater numbers compared to coastal colonies during the last census. The fourth seabird census (Seabirds Count) will provide a comprehensive picture of trends in the UK common gull breeding population when it reports in 2021. American mink *Neovison vison* are known to have severe negative effects at a local level, taking both eggs, chicks and adults, and causing colony abandonment[1,2], but it is unknown whether this is the main reason for the apparent decline nationally.

During Seabird 2000 over half (57%) of the total common gull population in Britain and Ireland bred inland, although, as inland colonies are surveyed infrequently, no trend can be generated from data submitted to the SMP. However, some large inland common gull colonies in Scotland are known to have declined severely, although the reasons are unknown.

Productivity

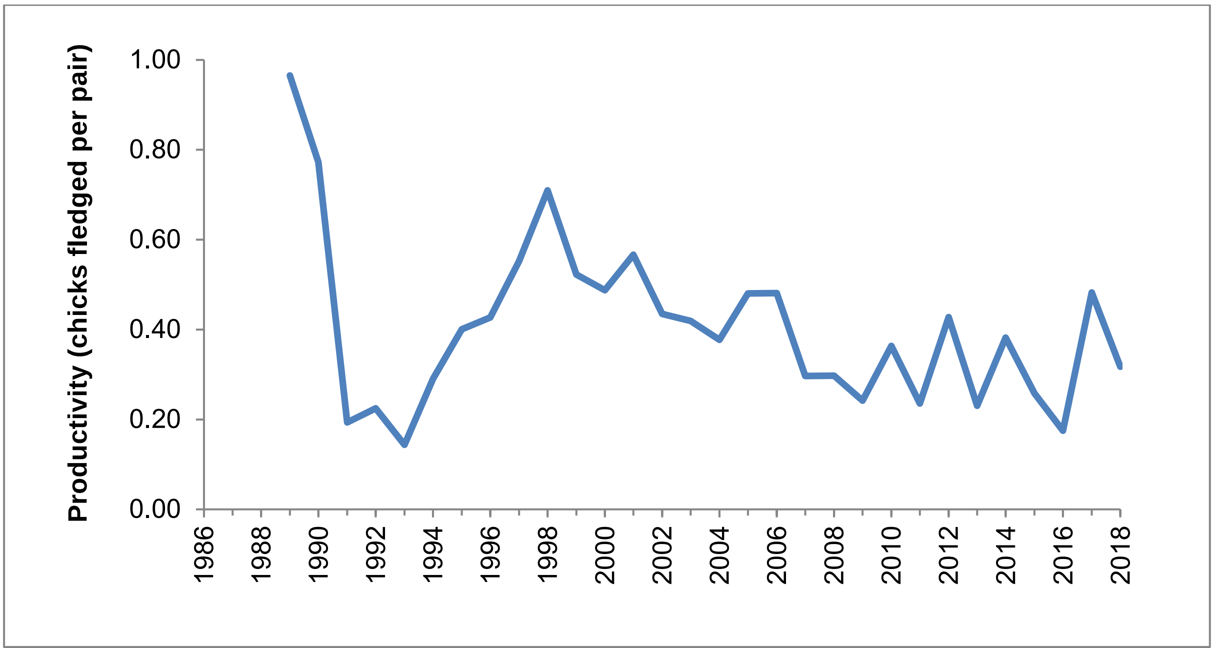

Figure 1. Trend in UK productivity (no. of chicks fledged per pair) of common gull 1989-2018. Based on SMP data; view the methods of analysis.

The sample of productivity data used in the generation of the above trend may not be representative at a UK level, as most data up to 2013 came from a study of the effects of American mink control on productivity of gulls and terns in western Scotland[2,3]. This showed the significant negative effects of mink, although results in some years may be partially clouded by predation of common gull eggs by larger gulls. Common gull productivity data collected from this study between 1996 and 2013 found colonies with successful mink control fledged an average of 0.71 chicks per pair per year, compared to 0.30 at colonies with no, or unsuccessful, mink control; on average productivity was 57% (range 27-77%) lower at colonies in the latter group. In 2014, success at these two groups of colonies was 0.68 and 0.19 chicks fledged per pair, respectively - a difference of 72%[3]. Productivity of common gull has declined since 1998 from 0.71 to 0.17 chicks fledged per pair, with its lowest index value in 2016 (0.17). Since then, it increased in 2017 but this figure should be treated with caution due to the small amount of data submitted to the SMP. In 2018, average productivity for common gull in the UK was 0.50 chicks fledged per pair which was higher than the long-term productivity average of 0.40 (1989-2018).

Scotland

Population estimates and change 1969-2002 (census data)

	Operation Seafarer (1969-70)	Seabird Colony Register (1985-88)	Seabird 2000 (1998-2002)
Population estimate (AON*) **Inland** **Total**	12,229	15,134	20,467 27,646 48,113
% change since previous census	n/a	+24	+35

* AON = Apparently Occupied Nests

Note: Inland colonies were not counted during the first two national censuses, so, to enable direct comparison, the percentage change refers to coastal colonies only.

Breeding Abundance

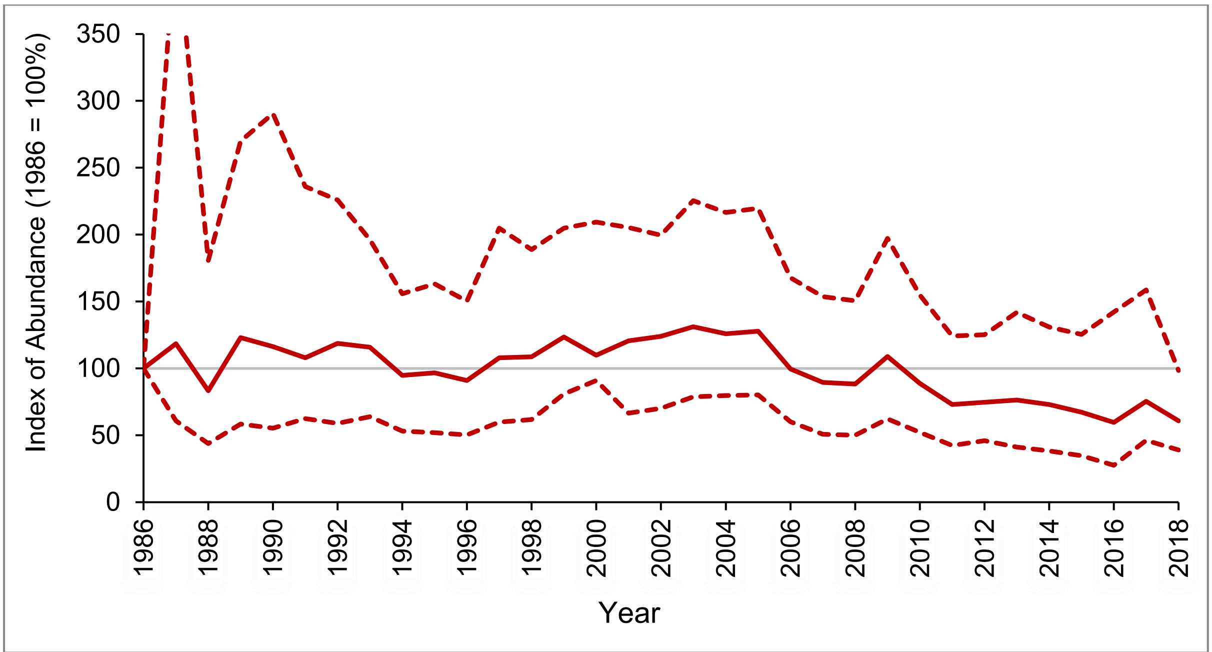

Figure 2. Trend in abundance index (solid line) of coastal-nesting common gulls in Scotland, 1986-2018 with 95% confidence limits (dotted lines). Based on SMP data; view the methods of analysis .

58% of common gulls recorded during the last census (Seabird 2000) were considered to be nesting within the coastal region (≤5km from the coastline)[4]. Coastal nesting common gulls in Scotland have been increasing since 1969-70 according to national census data. Numbers recorded during Seabird 2000 were 35% higher than during the Seabird Colony Register and 67% higher than during Operation Seafarer. The abundance trend using the SMP sample agrees with the national census data over the same period, although suggests a slightly higher abundance at the time of Seabird 2000. Since 2005, the trend has been downward, with a slight recovery in 2009, the index in 2018 stands at 39% below the1986 baseline. A 58% decline was found at a sample of 132 coastal sites (1,207 AON) in 2018. These represent only 10% of all sites in Scotland counted during Seabird 2000 but do provide an indication of the current status of Scotland’s breeding common gull population.

Numbers at some large inland colonies, not part of the above analysis, have declined severely, for unknown reasons. For example, the first systematic survey of colonies at the Correen Hills and Mortlach Hills in 1988-89 found 24,500 and 16,200 AON, respectively. By 1995, the Correen Hills colony had declined to 6,400 AON, and by 1998, had become extinct. The Mortlach Hills colonies followed a similar fate, having declined since 1998 when they held 18,136 AON; 6,565 AON were recorded in 2003 and 6,240 AON in 2007/08. It is doubtful whether decreases in both these areas have been compensated by increases at other colonies or by the establishment of new colonies. Two major colonies (Tom Mor and Tips of Corsemaul) which were not present during Seabird 2000 held just 4,156 and 2,084 in 2007 and 2008 respectively. Both colonies were surveyed again in 2015 but had declined by 61% and 23% respectively.

Productivity

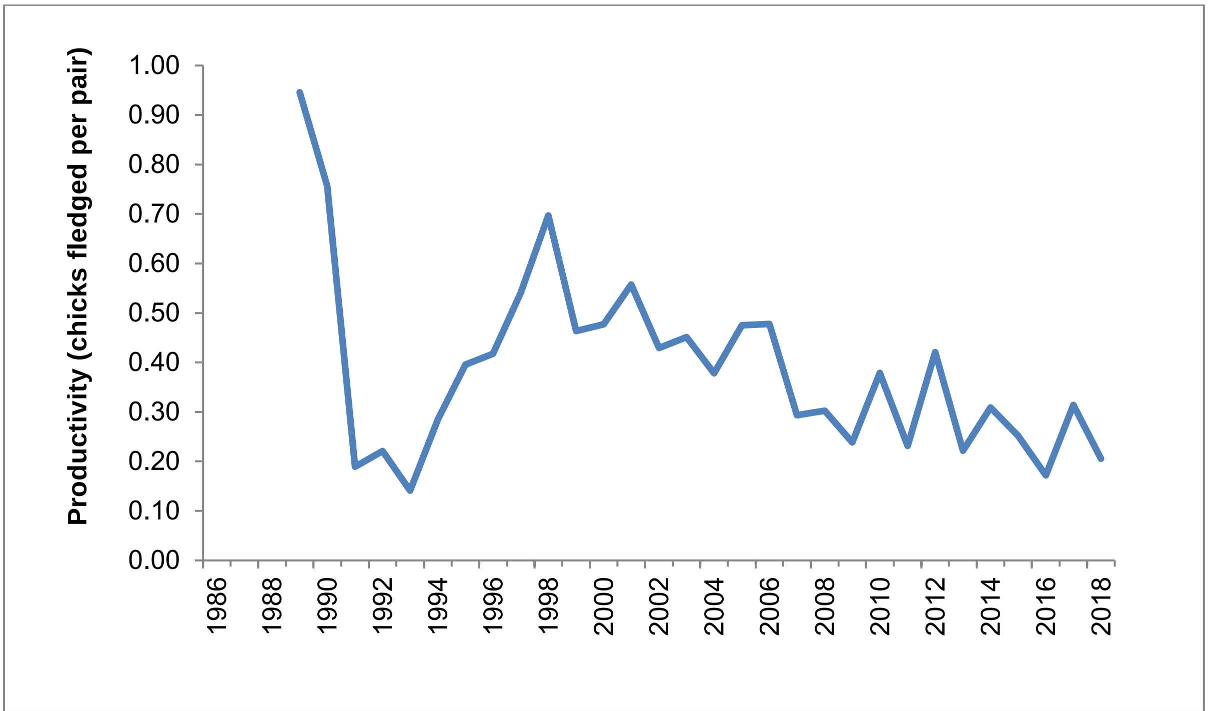

Figure 3. Trend in productivity (no. of chicks fledged per pair) of common gull in Scotland, 1989-2018. Based on SMP data; view the methods of analysis .

Productivity of common gulls in Scotland has declined since the late 1990s with poor breeding seasons in 2009, 2011, 2013, 2016 and 2018. Between 1996 and 2003, most information on common gull productivity came from a study of the effects of American mink *Neovison vison* control on gulls and terns nesting on west coast islands[2] and may, therefore, not be representative of Scotland as a whole. American Mink can have a significant depressive effect on productivity. Common gull data collected from this area between 1996 and 2013 found colonies with successful mink control fledged an average of 0.71 chicks per pair per year, compared to 0.30 at colonies with no, or unsuccessful, mink control; on average productivity was 57% (range 27-77%) lower at colonies in the latter group. In 2014, productivity at these two groups of colonies was 0.68 and 0.19 chicks fledged per pair respectively - a difference of 72%[3].

England

Population estimates and change 1969-2002 (census data)

	Operation Seafarer (1969-70)	**Seabird Colony Register (1985-88)**	**Seabird 2000 (1998-2002)**
Population estimate (AON*) **Inland** **Total**	8	31	33 11 44
% change since previous census	n/a	+287	+6

* AON = Apparently Occupied Nests

Note: Inland colonies were not counted during the first two national censuses, so, to enable direct comparison, the percentage change refers to coastal colonies only.

Breeding Abundance

Few common gulls nest in England, with eight AON being recorded during Operation Seafarer and 31 during the Seabird Colony Register (SCR). During Seabird 2000, 15 colonies were found with total numbers close to that recorded by the SCR. Information from colonies counted on an annual basis suggests that the common gull breeding population in England increased in the decade following Seabird 2000 but may have declined more recently. For example, between 2003 and 2018 records were received from a sample of between five and nine colonies, where numbers ranged from 20 AON (2004 and 2005) to 64 AON (2008), although only 18 pairs were reported from eight of these colonies in 2018.

Productivity

With only a handful of pairs nesting in England, few meaningful data on productivity are received. Monitored pairs tend to be in colonies containing terns which receive most of the targeted effort toward recording breeding performance. Complete failure is, however, usually noticed and recorded but successful years may not be recorded. Hence, productivity data for this species may be biased toward recording zeros, so the estimated average productivity of 0.50 and 0.29 chicks fledged per nest per year for 2017 and 2018 respectively (there was no significant difference over time) may be low due to this potential bias.

Wales

Population estimates and change 1969-2002 (census data)

	Operation Seafarer (1969-70)	Seabird Colony Register (1985-88)	Seabird 2000 (1998-2002)
Population estimate (AON*) **Inland** **Total**	2	0	0 0 0
% change since previous census	n/a	-100	n/a

* AON = Apparently Occupied Nests

Note: Inland colonies were not counted during the first two national censuses, so, to enable direct comparison, the percentage change refers to coastal colonies only.

Breeding Abundance

Common gull no longer breeds in Wales. Two pairs were recorded during Operation Seafarer but none were found during the last two censuses.

Productivity

This species ceased to breed in Wales before the SMP started, so no data on productivity are available.

Northern Ireland

Population estimates and change 1969-2002 (census data)

	Operation Seafarer (1969-70)	Seabird Colony Register (1985-88)	Seabird 2000 (1998-2002)
Population estimate (AON*) **Inland** **Total**	56	192	383 174 557
% change since previous census	n/a	+243	+99

* AON = Apparently Occupied Nests

Note: Inland colonies were not counted during the first two national censuses, so, to enable direct comparison, the percentage change refers to coastal colonies only.

Breeding Abundance

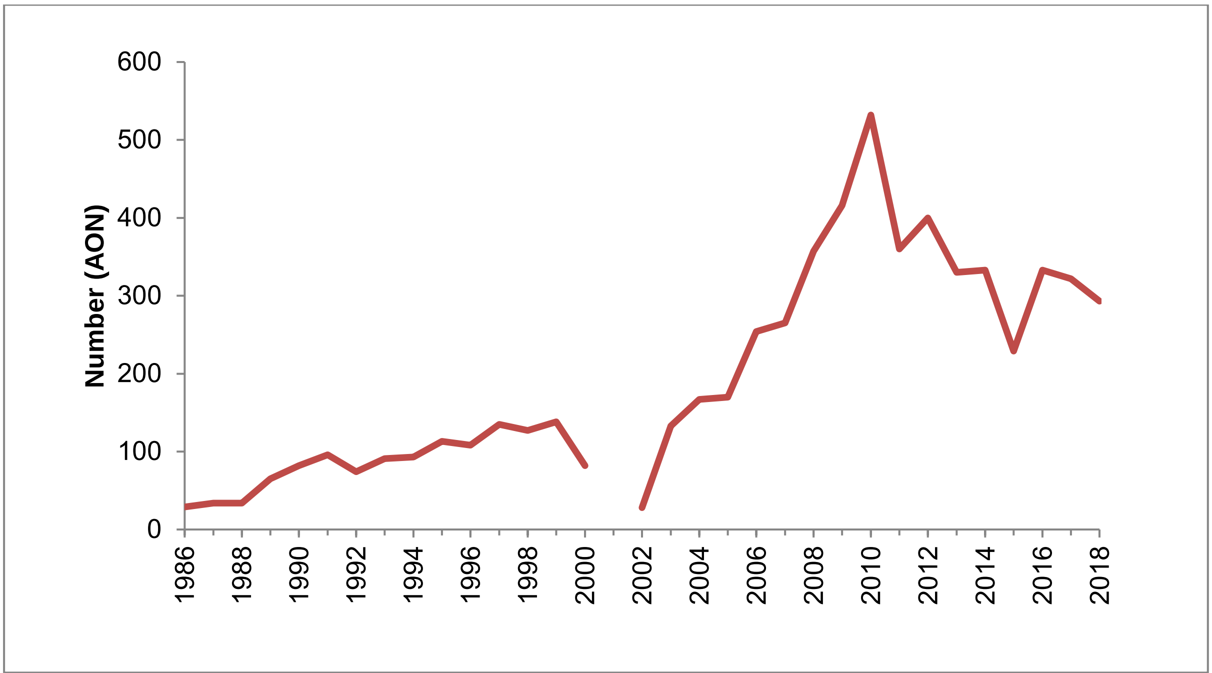

Figure 4. Abundance of common gull at Strangford Lough , 1986-2018.

National census data show that the number of coastal nesting common gulls in Northern Ireland increased between Operation Seafarer and Seabird 2000. The largest colonies are found on the Copeland Islands and at Strangford Lough. Common gull numbers at Strangford Lough (Figure 4) increased steadily from the late 1980s to 1999. A sharp decline occurred between 1999 and 2002 (access restrictions due to foot and mouth disease prevented counting in 2001) as numbers fell from 138 to 28 AON. Numbers then increased rapidly to a peak of 532 AON in 2010 but declined again to 229 AON in 2015. A total of 293 AON were recorded during the 2018 breeding season and a further 105 AON were estimated at four other colonies that year. In 2009, 850 common gull AON were recorded on the Copeland Islands, although numbers had declined to 452 AON in 2012. The population of coastal nesting common gulls in Northern Ireland may have increased since Seabird 2000, although without a more recent count from the Copeland Islands, there is some uncertainty.

Inland colonies, which held 174 AON during Seabird 2000, have not been surveyed to any great extent in recent years although 121 AON were recorded at the largest one on Lower Lough Erne in 2018[5].

Productivity

Data submitted to the SMP on the productivity of common gulls in Northern Ireland are sparse; thus, no meaningful average productivity value can be given.

Republic of Ireland

Population estimates and change 1969-2018 (census data)

	Operation Seafarer (1969-70)	Seabird Colony Register (1984-85)	Seabird 2000 (1998-2002)	Republic of Ireland Census (2015-18)
Population estimate (AON*) **Inland** **Total**	688	109	586 474 1,060	779 1,169 1,948
% change since previous census	n/a	-531	+438	+82

* AON = Apparently Occupied Nests

Note: Inland colonies were not counted during the first two national censuses, so, to enable direct comparison, the percentage change refers to coastal colonies only.

Breeding Abundance

During Seabird 2000, 586 common gull AON were recorded in the Republic of Ireland, five times as many as recorded by the Seabird Colony Register census, but still 100 pairs fewer than were found during Operation Seafarer. The recent Republic of Ireland Seabird Census recorded 1,948 AON, an increase of 82% since Seabird 2000, with over 60% of the population now nesting at inland sites (45% during Seabird 2000). Much of this increase in AON is due to higher survey effort rather than driven by site-based population changes[6].

Productivity

Data submitted to the SMP on common gull productivity in the Republic of Ireland are sparse; thus, no meaningful average productivity value can be given.

All Ireland

Population estimates and change 1969-2002 (census data)

	Operation Seafarer (1969-70)	Seabird Colony Register (1985-88)	Seabird 2000 (1998-2002)
Population estimate (AON*) **Inland** **Total**	744	301	969 648 1,617
% change since previous census	n/a	-60	+222

* AON = Apparently Occupied Nests

Note: Inland colonies were not counted during the first two national censuses, so, to enable direct comparison, the percentage change refers to coastal colonies only.

Breeding Abundance

The Irish coastal nesting common gull population decreased by 60% between the Operation Seafarer and Seabird Colony Register (SCR) censuses. Between the SCR and Seabird 2000 censuses it increased by 222% to 969 AON, 30% higher than the Operation Seafarer census.

During Seabird 2000, Northern Ireland held approximately 30% of the whole of Ireland breeding population of common gulls. The largest colonies in Northern Ireland are found on the Copeland Islands and at Strangford Lough. At Strangford Lough, 293 AON were recorded in 2018 compared to 82 AON during Seabird 2000, indicating that the national population may have increased during this period. However, without a more recent count from the Copeland Islands, there is some uncertainty. Inland colonies, which held 174 AON during Seabird 2000, have not been surveyed to any great extent in recent years, although 121 AON were recorded at the largest one on Lower Lough Erne in 2018[4].

The recent Republic of Ireland Seabird Census (2015-2018) recorded 1,948 AON, an increase of 82% since Seabird 2000. Much of this increase in AON is due to higher survey effort rather than driven by site-based population changes[6]. Inland colonies, which held 474 AON during Seabird 2000, now hold 1,169 AON, an increase of 147%. Over 60% of the common gull population now breeds at inland sites (45% during Seabird 2000)[5].
There were insufficient data from all-Ireland to allow trends to be generated.

Productivity

Data submitted to the SMP on the productivity of common gulls from colonies throughout Ireland are sparse; thus, no meaningful average productivity value can be given.

Isle of Man

Population estimates and change 1969-2002 (census data)

	Operation Seafarer (1969-70)	**Seabird Colony Register (1984-85)**	**Seabird 2000 (1998-2002)**	**Isle of Man Census (2017-18)**
Population estimate (AON*) **Inland** **Total**	n/a	5	6 0 6	3 0 3
% change since previous census	n/a	n/a	+20	-50

* AON = Apparently Occupied Nests

Note: Inland colonies were not counted during the first two national censuses, so, to enable direct comparison, the percentage change refers to coastal colonies only.

Breeding Abundance

Only a few pairs of common gull nest on the Isle of Man. Five AON were recorded during the Seabird Colony Register census and six during Seabird 2000. During the 2017 Isle of Man Seabird Census, two AON were found at the Point of Ayres Gravel Pits and one on the lighthouse wall at the Point of Ayre[7], representing a 50% decline in the population since Seabird 2000.

Productivity

No systematic data on the productivity of common gulls on the Isle of Man have been submitted to the SMP.

Channel Islands

Common gull does not breed on the Channel Islands.

UK phenology, diet, survival rates

No data have been collected as part of the Seabird Monitoring Programme.

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Lesser Black-backed Gull *Larus fuscus*

Description

The following has been adapted from original text by John Calladine in Seabird Populations of Britain and Ireland (with permission from A&C Black, London).

The lesser black-backed gull breeds in north and west Europe and has increased in numbers throughout its range during much of the 20th century. During this time, they have become less migratory and can now be found within much of their breeding range throughout the year. The species nests colonially, often with other gulls, especially the herring gull. Colonies are found on islands offshore and within inland freshwater bodies, coastal cliffs, sand dunes, salt marshes, moorland and on the rooftops of buildings. Seemingly, many sites that are either inaccessible to ground predators (e.g. islands and urban rooftops) or where ground predators are particularly scarce (e.g. narrow peninsulas or on moorland managed as sporting estate) can prove attractive for nesting. Though often sharing breeding areas with herring gulls, their nest sites and feeding strategies generally differ; lesser black-backed gulls can forage over larger distances and they tend to nest within more vegetated areas.

Conservation status

Lesser black-backed gull is currently identified as a conservation priority in the following:

Amber listed in Birds of Conservation Concern 4 (2015 update)
(further information on Conservation Designations for UK Taxa)
Amber listed in Birds of Conservation Concern in Ireland 2014-2019 (2014 update)
EC Birds Directive - migratory species

International importance

UK Population	% Biogeographic Population	% World Population
112,000 AON*	62.6 (ssp. *graellsii*)	38.4

*AON = Apparently Occupied Nests

The UK population figure (rounded to the nearest hundred) was derived from data in Mitchell, P.I., Newton, S.F., Ratcliffe, N. and Dunn, T.E. (eds.) 2004. *Seabird Populations of*

Britain and Ireland. Poyser, London. This was also the source of figures for the Biogeographic and World populations.

Note: The UK population figure above includes data from both inland and coastal colonies and hence differs from that tabled below.

UK population estimates and change 1969-2002 (census data)

Prior to Seabird 2000, the population of lesser black-backed gulls in the UK has only ever been surveyed incompletely. During Operation Seafarer (1969-70), complete coverage of coastal colonies was achieved but no inland colonies were counted. Both coastal and inland colonies were surveyed during the SCR Census (1985-88), but coverage inland was incomplete and so only provided a minimum estimate of the number nesting away from the coast. Seabird 2000 thus represented the first attempt to census all coastal and inland breeding colonies. While coverage was good in most areas, the following urban areas were not surveyed: inland Durham (although this probably had little overall impact since only two nests were recorded there in 1987); West and East Lothian; Dumfries; Dover and Folkestone; Cheriton; and Sunderland and South Shields. Furthermore, the several hundred pairs that were believed to be nesting on the rooftops of Edinburgh proved practically impossible to survey. Elsewhere, coverage of roof-nesting gulls was good, and was aided by aerial surveys in places like south Wales, Gloucester, Glasgow and Inverness. Apparently occupied nests (AON) were counted at the majority of colonies. However, at some colonies flush counts of individuals attending the colony were made and then divided by two to provide a rough approximation of the number of AON. This is the least accurate method for counting breeding gulls, as such counts will include an unknown percentage of non-breeders and attendance at the colony by both members of a pair is highly variable throughout the day and throughout the breeding season. During Seabird 2000, 91% of counts were of nests; the rest were derived from counts of birds, apparently occupied sites or territories. In colonies mixed with herring gulls, the determination of the proportion of a count to assign to a particular species was determined from sample head counts representative of the colony as a whole.

	Operation Seafarer (1969-70)	**Seabird Colony Register (1985-88)**	**Seabird 2000 (1998-2002)**
UK Population estimate (AON*) **Inland** **Total**	48,217	62,321	87,413 24,547 111,960
% change since previous census	n/a	+29	+40

*AON = Apparently Occupied Nests

Note: Inland colonies were not counted during the first two national censuses, so, to enable direct comparison, the percentage change refers to coastal colonies only.

Distribution/abundance

The Seabird 2000 census provides the most comprehensive recent assessment of the distribution and abundance of breeding seabirds. Numbers found in different regions, and a map showing the location and size of colonies, is provided in the Seabird 2000 lesser black-backed gull results page

The locations sampled during the annual Seabird Monitoring Programme provide some information on distribution and are accessible via the Seabird Monitoring Programme online database.

Annual abundance and productivity by geographical area

With reference to the regional accounts below please note the following.

Breeding abundance: graphs of abundance index with 95% CLs are only shown for a region where the trend produced has been deemed accurate (see methods of analysis). Where a trend was thought to be inaccurate, graphs of abundance at major colonies in a region may be shown instead, particularly if such colonies hold greater than 10% of the regional population, are monitored frequently and may thus help illustrate regional population fluctuations outwith national censuses. Occasionally, too few data have been collected regionally to produce either of these.

Productivity: graphs of productivity are only shown if analysis of breeding success data produced a significant result for regional and/or year effects (again see methods of analysis). If results were not significant, then a regional mean productivity value is given. However, on some occasions too few data are available from which to provide a meaningful average. Furthermore, for 11 species where the quality of monitoring data available was considered high, population viability analysis was undertaken at the UK level and the results of this are also reported.

United Kingdom

Breeding abundance

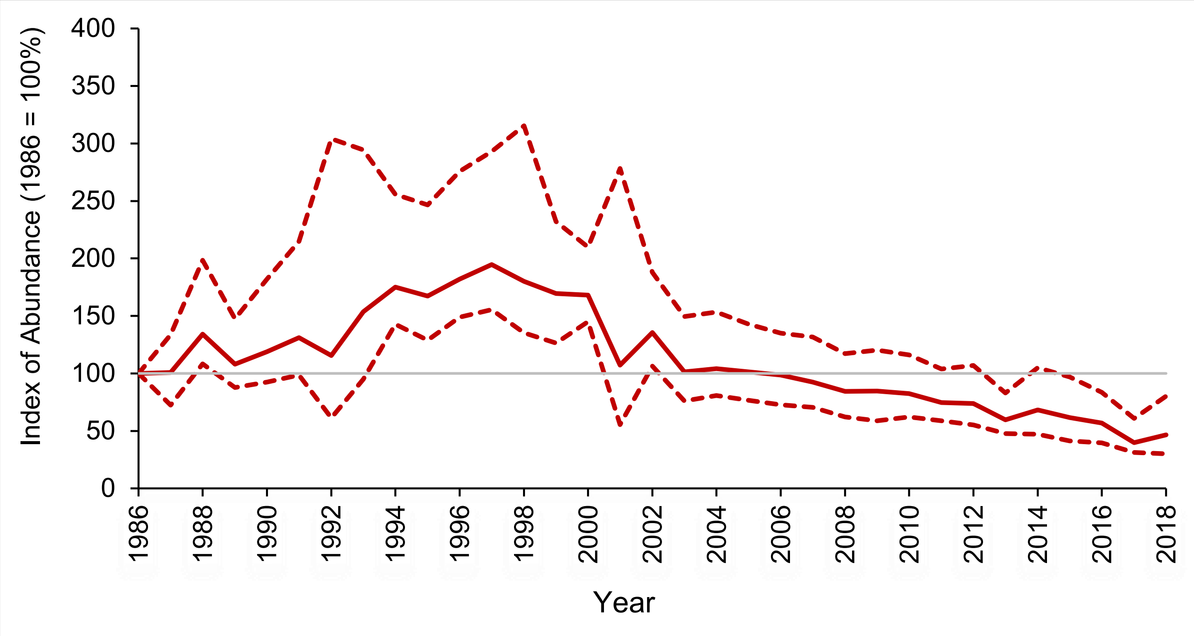

Figure 1. Trend in abundance index (solid line) of natural-nesting lesser black-backed gulls in the UK, 1986-2018 with 95% confidence limits (dotted lines). This abundance trend excludes urban nesting gulls from the sample and, therefore, may not be representative of trends in the entire UK population. Based on SMP data; view the methods of analysis.

Note: 'Natural-nesting' is defined as moors, cliffs, marshes, beaches and other areas of semi-natural habitat, while 'urban-nesting' is defined as human-built structures.

National census data indicate lesser black-backed gulls nesting in coastal colonies increased by 29% from 1969-70 (48,000 pairs) to 1985-88 (62,000 pairs). Increases from 1969 onward were probably a result of increased food availability from fishery discards[1] and from landfill sites. A further 40% increase (87,413 pairs) occurred between the 1985-88 census and the next one in 1998-2002.

There are uncertainties as to how representative the SMP sample is of the lesser black-backed gull UK population trend since the last seabird census (1998-2002). Uncertainties relate to the relatively small number of urban nesting sites contributing to the annual SMP sample for lesser black-backed gulls (annual average 5% of sites 1999–2014).

The trend in Figure 1 is, therefore, based only on the natural-nesting component of the SMP sample and may not reflect the UK population trend i.e. that of both natural and urban nesting lesser black-backed gulls. Between 2002 and 2018, confidence intervals derived from the natural-nesting lesser black-backed gull sample have run parallel to the abundance index and have become increasingly narrow, giving confidence that the underlying data indicate a real downward trend of their population over the last 15-20 years.

Although a real downward trend at UK level is likely given large scale declines at key colonies, representativeness of the magnitude of the SMP trend is still somewhat unclear when compared to census data. We, consequently, have low confidence in the ability of SMP sample data to predict trends in the UK lesser black-backed gull population and, therefore, advise that census data should solely be used for this purpose.

Several major colonies surveyed since Seabird 2000 in Scotland, England and Wales appear to be in decline while increases have been recorded in the smaller population in Northern Ireland. For example, in 2017 two of the largest colonies in Wales (Skomer and Skokholm) had declined, since Seabird 2000, by 49% and 46% respectively. Similar has been observed in England where the major colony at Orford Ness declined by 98% from 5,500 AON in 2001 to 335 AON in 2013 and 97 AON in 2018. However, the neighbouring colony at Havergate Island increased from 290 AON during Seabird 2000 to 1,327 AON in 2018. The colony at Walney Island has decreased by 91% (19,487 AON during Seabird 2000 to 1,981 in 2018) and Bowland Fells by 21% (18,518 AON during Seabird 2000 to 14,627 AON in 2018). In contrast the Ribble and Alt Estuary colony increased by 69% from 4,150 AON in 1998 to 7,022 in 2016. Ailsa Craig, the largest colony in Scotland during Seabird 2000, now only holds 146 AON a decline of 64%. The causes of these declines may be due to a decrease in the availability of domestic refuse, reduced discards from fisheries[2], predation, cannibalism[3] and human disturbance. A major driver of recent population decline in Wales may have been a reduction in adult survival rate; estimates of survival on Skomer, the only UK colony where this parameter is monitored for lesser black-backed gull, declined between 1993 and 2002 although have been higher since. Natural nesters increased until 1997, after which a slow decline is evident until 2000 when the index drops more steeply but recovers the year after. Since then the index has decreased further and in 2018 was 59% below the 1986 baseline when monitoring began (Figure 1).

Three censuses of roof-nesting gulls were undertaken: in 1976[4], in 1993-95[5] and during the 1998-2002 Seabird 2000 census[6], which aimed to count all gulls regardless of habitat. The number of roof-nesting lesser black-backed gulls increased dramatically between these surveys with their populations increasing by 7.7 and 4.3 times respectively since the 1976 census. These censuses counted all inland and coastal gulls nesting on buildings from vantage points and were seen as absolute counts at the time. However, the first two censuses (1976 and 1993-95) stated that, because of difficulties in locating all nests at colonies, population sizes were likely to be underestimates. The Seabird 2000 census suffered similar methodological issues and did not attain complete coverage so will have also underestimated the size of the roof-nesting population. The degree of under-estimation is, however, likely to be modest, particularly for Operation Seafarer, as inland/roof-nesting only became commonplace from the mid-1970s onwards[4]. The UK trend in roof-nesters since Seabird 2000 is unknown due to insufficient survey coverage, though colonies in south-west and north-west England have expanded in range (comparing Seabird 2000 with the 2007-11 Breeding Bird Atlas)[7].

The causes of the population increase in urban areas may have been facilitated by an abundance of locally available food (e.g. from fast-food street litter and domestic/commercial rubbish bins), and safe (predator-free) nesting sites in the form of flat roofed buildings.

Productivity

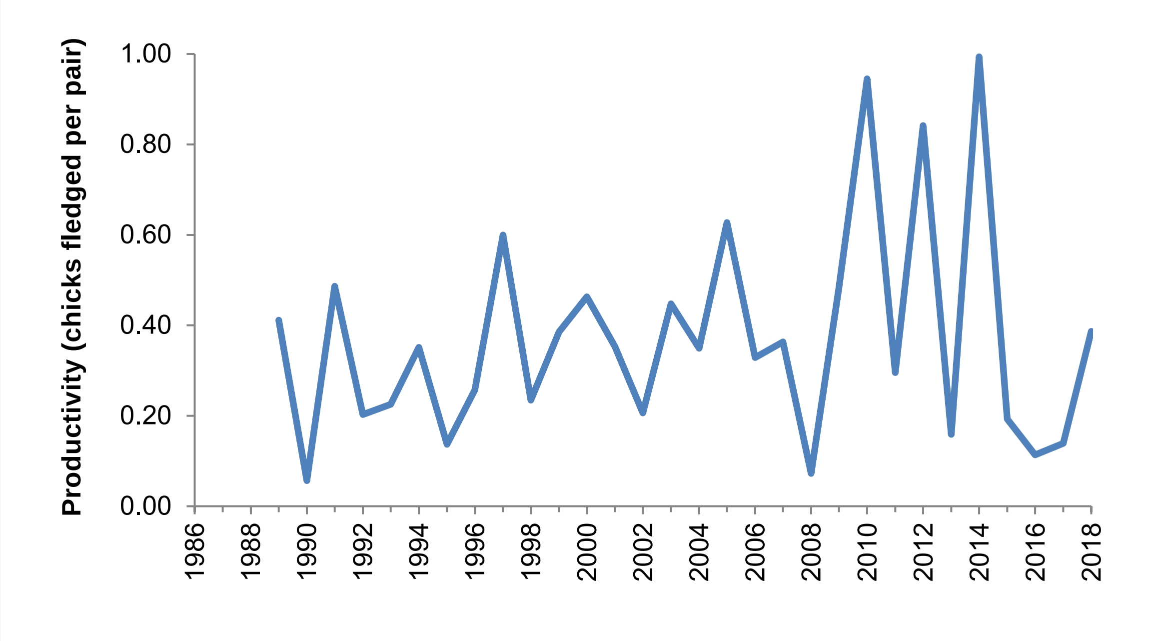

Figure 2. Trend in UK productivity (no. of chicks fledged per pair) of natural-nesting lesser black-backed gull 1989-2018. This productivity trend excludes urban nesting gulls from the sample and, therefore, may not be representative of trends in the entire UK population. Based on SMP data; view the methods of analysis.

Productivity measured at UK natural-nesting colonies has fluctuated widely over the recording period, though has often been low. Local productivity rates have been linked to nesting habitat[8,9], parental condition[10] and fishery discards[11]. American mink *Neovison vison* are known to lower productivity in Scotland but factors influencing this parameter in other parts of the UK are largely unknown or poorly reported.
There have been three years with productivity above 0.60 chicks fledged per nest (2010, 2012 and 2014). In 2018, productivity was just 0.38 (Figure 2), very much below the national average of 0.52 chicks fledged per pair between 1989 and 2018.

Scotland

Population estimates and change 1969-2002 (census data)

	Operation Seafarer (1969-70)	**Seabird Colony Register (1985-88)**	**Seabird 2000 (1998-2002)**
Population estimate (AON*) **Inland** **Total**	12,031	19,524	21,565 3,492 25,057
% change since previous census	n/a	+62	+10

* AON = Apparently Occupied Nests

Note: Inland colonies were not counted during the first two national censuses, so, to enable direct comparison, the percentage change refers to coastal colonies only.

Breeding abundance

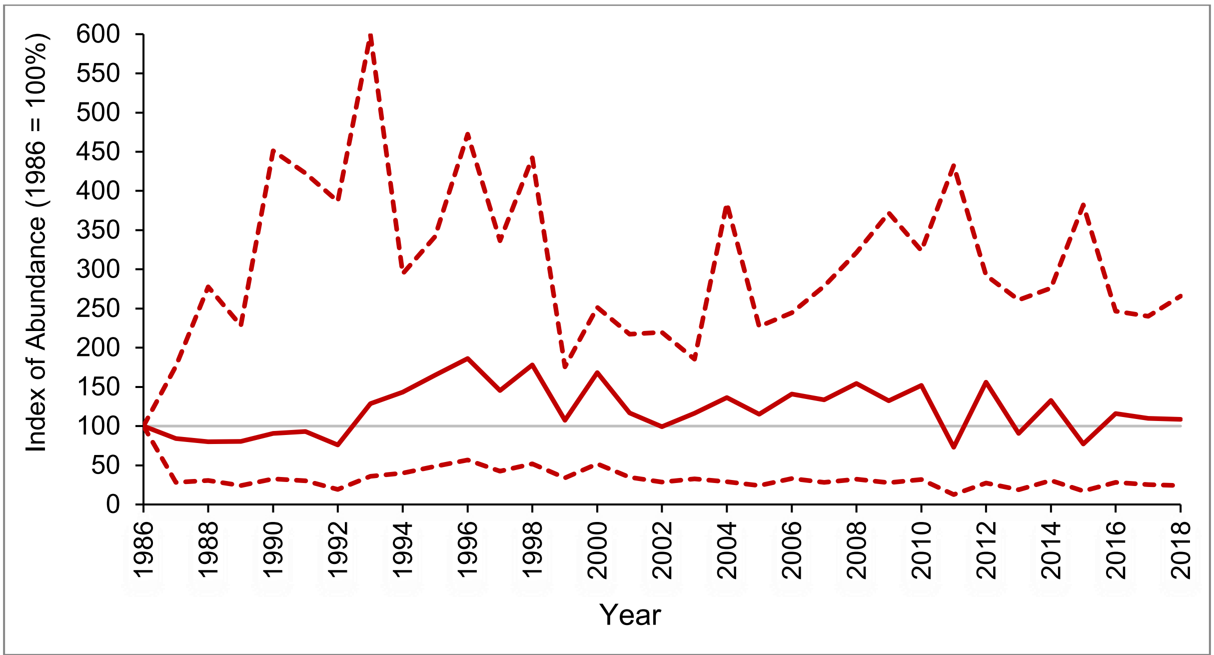

Figure 3. Trend in abundance index (solid line) of natural-nesting lesser black-backed gull in Scotland, 1986-2018 with 95% confidence limits (dotted lines). This abundance trend excludes urban nesting gulls from the sample and, therefore, may not be representative of trends in the entire UK population. Based on SMP data; view the methods of analysis.

Between the Seabird Colony Register and Seabird 2000 censuses, coastal-nesting lesser black-backed gull numbers increased by 10%. Prior to this, a large increase was recorded by the SCR census, 62% higher than Operation Seafarer. Reasons for the increase are unknown but, for example, on the Isle of May (the largest colony in Scotland that is counted frequently), numbers increased from the late 1980s to the mid-1990s, with a particularly steep increase between 1992 and 1993, associated with the cessation of gull control measures undertaken in 1984-88 to reduce gull predation on other seabirds[12].

In Scotland, the natural-nesting lesser black-backed gull population declined during the late 1980s but increased between 1992 and 1996. Since then it has fluctuated between 30% below and 90% above the 1986 baseline (Figure 3). In 2018, the index was 9% above the 1986 baseline. The trend in abundance obtained from analysing natural-nesting colony data held by SMP (Figure 3) does, however, overestimate the change known to have occurred between the SCR and Seabird 2000.

Urban-nesting lesser black-backed gulls increased considerably between surveys in 1993-95[5] (1,356 AON) and Seabird 2000 (3,846 AON), although little information on their status is available since then. At the last census, Scotland held the second largest proportion of urban-nesting lesser black-backed gulls in the UK (33%).

Productivity

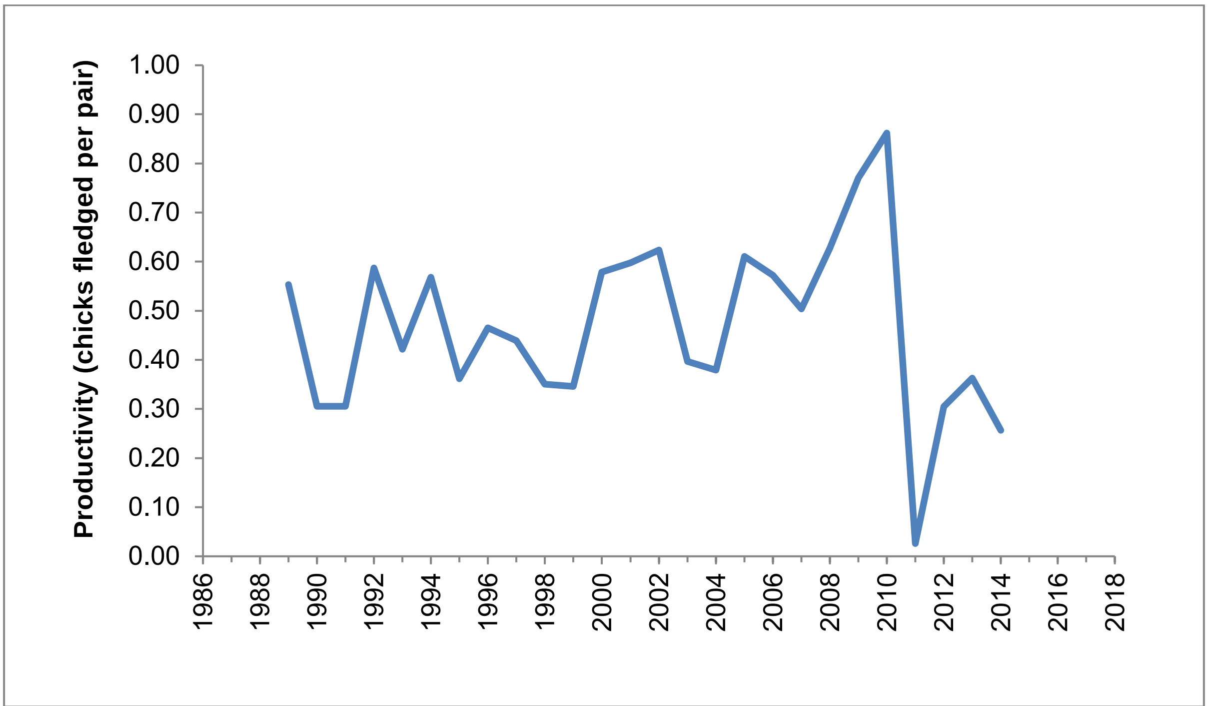

Figure 4. Trend in productivity (no. of chicks fledged per pair) of natural-nesting lesser black-backed gull in Scotland, 1989-2015. This productivity trend excludes urban nesting gulls from the sample and, therefore, may not be representative of trends in the entire UK population. Based on SMP data; view the methods of analysis.

Productivity of natural-nesting lesser black-backed gulls in Scotland has been variable over the recording period, with no clear trend. Predation by American mink at colonies in south-west Scotland is the main cause of low productivity in some, but not all, years. Higher productivity in recent years may be a result of efforts to remove this destructive species from affected colonies. However, productivity from 2011 to 2015 was lower than the period until 2007, probably due to a combination of factors such as predation, poor weather and poor feeding conditions. In 2015, 0.26 chicks were fledged per pair, the second lowest value recorded since the beginning of the SMP data collection in 1986. No additional productivity data have been submitted to the SMP since 2015.

England

Population estimates and change 1969-2002 (census data)

	Operation Seafarer (1969-70)	Seabird Colony Register (1985-88)	Seabird 2000 (1998-2002)
Population estimate (AON*)	24,434	22,306	44,133
Inland			20,075
Total			64,208

	Operation Seafarer (1969-70)	Seabird Colony Register (1985-88)	Seabird 2000 (1998-2002)
% change since previous census	n/a	-9	+98

* AON = Apparently Occupied Nests

Note: Inland colonies were not counted during the first two national censuses, so, to enable direct comparison, the percentage change refers to coastal colonies only.

Breeding abundance

Figure 5. Abundance of lesser black-backed gull at South Walney (Cumbria), 1986-2018.

National census data show numbers of coastal-nesting lesser black-backed gulls in England changed little between Operation Seafarer and the Seabird Colony Register but had doubled by the time of Seabird 2000 to just over 44,000 pairs.

The SMP sample trend for natural-nesting lesser black-backed gulls is not provided as it has extremely wide confidence intervals, although since Seabird 2000 numbers at several natural nesting sites have decreased. For example, at South Walney (Figure 5) numbers have decreased by 91% since a peak of 22,200 AON in 1997. Declines have also occurred at other large colonies since Seabird 2000 such as Bowland Fells by 21% and Orford Ness (-98%) However, Bowland Fells' neighbouring colony at Havergate Island increased from 290 AON during Seabird 2000 to 1,327 AON in 2018, an increase of 357%. The causes of the declines may be linked to past control measures at Bowland Fells SPA due to extensive culling of lesser black-backed gulls (to protect breeding red grouse and wading birds) and predation of their chicks and eggs by foxes *Vulpus vulpus* at Orford Ness[13].

Urban-nesters increased greatly between surveys in 1976[4] (127 AON), 1993-95[5] (954 AON) and Seabird 2000 (6,550 AON)[6]. Since then, comprehensive information is unavailable, although large increases have been recorded in some cities and towns in south-west and north-west England[14]. However, the number of gulls nesting in some urban areas may have been underestimated during Seabird 2000, or not counted at all. At the last census, England held the largest proportion of urban roof-nesting gulls within the UK (59.7%).

Productivity

Few data on the productivity of natural-nesting lesser black-backed gulls at English colonies have been collected as part of the SMP. On average, lesser black-backed gulls fledged 0.42 chicks per nest per year between 2007 and 2018; there was no statistically significant variation over time.

Wales

Population estimates and change 1969-2002 (census data)

	Operation Seafarer (1969-70)	Seabird Colony Register (1985-88)	Seabird 2000 (1998-2002)
Population estimate (AON*) **Inland** **Total**	11,529	20,043	20,682 40 20,722
% change since previous census	n/a	+74	+3

* AON = Apparently Occupied Nests

Note: Inland colonies were not counted during the first two national censuses, so, to enable direct comparison, the percentage change refers to coastal colonies only.

Breeding abundance

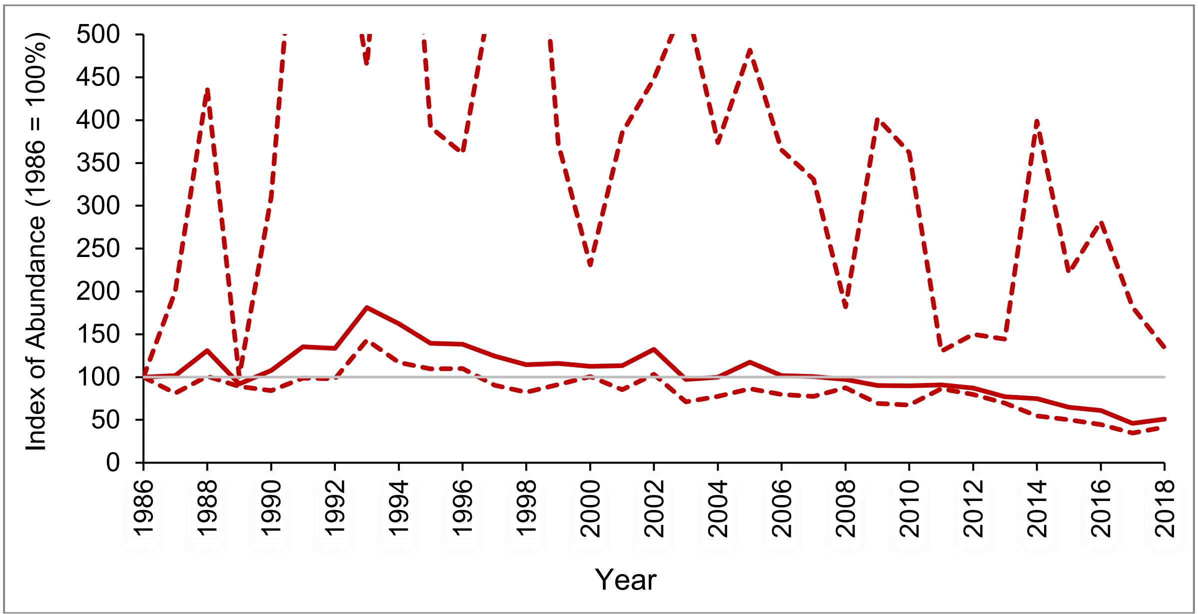

Figure 6. Trend in abundance index (solid line) of natural-nesting lesser black-backed gulls in Wales, 1986-2018 with 95% confidence limits (dotted lines; drawing of upper limit restricted to preserve detail in the abundance index). This abundance trend excludes urban nesting gulls from the sample and, therefore, may not be representative of trends in the entire UK population. Based on SMP data; view the methods of analysis.

In Wales, the number of coastal-nesting lesser black-backed gulls increased by 74% between Operation Seafarer and the Seabird Colony Register with similar numbers recorded during Seabird 2000. Counts at two of the largest Welsh colonies, Skomer and Skokholm do, however, suggest that the natural nesting lesser black-backed gull population in Wales may have declined considerably since the last census. These colonies held a total of 12,426 AON in 2000 and only 6,499 in 2018, a decline of 48%. Decreases in adult survival rate and productivity are likely to be the main drivers of this long-term breeding population decline, although it is also possible that some birds may have relocated. Other causes may be a reversal of the factors responsible for earlier population increases, namely a decrease in the availability of domestic refuse and reduced discards from fisheries[1,15].

In Wales, natural nesters increased during the late 1980s and early 1990’s. Since then, the abundance index shows a sustained decline (Figure 6), with the lowest ever value being recorded in 2017. In 2018, the index was 49% lower than the 1986 baseline, only a slight improvement on 2017 (54% below).

Urban-nesters increased between surveys in 1976[4] (198 AON), 1993-95[5] (201 AON) and Seabird 2000 (394 AON)[6]. No nationwide census has been undertaken since, but 2,696 AON were reported from Cardiff alone in 2011, suggesting a large increase may have occurred in urban areas.

Productivity

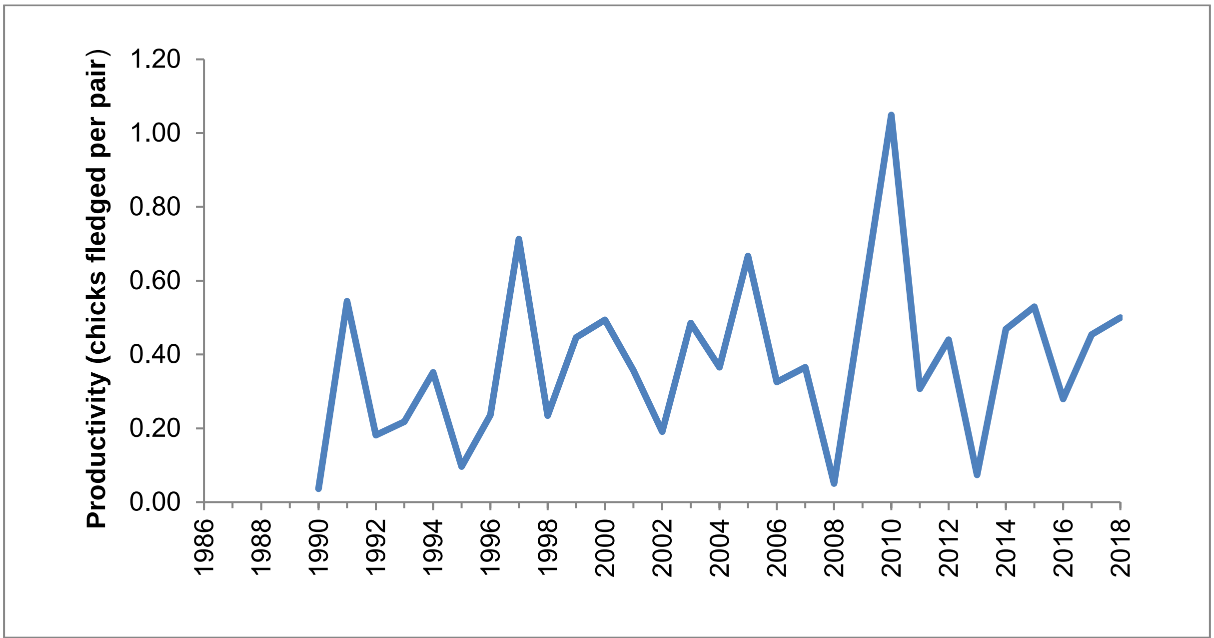

Figure 7. Trend in productivity (no. of chicks fledged per pair) of natural-nesting lesser black-backed gull in Wales, 1990-2018. This productivity trend excludes urban nesting gulls from the sample and, therefore, may not be representative of trends in the entire Welsh population. Based on SMP data; view the methods of analysis.

The trend in natural-nesting lesser black-backed gull productivity for Wales fluctuates widely and is heavily influenced by data from the very large Skomer colony where success has often been low, averaging 0.33 chicks fledged per pair between 1990 and 2018. Years with poor productivity have been linked with a reduction in food availability during the chick rearing period, largely due to changes in the fishing industry and chicks being fed on earthworms[16]. In 2010, lesser black-backed gulls on Skomer had their most successful breeding season in the period of the SMP, fledging 0.89 chicks per pair. Only on five other occasions in 28 years of monitoring has success at this colony been above 0.50: 1991 (0.54), 1997 (0.71), 2005 (0.66), 2011, (0.89), 2015 (0.53) and 2018 (0.50).

Northern Ireland

Population estimates and change 1969-2002 (census data)

	Operation Seafarer (1969-70)	**Seabird Colony Register (1985-88)**	**Seabird 2000 (1998-2002)**
Population estimate (AON*) **Inland** **Total**	223	448	1,033 940 1,973
% change since previous census	n/a	+101	+131

* AON = Apparently Occupied Nests

Note: Inland colonies were not counted during the first two national censuses, so, to enable direct comparison, the percentage change refers to coastal colonies only.

Breeding abundance

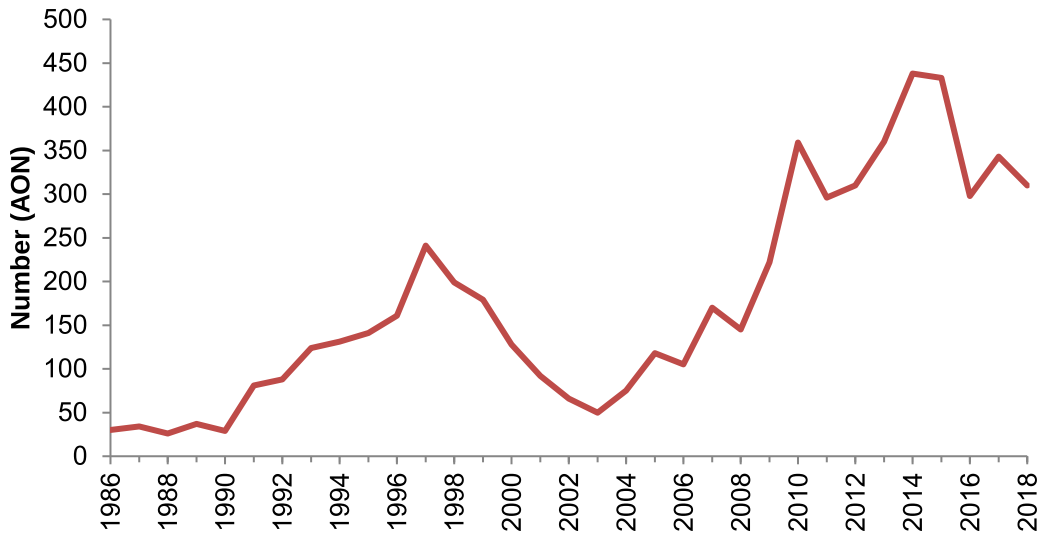

Figure 8. Abundance of lesser black-backed gull at Strangford Lough, 1986-2018.

Lesser black-backed gulls breed at approximately 30 colonies in Northern Ireland, although few are monitored in any one year, so a representative annual trend is not available. Numbers doubled between Operation Seafarer and the Seabird Colony Register, and then more than doubled again by Seabird 2000. Recent counts of both natural and urban nesting lesser black-backed gulls suggest that the Northern Ireland population has increased overall since Seabird 2000.

At Strangford Lough (Figure 8), one of the more frequently monitored colonies, natural nesting lesser black-backed gull numbers increased from 50 AON in 2003 to a peak of 438 AON in 2015, although held only 310 AON in 2018. In 2018, Lighthouse Island (Copeland Islands) held 365 natural nesting lesser black-backed gull AON, a decline of 34% since 2012. Inland, 1,316 AOT were recorded at Lower Lough Erne in 2018 where just over 100 AOT were found during Seabird 2000 and a total of 2,052 individuals were recorded at colonies on Lough Neagh in 2018[17].

The number of urban-nesting lesser black-backed gulls in Northern Ireland increased from eight AON in 1993-95[4] to 63 AON in Seabird 2000[6]. The urban nesting population has increased since Seabird 2000, with at least 101 AON being recorded in Belfast city centre and harbour in 2018, and an additional 12 AON recorded in the wider Belfast area. However, due to the complexity of the roof-scape and the limited number of vantage points, this is likely to be an underestimate. In addition, 77 urban-nesting adults were recorded at a colony in Carrickfergus[17].

Productivity

Data submitted to the SMP on the productivity of lesser black-backed gulls in Northern Ireland are sparse; thus, no meaningful average productivity value can be given.

Republic of Ireland

Population estimates and change 1969-2018 (census data)

	Operation Seafarer (1969-70)	Seabird Colony Register (1984-85)	Seabird 2000 (1998-2002)	Republic of Ireland Census (2015-18)
Population estimate (AON*) **Inland** **Total**	1,460	1,219	2,062 814 2,876	7,112**
% change since previous census	n/a	-20	+69	+148

* AON = Apparently Occupied Nests
** This population estimate figure is a combination of inland and coastal as information on the split were not available[18].

Note: Inland colonies were not counted during the first two national censuses, so, to enable direct comparison, the percentage change refers to coastal colonies only.

Breeding abundance

Seabird 2000 recorded just over 2,000 pairs of coastal-nesting lesser black-backed gulls in the Republic of Ireland. This was an increase of 69% since the Seabird Colony Register and 41% higher than that recorded by Operation Seafarer. The recent Irish Seabird Census (2015-2018) recorded a total of 7,112 AON, an increase of 148% since Seabird 2000, of which approximately 20% were from islands on inland lakes[18]. One of the most important inland colonies (Inishgoosk on Lough Derg) during Seabird 2000, no longer holds a breeding lesser black-backed gull population. This extirpation coincided with strong recorded growth at other inland sites, including Loughs Conn and Mask. The colonies at Roaringwater Bay and Incharmadermot Island (Lough Ree) now hold almost a third of the Republic of Ireland lesser black-backed gulls breeding population, with 1,288 AON and >1,000 AON recorded respectively during the recent census.

During Seabird 2000, 21 pairs nested on roofs in urban areas of the Republic of Ireland but there has been no update on this figure.

There were insufficient data from the Republic of Ireland to allow an abundance trend to be generated.

Productivity

Data submitted to the SMP on the productivity of lesser black-backed gulls in the Republic of Ireland are sparse; thus, no meaningful average productivity value can be given.

All Ireland

Population estimates and change 1969-2002 (census data)

	Operation Seafarer (1969-70)	**Seabird Colony Register (1984-85)**	**Seabird 2000 (1998-2002)**
Population estimate (AON) **Inland** **Total**	1,683	1,667	3,095 1,754 4,849
% change since previous census	n/a	-1	+86

* AON = Apparently Occupied Nests
** This population estimate figure is a combination of inland and coastal as information on the split were not available[5].

Note: Inland colonies were not counted during the first two national censuses, so, to enable direct comparison, the percentage change refers to coastal colonies only.

Breeding abundance

The lesser black-backed gull coastal-nesting population for the whole of Ireland was stable between the first two national censuses but increased by 86% between the Seabird Colony Register and Seabird 2000. In Northern Ireland, total numbers at the few inland and coastal colonies (1,991 AON) surveyed recently now exceed that recorded for the whole country during Seabird 2000 (1,973 AON). These, combined with data from the recent census of the Republic of Ireland, suggest that the total breeding population in the whole of Ireland is at least 9,103 AON.

Roof-nesters increased from eight AON in 1993-95[3] to 63 in during Seabird 2000, although a more recent update is not available.

Productivity

Data submitted to the SMP on the productivity of lesser black-backed gulls from colonies throughout Ireland are sparse; thus, no meaningful average productivity value can be given.

Isle of Man

Population estimates and change 1969-2002 (census data)

	Operation Seafarer (1969-70)	Seabird Colony Register (1984-85)	Seabird 2000 (1998-2002)	Isle of Man Census (2017-18)
Population estimate (AON*) **Inland** **Total**	54	99	114 0 114	36
% change since previous census	n/a	+83	+15	-68

* AON = Apparently Occupied Nests

Note: Inland colonies were not counted during the first two national censuses, so, to enable direct comparison, the percentage change refers to coastal colonies only.

Breeding abundance

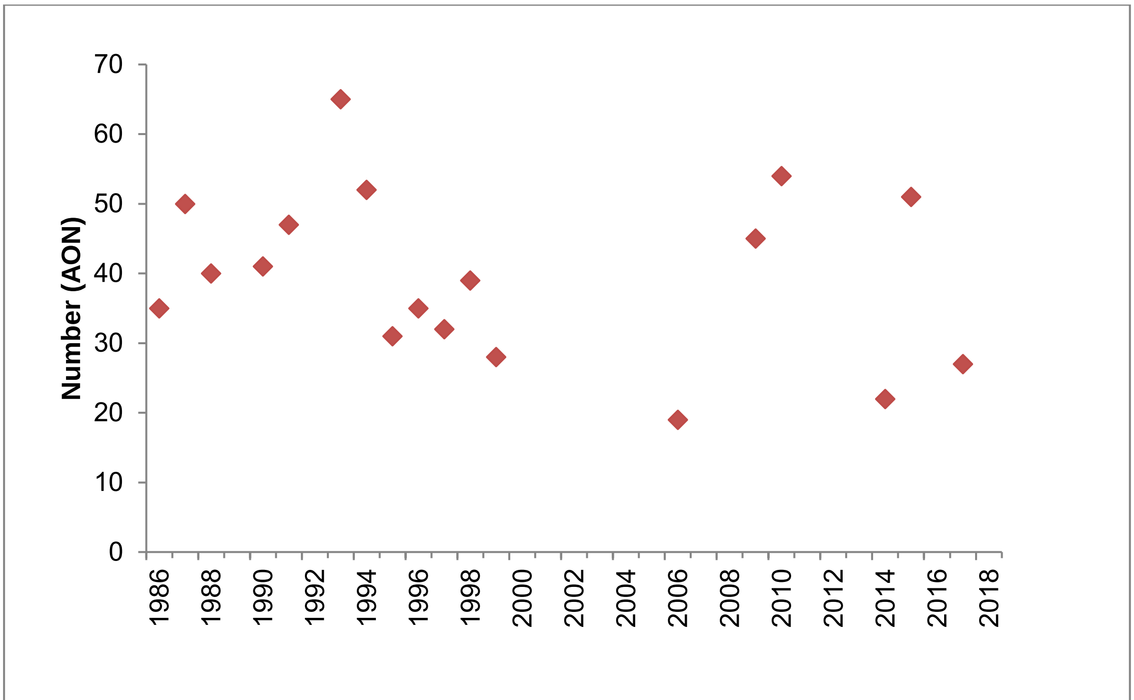

Figure 9. Abundance of lesser black-backed gull on the Calf of Man, 1986-2017.

The population of lesser black-backed gulls on the Isle of Man more than doubled between Operation Seafarer and Seabird 2000 from 54 to 114 AON, although in 2017 a breeding seabird census recorded just 36 AON. The most comprehensive time series of breeding lesser black-backed gull data comes from the Calf of Man which held *c.*25% of the lesser black-backed gull population during Seabird 2000 (28 AON in 1999) and 27 AON during the 2017 census (Figure 9)[19].

Productivity

No systematic data on the productivity of lesser black-backed gulls on the Isle of Man have been submitted to the SMP.

Channel Islands

Population estimates and change 1969-2016 (census data)

	Operation Seafarer (1969-70)	Seabird Colony Register (1984-85)	Seabird 2000 (1998-2002)	Channel Islands Census (2015-16)
Population estimate (AON*) **Inland** **Total**	304	778	1,734 0 1,734	1,796 0 1,796
% change since previous census	n/a	+156	+123	+4

* AON = Apparently Occupied Nests

Note: Inland colonies were not counted during the first two national censuses so, to enable direct comparison, the percentage change refers to coastal colonies only.

Breeding abundance

National census data show that the population of breeding lesser black-backed gulls in the Channel Islands increased between Operation Seafarer and Seabird 2000 (1998-2002), when numbers were nearly six times those recorded in 1969/70. A breeding seabird census of the Channel Islands in 2015 and 2016 recorded a total of 1,796 lesser black-backed gull AON representing an increase of 4% since Seabird 2000[20].

Productivity

No systematic data on the productivity of lesser black-backed gulls on the Channel Islands have been submitted to the SMP.

UK phenology, diet, survival rates

Phenology

No systematic data on phenology (timing of life-cycle events) have been collected as part of the SMP.

Diet

No systematic data on diet have been collected as part of the SMP.

Survival rate

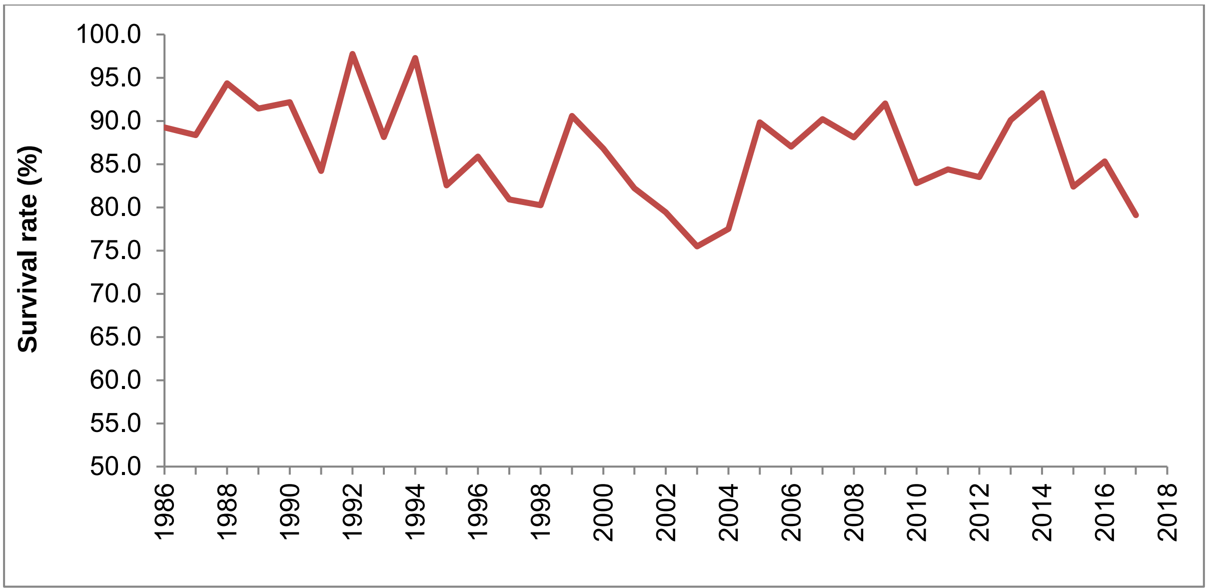

Figure 10. Estimated adult survival rate of lesser black-backed gull on Skomer, 1986-2017.

The single estimate of adult survival rate provided to the SMP comes from the large population breeding on Skomer (Figure 10) where it has averaged 0.88, although there has been a decline over time[21] Survival rate declined between 1994 and 2003, then recovered until 2009. Survival rate then fluctuated, although since 2014 has again been in decline. The decline in survival rate between 1994 and 2003 coincided with a rapid decrease in the number of lesser black-backed gulls breeding on Skomer, presumably caused by very low breeding success, lowering recruitment to the breeding population, although unsuccessful adults may have been deserting Skomer in favour of other breeding locations. Survival of breeding adult birds between 2016 and 2017 dropped to 0.79, the lowest level since 2003. Poor adult survival may be one of the drivers behind long-term decline in breeding numbers on Skomer but it is not known how many of the 'missing' birds die over the winter and how many move elsewhere[21].

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Herring Gull *Larus argentatus*

Description

The following has been adapted from original text by Brian Madden and Stephen F. Newton in Seabird Populations of Britain and Ireland (with permission from A&C Black, London).

The herring gull breeds mainly in north and west Europe. It is widely distributed around the coasts of the British Isles, and prefers to nest on rocky coastline, with cliffs, islets and offshore islands, though a range of other habitats are used including sand dunes, shingle banks and, increasingly, rooftops of buildings in urban areas. A small proportion of the population nests inland, mainly on lake islands and moorland. The herring gull is an opportunist feeder, being both predator and scavenger. While primarily a coastal feeder, it readily takes advantage of the often abundant food supplies available indirectly from man, especially waste from the fishing industry and landfill sites. Outside of the breeding season, herring gulls are common along coastlines and inshore waters but also occur inland.

Conservation status

Herring gull is currently identified as a conservation priority in the following:

EC Birds Directive - migratory species
Red listed in Birds of Conservation Concern 4 (2015 update)
UK BAP - priority species
(further information on Conservation Designations for UK Taxa)
Red listed in Birds of Conservation Concern in Ireland 2014-2019 (2014 update)

International importance

UK Population	% Biogeographic Population	% World Population
139,200 AON*	18.5	12.1

*AON = Apparently Occupied Nests

The UK population figure (rounded to the nearest hundred) was derived from data in Mitchell, P.I., Newton, S.F., Ratcliffe, N. and Dunn, T.E. (eds.) 2004. *Seabird Populations of Britain and Ireland.* Poyser, London. This was also the source of figures for the Biogeographic and World populations.
Note: The UK population figure above includes data from both inland and coastal colonies and hence differs from that tabled below.

UK population estimates and change 1969-2002 (census data)

Seabird 2000 represents the first attempt to census all inland breeding colonies of herring gulls. However, only 1% of herring gulls in the UK breed away from the coast. Coverage in Seabird 2000, although not complete, was comprehensive across the different colony types and all major colonies and breeding areas were counted. A review found the following urban areas were not surveyed: inland Durham and some large roof-nesting colonies in Dumfries (Dumfries and Galloway), Jarrow (Northumberland), Sunderland and South Shields (Tyne and Wear) and in Dover, Folkestone and Cheriton (all Kent) were also missed. Elsewhere, coverage of roof-nesting gulls was good, abetted by aerial surveys in places like south Wales, Gloucester, Glasgow and Inverness. At most colonies, apparently occupied nests (AON) were counted. However, at some colonies, flush counts of individuals attending the colony were made and then divided by two to provide a rough measure of the number of AON. This is the least accurate method for censusing breeding gulls, as such counts will include an unknown percentage of non-breeders and attendance at the colony by both members of a pair is highly variable throughout the day and throughout the breeding season. During Seabird 2000, only 4% of the population estimate for the UK was obtained from counts of individuals, compared to 6% during the SCR Census (1985-88). Hence the estimates from the two censuses are comparable in terms of the methods used. In mixed colonies, generally shared with lesser black-backed gulls, the determination of the proportion of a count to assign to a particular species provides a further potential source of error, as the eggs of the two species cannot be readily distinguished. In all but the smallest colonies it was recommended that the proportion of herring gulls is determined from sample head counts representative of the colony as a whole.

	Operation Seafarer (1969-70)	**Seabird Colony Register (1985-88)**	**Seabird 2000 (1998-2002)**
UK Population estimate (AON*) **Inland** **Total**	285,929	149,197	130,230 1,960 132,190
% change since previous census	n/a	-48	-13

*AON = Apparently Occupied Nests

Note: Inland colonies were not counted during the first two national censuses so, to enable direct comparison, the percentage change refers to coastal colonies only.

For census results for individual countries and Ireland, the Channel Islands and the Isle of Man see under relevant sections below.

Distribution/abundance

The Seabird 2000 census provides the most comprehensive recent assessment of the distribution and abundance of breeding seabirds. Numbers found in different regions, and a map showing the location and size of colonies, is provided in the Seabird 2000 herring gull results page.

The locations sampled during the annual Seabird Monitoring Programme provide some information on distribution and are accessible via the Seabird Monitoring Programme online database.

Annual abundance and productivity by geographical area

With reference to the regional accounts below please note the following.

Breeding abundance: graphs of abundance index with 95% CLs are only shown for a region where the trend produced has been deemed accurate (see methods of analysis). Where a trend was thought to be inaccurate, graphs of abundance at major colonies in a region may be shown instead, particularly if such colonies hold greater than 10% of the regional population, are monitored frequently and may thus help illustrate regional population fluctuations outwith national censuses. Occasionally, too few data have been collected regionally to produce either of these.

Productivity: graphs of productivity are only shown if analysis of breeding success data produced a significant result for regional and/or year effects (again see methods of analysis). If results were not significant, then a regional mean productivity value is given. However, on some occasions too few data are available from which to provide a meaningful average. Furthermore, for 11 species where the quality of monitoring data available was considered high, population viability analysis was undertaken at the UK level and the results of this are also reported.

United Kingdom

Breeding abundance

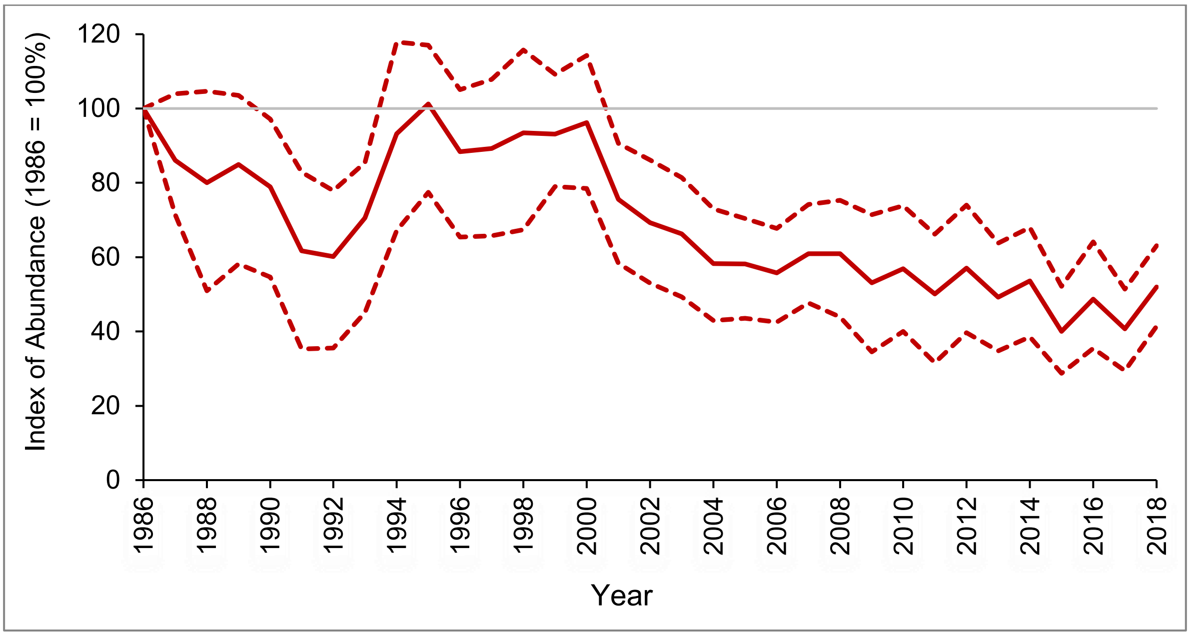

Figure 1. Trend in abundance index (solid line) of natural-nesting herring gulls in the UK, 1986-2018 with 95% confidence limits (dotted lines). This abundance trend excludes urban nesting gulls from the sample and, therefore, may not be representative of trends in the entire UK population. Based on SMP data; view the methods of analysis

Note: 'Natural-nesting' is defined as moors, cliffs, marshes, beaches and other areas of semi-natural habitat, while 'urban-nesting' is defined as human-built structures.

There are uncertainties as to how representative the SMP sample is of the entire UK herring gull breeding population (i.e. natural and urban-nesting herring gulls combined), as only a relatively low proportion of the sample comes from the urban nesting population (6% average per-annum over the sampling range). We, consequently, have low confidence in the ability of SMP sample data to predict trends in the entire UK herring gull population and do not, therefore, include a combined urban and natural nesting population trend in this report (Table 1). Census data should, therefore, be solely used for this purpose.

UK census data, where each census is a complete count of all known colonies at that time, indicate coastal nesting herring gulls decreased by 48% from 1969-70 (285,900 pairs) to 1985-88 (149,200 pairs), with a continuing decline, albeit at a slower rate (-13%), between the 1985-88 and 1998-2002 censuses (130,230 pairs).

After the Seabird Colony Register Census, natural nesting abundance decreased until 1992, after which it increased to 4% below the baseline value in 2000. The index then fell to its lowest ever value in 2015, 60% below the 1986 baseline. Since then it has been fluctuating and in 2018 was 48% below the baseline (Figure 1).

At the time of the Seabird 2000 census, approximately 14% of the UK herring gull population nested on buildings, compared to natural habitats; a proportion and total number that increased from 1976[1] (when just 63 pairs nested on roofs) to 1993-95[2] (10,900) and 1998-2002 (20,000)[3]. The abundant food supply in urban areas provided by street litter and insecure refuse bags/bins, combined with abundant safe nesting sites, has probably encouraged this increase[2]. We do not know the current size of the urban nesting gull population.

The decrease in the coastal natural nesting herring gull population may be indicative of decline in the entire UK breeding population, although this will not be known until a new census, which includes natural and urban nesting gulls, has been undertaken. The reasons for the apparent decline in the natural nesting population are not well understood. Botulism is thought to have been a major factor in the decline between the first two censuses and possibly thereafter; refuse tips may have been the source of the *Clostridium botulinum* bacterium that caused the disease, which also is widespread in wetland sediments[3]. A decrease in the availability of food scavenged from refuse tips (associated with changes in refuse management in recent years)[3]; and reductions in the availability of discards from fisheries[5,6] may have also contributed to a decrease in the natural nesting herring gull population. Ground predators have also had an effect at some colonies[7].

Productivity

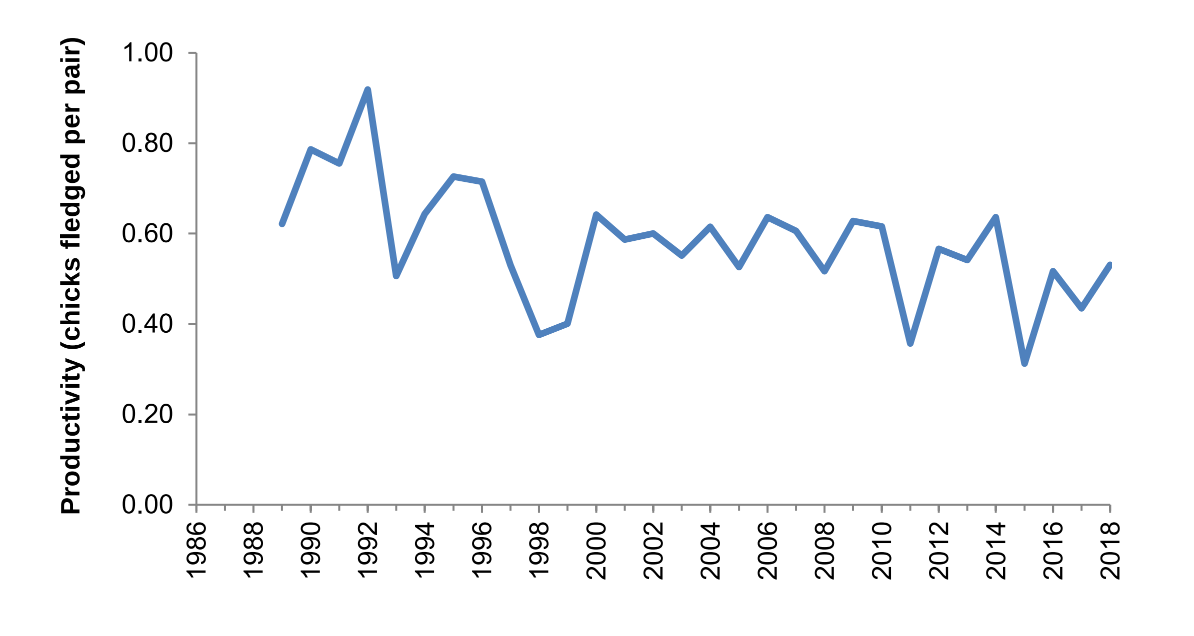

Figure 2. Trend in UK productivity (no. of chicks fledged per pair) of natural-nesting herring gull 1986-2018. This productivity trend excludes urban nesting gulls from the sample and therefore, may not be representative of trends in the entire UK population. Based on SMP data; view the methods of analysis.

Although there were large fluctuations in UK natural-nesting herring gull productivity between 1989 and 1999, there does appear to be an underlying declining trend during this period. Between 2000 and 2010, productivity improved and was relatively stable, although never high, with an average of 0.60 chicks fledged per pair annually. In 2011, productivity declined to 0.36 then recovered to 0.64 by 2014. In 2015, productivity declined to its lowest level since sampling began (0.31) although, by 2018 had increased again to 0.53 chicks fledged per pair.

Analysis of the SMP dataset found that mean productivity of herring gulls at monitored nests was 0.75 and declined at a rate of 0.016 chicks per nest per year[8]. This equated to a decline of 31% over the study period 1986-2008. The quality of the existing dataset meant a change in breeding success greater than 10% could be detected with confidence. Population viability analysis (using available life history information such as population size, clutch size, age at first breeding and survival rates of different age classes) predicted that, were this rate of success to be maintained, herring gull populations would decline by 60% over 25 years. For the population to stabilise, breeding success would have to increase to 1.30-1.50 chicks per nest per year. Declines in productivity are often due to the depredation of eggs and young.

Scotland

Population estimates and change 1969-2002 (census data)

	Operation Seafarer (1969-70)	Seabird Colony Register (1985-88)	Seabird 2000 (1998-2002)
Population estimate (AON*) **Inland** **Total**	159,237	92,950	71,659 471 72,130
% change since previous census	n/a	-42	-23

* AON = Apparently Occupied Nests

Note: Inland colonies were not counted during the first two national censuses, so, to enable direct comparison, the percentage change refers to coastal colonies only.

Breeding abundance

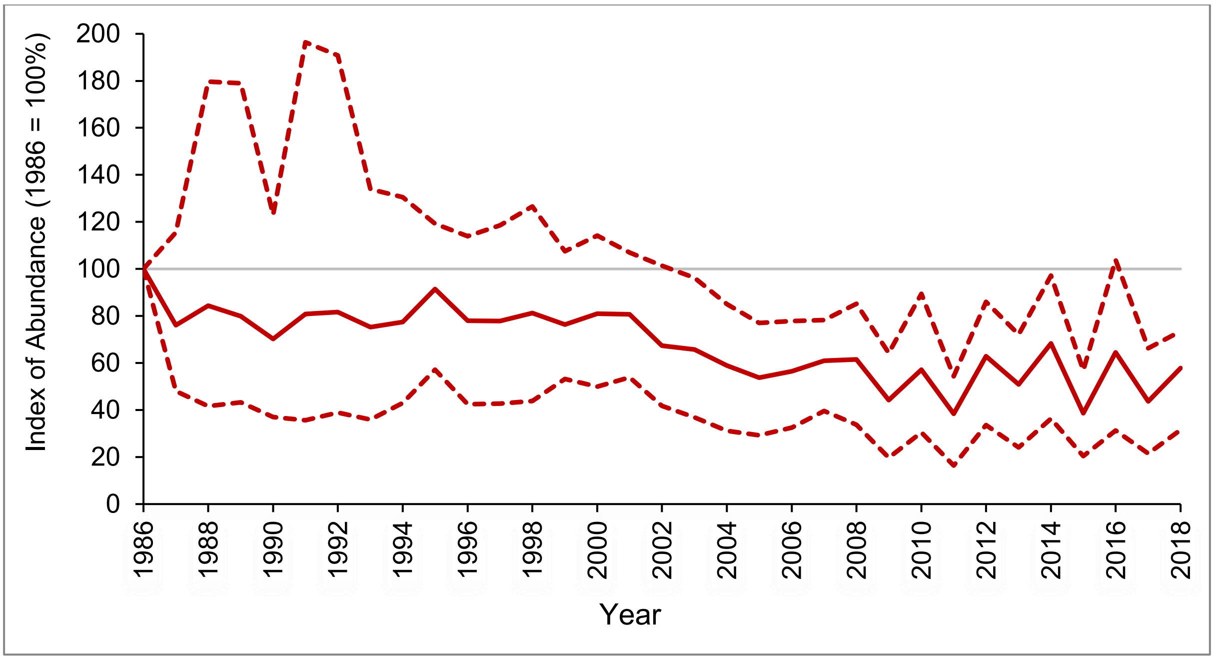

Figure 3. Trend in abundance index (solid line) of natural-nesting herring gulls in Scotland, 1986-2018 with 95% confidence limits (dotted lines). This abundance trend excludes urban nesting gulls from the sample and, therefore, may not be representative of trends in the entire UK population. Based on SMP data; view the methods of analysis.

The number of herring gulls nesting in coastal areas of Scotland declined severely between 1969-70 and 1998-2002. National census data show -42% of the population disappeared between Operation Seafarer and the Seabird Colony Register with a further decline of 23% by the time of Seabird 2000. Due to urban colonies being surveyed infrequently, no trend for the entire herring gull population in Scotland (i.e. urban and natural nesting combined) can be generated from data submitted to the SMP.

In Scotland, the index in Figure 3 shows a steady decline in natural nesting herring gull abundance to 56% below the 1986 baseline in 2009. Since then, the abundance index has fluctuated, although has remained well below the baseline. In 2015, the index fell to 62%, the lowest value recorded since herring gull monitoring began. In 2018, the index had recovered slightly but was still at 42% below the baseline.

A suite of 130 natural-nesting herring gull colonies counted in 2018 held 10,433 AON/AOT, compared to 16,076 AON/AOT during Seabird 2000 - a decline of 35%. These colonies only represent around 40% of the overall population counted during Seabird 2000, although may give an indication of the trend in the natural-nesting herring gull population of Scotland.

At the last census, Scotland held the second largest proportion of urban roof-nesting gulls within the UK (33.0%). Numbers nesting on buildings in towns and cities increased from 1976[1] (55 pairs) to 1993-1995[2] (3,568 pairs) and to 1998-2002 (5,843 pairs)[3]. The current number of urban nesting gulls in Scotland is unknown but is likely to have increased in some areas. Very few urban areas have been surveyed since the last census, so no meaningful summary can be provided to indicate if herring gulls are increasing or decreasing in these areas.

Productivity

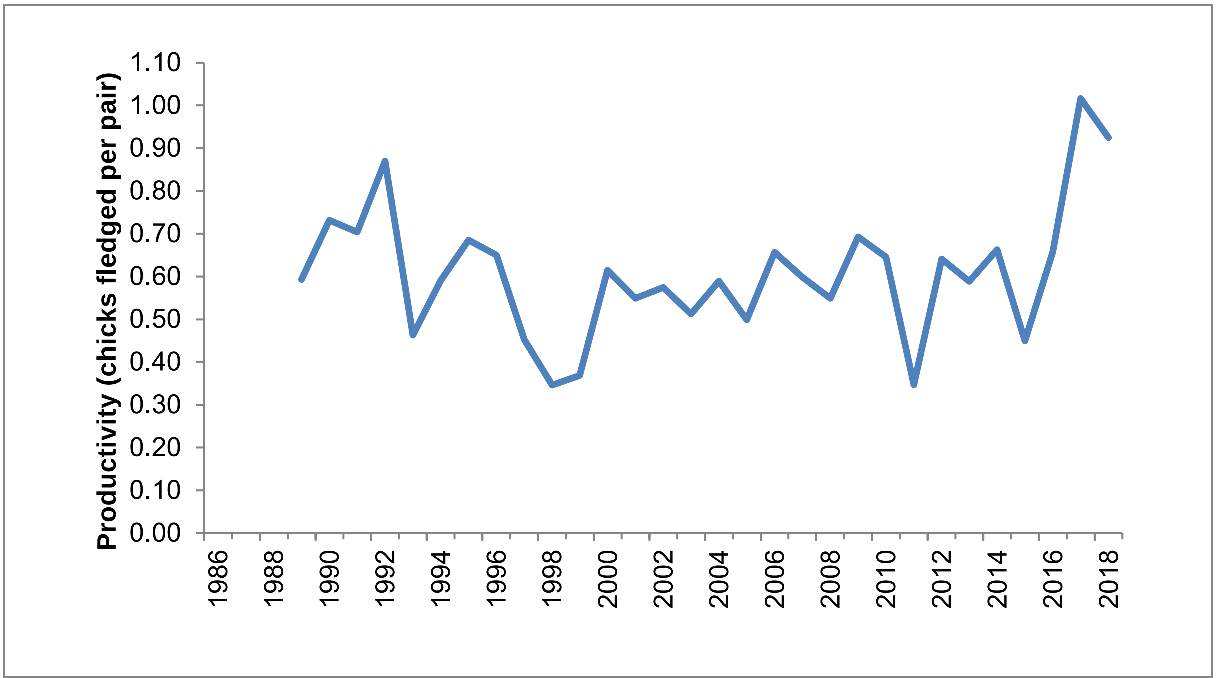

Figure 4. Trend in productivity (no. of chicks fledged per pair) of natural-nesting herring gulls in Scotland, 1989-2018. This productivity trend excludes urban nesting gulls from the sample and, therefore, may not be representative of trends in the entire UK population. Based on SMP data; view the methods of analysis.

The trend in productivity for natural-nesting herring gull in Scotland closely matches that of the UK because 84% of the data have been collected at Scottish colonies. Most information on productivity of natural-nesting herring gull in Scotland comes from a study of the effects of American mink control on the breeding success of gulls and terns on west coast islands. This introduced mammal can have a significant depressive effect on breeding success, although usually not to the same extent as that seen for common gull. Herring gull productivity data collected from this study area between 1996 and 2013 found colonies with successful mink control fledged an average of 0.91 chicks per pair per year, compared to 0.61 at colonies with no, or unsuccessful, mink control; so, on average, mink lowered breeding success by 33% (range 0-71%). In 2014, success at these two groups of colonies was 0.99 and 0.58 chicks fledged per pair, respectively - a reduction of 41% due to the effects of American mink[4]. Trapping, specifically targeting colonies where the American mink are most active, has helped to raise the number of young fledged over at least the last decade and thus may be one of the causes of the upward trend in productivity visible in Figure 4 since the late 1990s. Predation of herring gull chicks by other gulls has also been responsible for reduced productivity on the Isle of May[9].

England

Population estimates and change 1969-2002 (census data)

	Operation Seafarer (1969-70)	Seabird Colony Register (1985-88)	Seabird 2000 (1998-2002)
Population estimate (AON*) **Inland** **Total**	62,114	27,597	43,932 1,433 45,365
% change since previous census	n/a	-56	+59

* AON = Apparently Occupied Nests

Note: Inland colonies were not counted during the first two national censuses, so, to enable direct comparison, the percentage change refers to coastal colonies only.

Breeding abundance

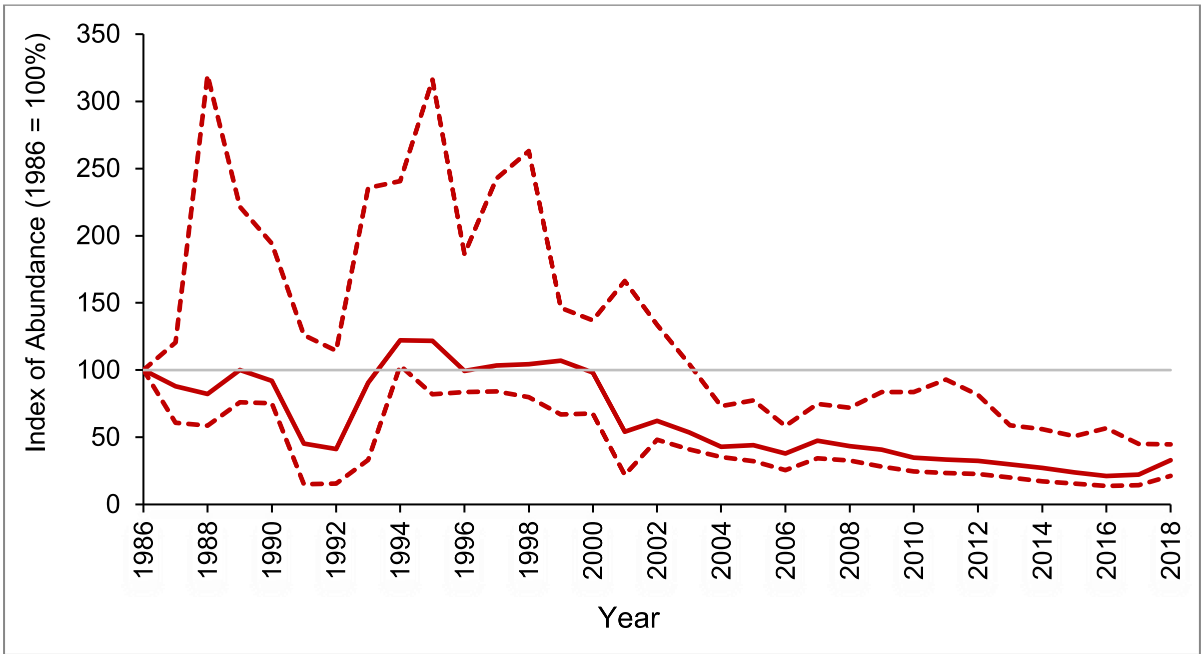

Figure 5. Trend in abundance index (solid line) of natural-nesting herring gull in England, 1986-2018 with 95% confidence limits (dotted lines). Based on SMP data; view the methods of analysis.

In common with Scotland and Wales, the natural nesting coastal herring gull population in England declined greatly between the censuses of 1969-70 and 1985-88. By Seabird 2000 (1998-2002), although the population had increased, numbers were still some 18,000 pairs lower than recorded during the 1969-70 census.

The SMP abundance trend (Figure 5) indicates that the natural-nesting herring gull population in England declined until the early 90s but then recovered to a maximum of 22% above the 1986 baseline in 1994. Herring gulls maintained positive index values until 2000, then plummeted to 46% below the baseline in 2001. Index values continued to decline and reached their lowest value of 79% below the 1996 baseline in 2016, although improved slightly in 2017 and 2018 to 78% and 68% below the baseline respectively. A suite of 74 colonies counted in 2018 held 7,441 AON/AOT compared to 17,614 AON/AOT during Seabird 2000 - a decline of 58%. These colonies comprise around 10% of the overall population counted during Seabird 2000 and may, therefore, not be representative of what is happening to the entire natural-nesting herring gull population in England.

At the last census, England held the largest proportion of urban roof-nesting gulls within the UK (59.7%). The number of roof-nesters has increased greatly, from 1,960 pairs in 1976[1] to 6,383 pairs in 1993-95 and to 12,284 pairs by Seabird 2000[3]. However, the current size of the urban population is unknown, though recent increases have been documented in towns in south-west and north-west England.

Productivity

Relatively few data are available on the productivity of natural-nesting herring gulls at English colonies hence a valid trend could not be generated.

Wales

Population estimates and change 1969-2002 (census data)

	Operation Seafarer (1969-70)	Seabird Colony Register (1985-88)	Seabird 2000 (1998-2002)
Population estimate (AON*) **Inland** **Total**	48,576	11,089	13,930 44 13,974
% change since previous census	n/a	-77	+26

* AON = Apparently Occupied Nests

Note: Inland colonies were not counted during the first two national censuses, so, to enable direct comparison, the percentage change refers to coastal colonies only.

Breeding abundance

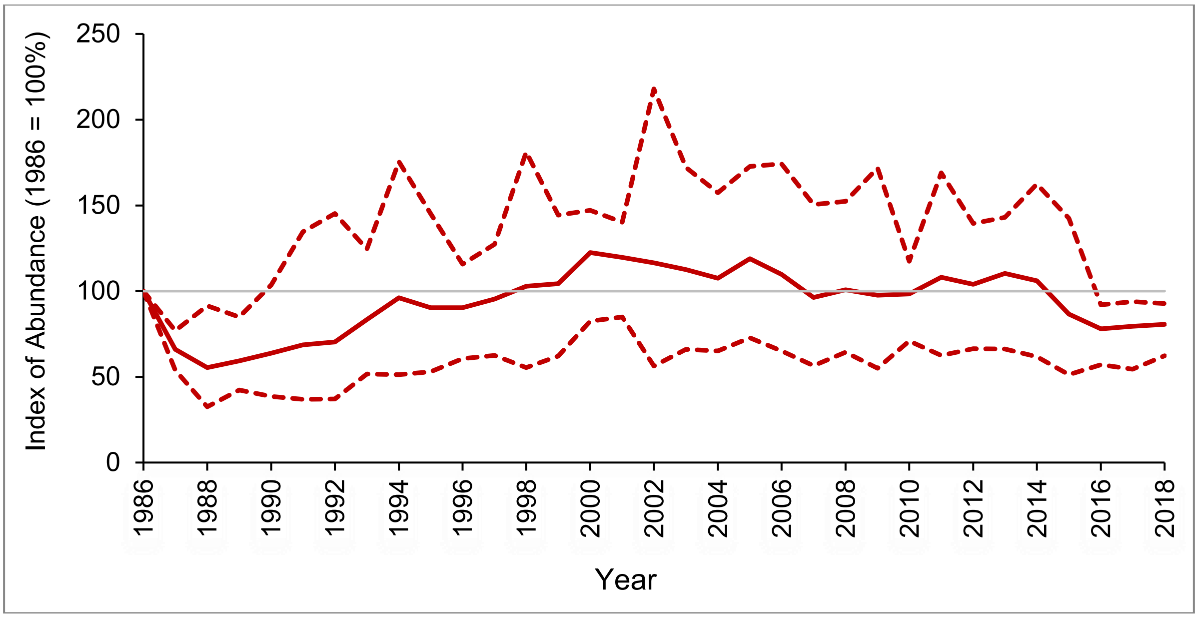

Figure 6. Trend in abundance index (solid line) of natural-nesting herring gulls in Wales, 1986-2018 with 95% confidence limits (dotted lines). This abundance trend excludes urban nesting gulls from the sample and, therefore, may not be representative of trends in the entire UK population. Based on SMP data; view the methods of analysis.

Coastal herring gull numbers fell by 77% in Wales between Operation Seafarer and the Seabird Colony Register and, although a subsequent increase of 26% was recorded by Seabird 2000, numbers were still 34,600 AON lower than in 1969-70. Natural-nesters decreased in the late 1980s but began increasing again in the early 1990’s until 2000. The trend fluctuated above the 1986 baseline until 2014 and then dropped below from 2015 (-13%; Figure 6) to 2018 (-20%). In 2018, a suite of 125 colonies were counted which held 5,945 AON compared to 6,769 during Seabird 2000, a decline of 12%. This sample represents just over 50% of the natural-nesting population counted during Seabird 2000 and, therefore, may be indicative of the current state of the Welsh population.

Urban roof-nesting herring gulls in Wales increased from 772 pairs in 1993-95[1] to 1,826 pairs in Seabird 2000[3]. In 2011, a survey of urban gulls in Cardiff recorded 640 AON. This represents a remarkable change in fortunes as previous estimates indicated 425 AON in 1975, four pairs in 1993 and none during Seabird 2000 (1998-2002).

Productivity

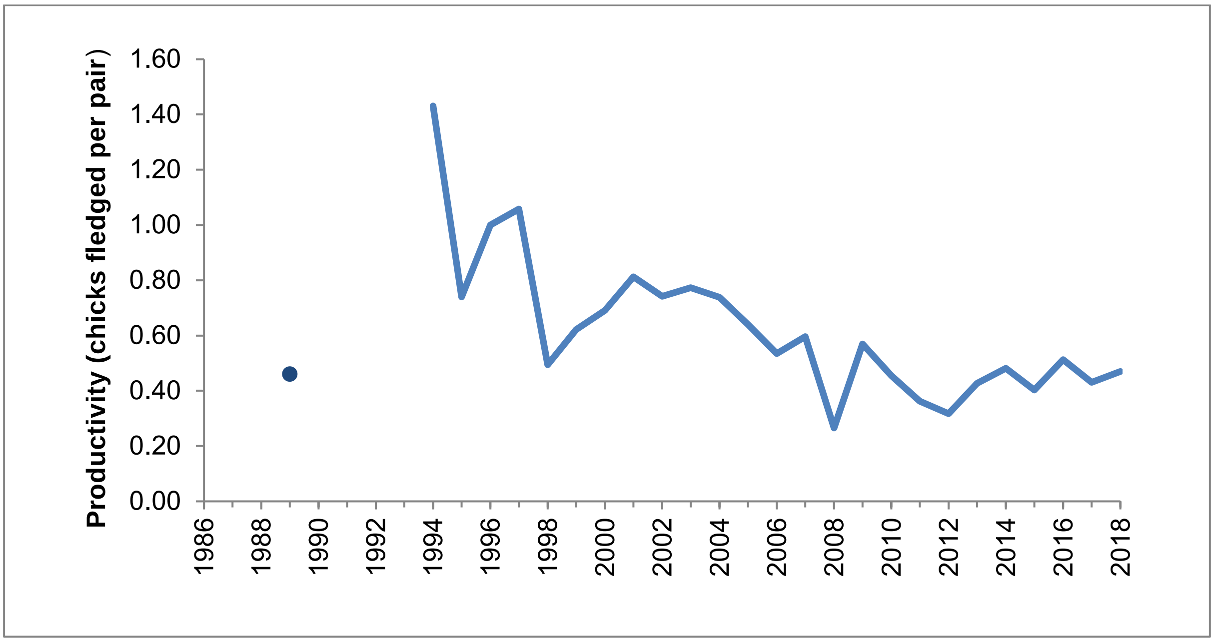

Figure 7. Trend in productivity (no. of chicks fledged per pair) of natural-nesting herring gulls in Wales, 1989-2018. This productivity trend excludes urban nesting gulls from the sample and, therefore, may not be representative of trends in the entire UK population. Based on SMP data; view the methods of analysis.

Productivity of natural-nesting herring gulls at colonies in Wales has been declining since 1994. Birds were very successful in that year, with productivity at 1.43 chicks per pair but between 1998 and 2018 herring gulls have typically fledged less than 0.60 chicks per pair (Figure 7). Unfortunately, the reasons for this continued decline in productivity are unknown.

Northern Ireland

Population estimates and change 1969-2002 (census data)

	Operation Seafarer (1969-70)	**Seabird Colony Register (1985-88)**	**Seabird 2000 (1998-2002)**
Population estimate (AON*) **Inland** **Total**	16,002	17,561	709 12 721
% change since previous census	n/a	+10	-96

* AON = Apparently Occupied Nests

Note: Inland colonies were not counted during the first two national censuses, so, to enable direct comparison, the percentage change refers to coastal colonies only.

Breeding abundance

Between Operation Seafarer and the Seabird Colony Register, herring gull numbers in Northern Ireland were buoyant when populations in the rest of the UK and in the Republic of Ireland were falling. The subsequent massive decline of 96% left just 709 AON by Seabird 2000. Botulism has been suspected as the main cause for large losses at some colonies e.g. Rathlin Island, the Copeland Islands and Strangford Lough. An abundance trend for natural-nesting herring gulls in Northern Ireland could not be generated based on insufficient count data submitted to the SMP. There might have been a slight recovery in the population since 2007 which may, in part, be due to increases at Copeland Islands and Strangford Lough, which increased by 302% (from 90 to 483 AON) and 437% (from 264 to 1,061 AON) respectively between 2005 and 2018.

In 2018, a vantage-point survey of Belfast city centre and harbour from two of the tallest buildings found at least 16 AON[11], however, this did not include the rooftops of the harbour area. A few other breeding locations, such as Carrickfergus and Antrim, were reported but no accurate numbers were recorded, however, it appears that the Northern Ireland urban nesting populations may be increasing.

Productivity

Data submitted to the SMP on the productivity of herring gulls in Northern Ireland are sparse; thus, no meaningful average productivity value is given.

Republic of Ireland

Population estimates and change 1969-2018 (census data)

	Operation Seafarer (1969-70)	Seabird Colony Register (1984-85)	Seabird 2000 (1998-2002)	Republic of Ireland Census (2015-18)
Population estimate (AON*) **Inland** **Total**	43,710	15,255	5,411 103 5,514	10,333
% change since previous census	n/a	-65	-64	+87

* AON = Apparently Occupied Nests

Note: Inland colonies were not counted during the first two national censuses, so, to enable direct comparison, the percentage change refers to coastal colonies only.

Breeding abundance

National census data show that the Republic of Ireland herring gull population declined between Operation Seafarer and the Seabird Colony Register censuses by 65% fall, with a further decline of 64% by the time of Seabird 2000. The recent Irish Seabird Census (2015-2018) recorded a total of 10,333 AON, an increase of 87% since Seabird 2000[13]. A few colonies not counted during Seabird 2000, e.g. at Roaringwater Bay, are now holding notable numbers. However, it is not clear if these are newly established colonies or are previously undetected ones[13].

The current status of the urban nesting herring gull population in the Republic of Ireland is unknown, as no counts have been carried out at urban colonies since Seabird 2000 when they held 209 AON.

Productivity

Data submitted to the SMP on the productivity of herring gulls in the Republic of Ireland are sparse; thus, no meaningful average productivity value is given.

All Ireland

Population estimates and change 1969-2002 (census data)

	Operation Seafarer (1969-70)	**Seabird Colony Register (1985-88)**	**Seabird 2000 (1998-2002)**
Population estimate (AON*) **Inland** **Total**	59,712	32,816	6,120 115 6,235
% change since previous census	n/a	-45	+87

* AON = Apparently Occupied Nests

Note: Inland colonies were not counted during the first two national censuses, so, to enable direct comparison, the percentage change refers to coastal colonies only.

Breeding abundance

National census data showed that herring gull numbers in the whole of Ireland declined severely between Operation Seafarer and Seabird 2000, although numbers in Northern Ireland were actually stable between the first two censuses. Data submitted to the SMP on the abundance of herring gulls from colonies across Ireland are sparse and, as such, it is not possible to produce an annual trend which is representative of the population.

In Northern Ireland, botulism was suspected to be the main cause for the large losses seen at some colonies, e.g. Copeland Islands and Strangford Lough, although increases at these colonies since 2005 may be indicative of a wider recovery in the Northern Ireland breeding population. The recent Republic of Ireland Seabird Census (2015-2018) recorded a total of

10,333 herring gull AON, an increase of 87% compared to Seabird 2000[13] and, as such, it is likely that the natural nesting population in the whole of Ireland has increased since Seabird 2000.

The urban-breeding herring gull populations in Northern Ireland and the Republic of Ireland are also likely to have increased since Seabird 2000, although this cannot be confirmed until an urban gull census is completed.

Productivity

Data submitted to the SMP on the productivity of herring gulls throughout Ireland are sparse; thus, no meaningful productivity value is given.

Isle of Man

Population estimates and change 1969-2002 (census data)

	Operation Seafarer (1969-70)	Seabird Colony Register (1984-85)	Seabird 2000 (1998-2002)	Isle of Man Census (2017-18)
UK Population estimate (AON*) **Inland** **Total**	9,875	9,064	7,127 0 7,127	1,251
% change since previous census	n/a	-8	-13	-61

* AON = Apparently Occupied Nests

Note: Inland colonies were not counted during the first two national censuses, so, to enable direct comparison, the percentage change refers to coastal colonies only.

Breeding abundance

Figure 8. Abundance of herring gull on the Calf of Man, 1986-2017.

Between Operation Seafarer and the Seabird Colony Register there was a decline of 9% in the number of herring gulls nesting on the Isle of Man. A larger decline then occurred so that by Seabird 2000 numbers had fallen a further 21% to 7,126 AON. In 2017, a census of the Isle of Man recorded 1,033 herring gull AON, representing a decline of 86% since Seabird 2000[15]. The decline was greatest at coastal sites (down 85% from 1999 to 2017) compared to urban sites (where a 31% decline was observed). The Calf of Man is the only colony that has been surveyed regularly since Seabird 2000 and reflects the declines seen in the Isle of Man herring gull population (Figure 8).

Productivity

No systematic data on the productivity of herring gulls on the Isle of Man have been submitted to the SMP.

Channel Islands

Population estimates and change 1969-2002 (census data)

	Operation Seafarer (1969-70)	**Seabird Colony Register (1984-85)**	**Seabird 2000 (1998-2002)**	**Channel Islands Census (2015-16)**
UK Population estimate (AON*) **Inland** **Total**	3,970	3,551	4,347 0 4,347	2,257

	Operation Seafarer (1969-70)	Seabird Colony Register (1984-85)	Seabird 2000 (1998-2002)	Channel Islands Census (2015-16)
% change since previous census	n/a	-11	+22	-48

* AON = Apparently Occupied Nests

Note: Inland colonies were not counted during the first two national censuses, so, to enable direct comparison, the percentage change refers to coastal colonies only.

Breeding abundance

In common with other areas of Britain and Ireland, the number of herring gulls breeding in the Channel Islands declined between Operation Seafarer and the Seabird Colony Register, although the size of this fall, a decline of 11%, was less severe. Numbers then increased by 22% between the Seabird Colony Register and Seabird 2000.

A breeding seabird census of the Channel Islands in 2015-16 recorded a total of 2,257 herring gull AON, representing a decrease of 48% since Seabird 2000[16].

Productivity

Data submitted to the SMP on the productivity of herring gulls in the Channel Islands are sparse; thus, no meaningful average productivity value is given.

UK phenology, diet, survival rates

Phenology

No systematic data on phenology (timing of life-cycle events) have been collected as part of the SMP.

Diet

No systematic data on diet have been collected as part of the SMP.

Survival rate

The only herring gull adult survival rate data submitted to the SMP comes from Skomer in Wales. Figure 9 shows there has been an overall decline in survival since 2000, although it recovered briefly to a peak of 97% in 2014. The most recent annual survival estimate (2016-17: 75%) was lower than the average over the study period (1978-2016: 82%). The extent to which this trend is representative of the UK as a whole is not known.

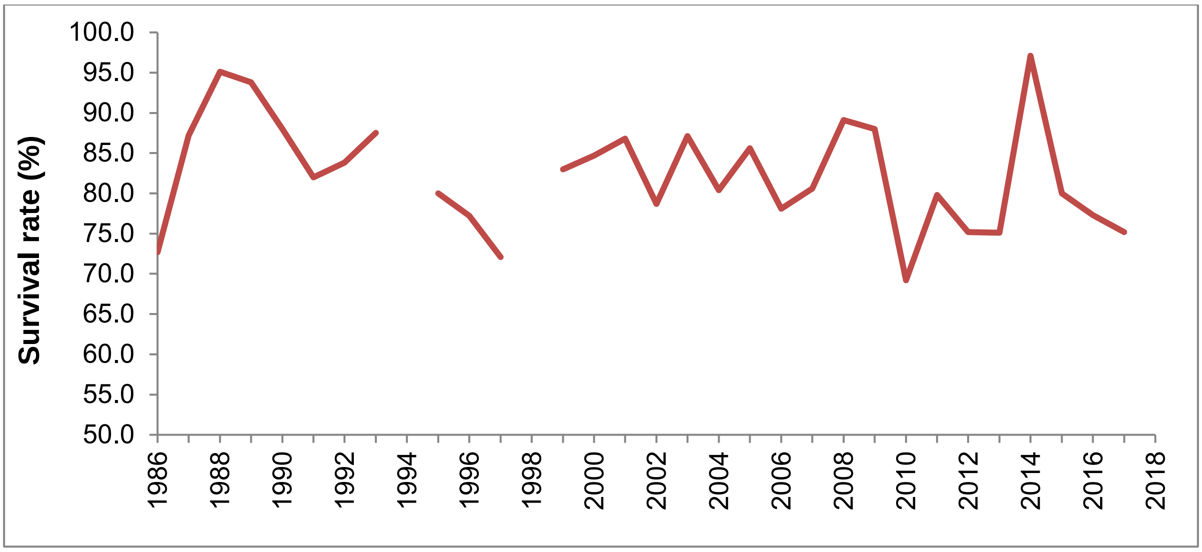

Figure 9. Estimated adult survival rate of herring gull on Skomer, 1986-2017.

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Great Black-backed Gull *Larus marinus*

Description

The following has been adapted from original text by James B. Reid in Seabird Populations of Britain and Ireland (with permission from A&C Black, London).

The great black-backed gull has an extensive breeding range across the north Atlantic and adjacent seas. Historically, Britain and Ireland have hosted most of the world population after Iceland and Norway. Great black-backed gulls breed mainly in the Outer and Inner Hebrides and the Northern Isles of Scotland. These regions offer extensive areas of the preferred breeding habitat of well-vegetated rocky coastline with stacks and cliffs. The 20th century saw widespread expansion of the breeding range and numbers on both sides of the Atlantic. In Britain at least, population increase was remarkable given that a period of decline rendered the species virtually extinct as a breeder towards the end of the previous century. The species nests almost exclusively in coastal habitats, but will occasionally nest inland at freshwater sites as well as on the roofs of buildings.

Conservation status

Great black-backed gull is currently identified as a conservation priority in the following:

Amber listed in Birds of Conservation Concern 4 (2015 update)
(further information on Conservation Designations for UK Taxa)
Amber listed in Birds of Conservation Concern in Ireland 2014-2019 (2014 update)
EC Birds Directive - migratory species

International importance

UK Population	% Biogeographic Population	% World Population
16,800 AON*	16.0 (Europe excl. Russia)	9.6

*AON = Apparently Occupied Nests

The UK population figure (rounded to the nearest hundred) was derived from data in Mitchell, P.I., Newton, S.F., Ratcliffe, N. and Dunn, T.E. (eds.) 2004. *Seabird Populations of Britain and Ireland.* Poyser, London. This was also the source of figures for the Biogeographic and World populations.

Note: The UK population figure above includes data from both inland and coastal colonies and hence differs from that tabled below.

UK population estimates and change 1969-2002 (census data)

No major gaps in survey coverage are known for the three national surveys as most colonies are well established. Great black-backed gulls often nest at low densities in mixed-species colonies, usually with lesser black-backed gulls, but their large size and conspicuous plumage, coupled with a distinctively deep voice, probably reduces the chances of such pairs being overlooked. However, solitary nests or pairs, especially those in remote areas, might easily have been missed. Seabird 2000 represented the first attempt to census all coastal and inland breeding colonies of great black-backed gull although only 20 pairs were found inland.

	Operation Seafarer (1969-70)	Seabird Colony Register (1985-88)	Seabird 2000 (1998-2002)
UK Population estimate (AON*) **Inland** **Total**	18,771	17,415	16,735 20 16,755
% change since previous census	n/a	-7	-4

*AON = Apparently Occupied Nests

Note: Inland colonies were not counted during the first two national censuses, so, to enable direct comparison, the percentage change refers to coastal colonies only.

For census results for individual countries and Ireland, the Channel Islands and the Isle of Man see under relevant sections below.

Distribution/abundance

The Seabird 2000 census provides the most comprehensive recent assessment of the distribution and abundance of breeding seabirds. Numbers are found in different regions, and a map showing the location and size of colonies, is provided in the Seabird 2000 greater black-backed gull results page.

The locations sampled during the annual Seabird Monitoring Programme provide some information on distribution and are accessible via the Seabird Monitoring Programme online database.

Annual abundance and productivity by geographical area

With reference to the regional accounts below please note the following.

Breeding abundance: graphs of abundance index with 95% CLs are only shown for a region where the trend produced has been deemed accurate (see methods of analysis). Where a trend was thought to be inaccurate, graphs of abundance at major colonies in a region may be shown instead, particularly if such colonies hold greater than 10% of the regional population, are monitored frequently and may thus help illustrate regional population fluctuations outwith national censuses. Occasionally, too few data have been collected regionally to produce either of these.

Productivity: graphs of productivity are only shown if analysis of productivity data produced a significant result for regional and/or year effects (again see methods of analysis). If results were not significant, then a regional mean productivity value is given. However, on some occasions too few data are available from which to provide a meaningful average. Furthermore, for 11 species where the quality of monitoring data available was considered high, population viability analysis was undertaken at the UK level and the results of this are also reported.

United Kingdom

Breeding abundance

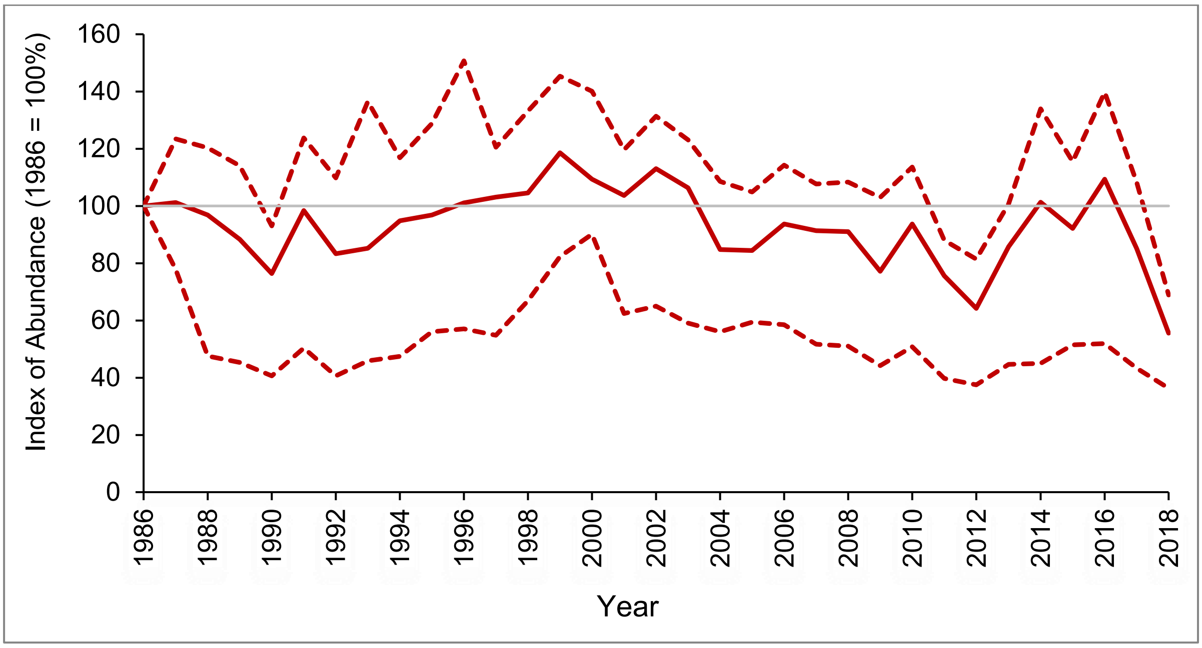


Figure 1, Trend in UK abundance index (solid line) of great black-backed gull 1986-2018 with 95% confidence limits (dotted lines). Based on SMP data; view the methods of analysis.

The abundance of great black-backed gull changed relatively little between the first census in 1969/70 and Seabird 2000. Data submitted to the SMP show the index peaked around the time of the most recent census (1999/2002) then declined to reach its second lowest point in 2012 (36% below the baseline). It then climbed 9% above the baseline in 2016, although by 2018 had declined steeply to 45% below the baseline, the lowest value since monitoring began. It has been suggested that great black-backed gulls have competitive advantage over other seabird species when scavenging at sea for fishery discards and offal[1], and hence have not undergone (at least, until recently) the declines that other scavengers (herring and lesser black-backed gull) have in recent decades which may be due to a reduction in discards and offal[2]. The species also forages on natural prey (e.g.

rabbits and other seabirds) and appears to be quite adaptable to changing dietary opportunities. Declining productivity may have contributed to the downward population trend noted from 1999 to 2005.

Productivity

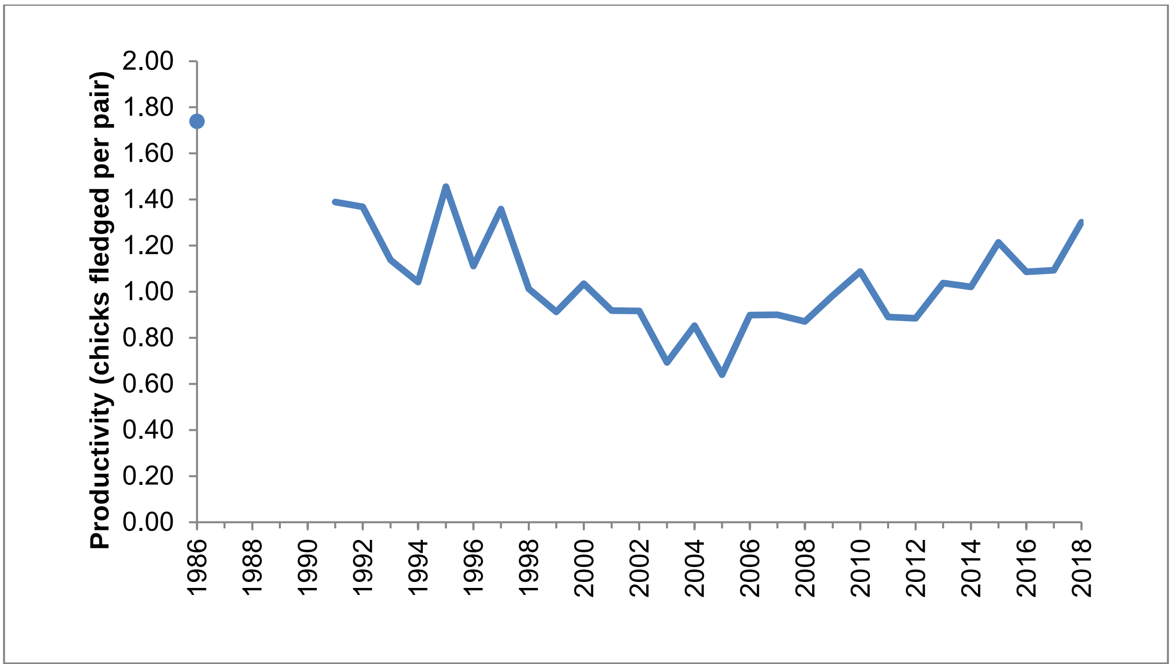


Figure 2. Trend in UK productivity (no. of chicks fledged per pair) of great black-backed gull 1986-2018. Based on SMP data; view the methods of analysis .

There is no clear trend in great black-backed gull productivity, or statistically significant variation over time; on average approximately 0.89 chicks fledged per nest per year between 1991 and 2018. The effects of predation by American mink on this large and aggressive gull appear to be less severe than for its smaller relatives. However, in some years, it does appear that mink can impact on productivity; in 2014, a comparison of islands off west Scotland with mink control against those with none found that productivity for each group was 3.00 and 0.94 chicks fledged per pair, respectively - a difference of 69%[3].

Scotland

Population estimates and change 1969-2002 (census data)

	Operation Seafarer (1969-70)	Seabird Colony Register (1985-88)	Seabird 2000 (1998-2002)
Population estimate (AON*) **Inland** **Total**	15,950	15,315	14,773 3 14,776

	Operation Seafarer (1969-70)	Seabird Colony Register (1985-88)	Seabird 2000 (1998-2002)
% change since previous census	n/a	-4	-4

* AON = Apparently Occupied Nests

Note: Inland colonies were not counted during the first two national censuses, so, to enable direct comparison, the percentage change refers to coastal colonies only.

Breeding abundance

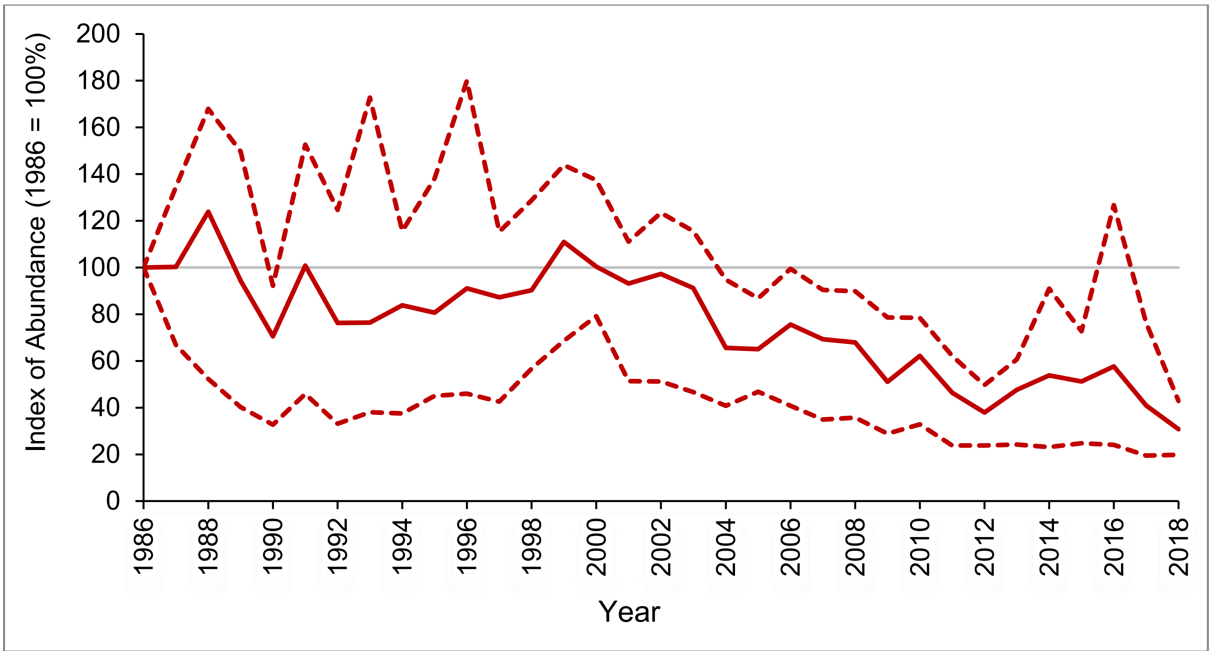


Figure 3. Trend in abundance index (solid line) of great black-backed gull in Scotland, 1986-2018 with 95% confidence limits (dotted lines). Based on SMP data; view the methods of analysis.

National census data show that numbers of great black-backed gulls in Scotland changed relatively little between 1969-70 and Seabird 2000, although the trend from SMP annual sampling (Figure 3), shows a decline from 1986 to 1990 followed by an increase until the Seabird 2000 census. Since Seabird 2000, there appears to have been a prolonged decline in the breeding population with the index in 2018 reaching in lowest ever value, at 69% below the 1986 baseline. In 2018, 112 colonies were surveyed (accounting for 10% of the great black-backed gull population in Scotland) and held a total of 907 AON, a 76% decline since Seabird 2000 (3,859 AON). Scotland’s largest colony, Calf of Eday, decreased by 97% between Seabird 2000 and 2018 (from 1,350 AON to 43 AON).

Productivity

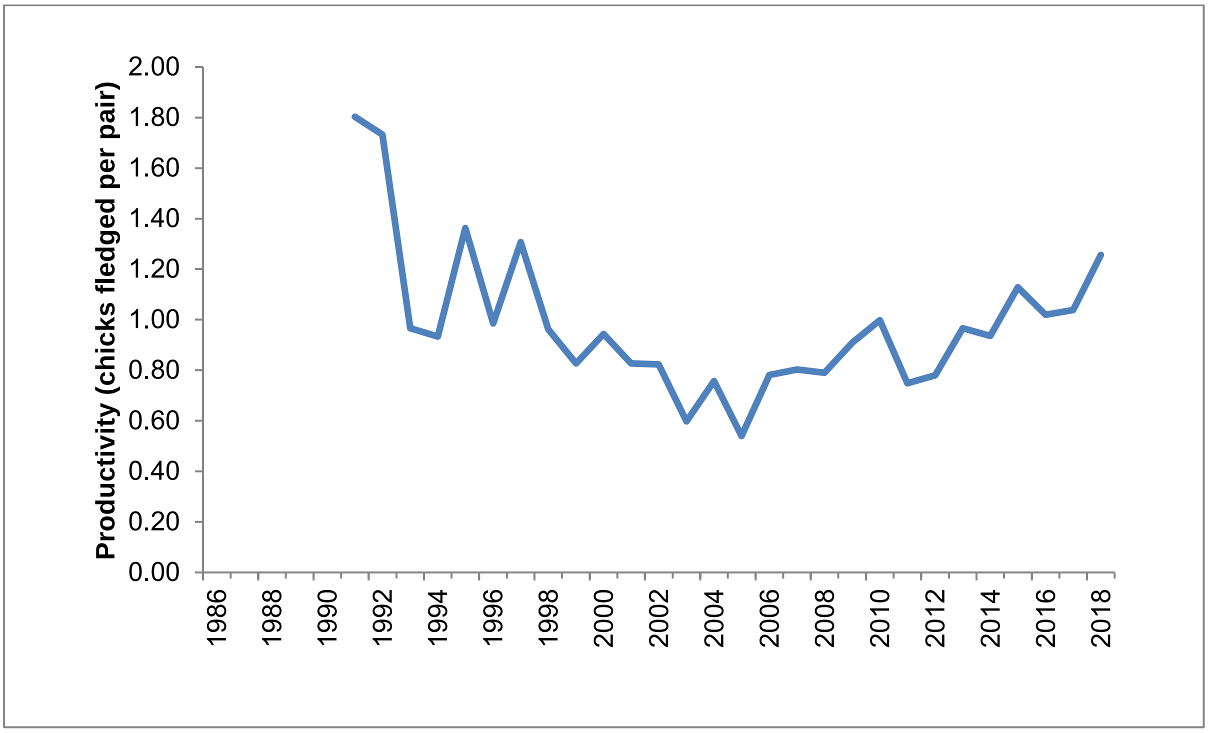


Figure 4. Trend in productivity (no. of chicks fledged per pair) of great black-backed gull in Scotland, 1991-2018. Based on SMP data; view the methods of analysis .

The trend in great black-backed gull productivity for Scotland closely matches that of the UK because 87% of data have been collected at Scottish colonies. Productivity of great black-backed gulls at Scottish colonies reached its lowest point in 2005 (at 0.54 chicks fledged per pair), although there was some fluctuation during this period. Productivity has improved since then and, in 2018, was 1.25 chicks fledged per pair. The decline in productivity between 1991 and 2005 may have contributed to the downward population trend noted since 1999. As with common and herring gulls, most data come from a long-term study of near-shore islands on the west coast of Scotland where American mink, an introduced mammal, can heavily depress productivity, by preying on the eggs and chicks of gulls, terns and other seabirds. In 2014, a comparison of islands where American mink were controlled against those with no, or unsuccessful, mink control found a difference of 69% (success of 3.00 and 0.94 chicks per pair in each group, respectively).

England

Population estimates and change 1969-2002 (census data)

	Operation Seafarer (1969-70)	Seabird Colony Register (1985-88)	Seabird 2000 (1998-2002)
Population estimate (AON*) **Inland**	1,676	1,534	1,466 10

	Operation Seafarer (1969-70)	Seabird Colony Register (1985-88)	Seabird 2000 (1998-2002)
Total			1,476
% change since previous census	n/a	-8	-4

* AON = Apparently Occupied Nests

Note: Inland colonies were not counted during the first two national censuses, so, to enable direct comparison, the percentage change refers to coastal colonies only.

Breeding abundance

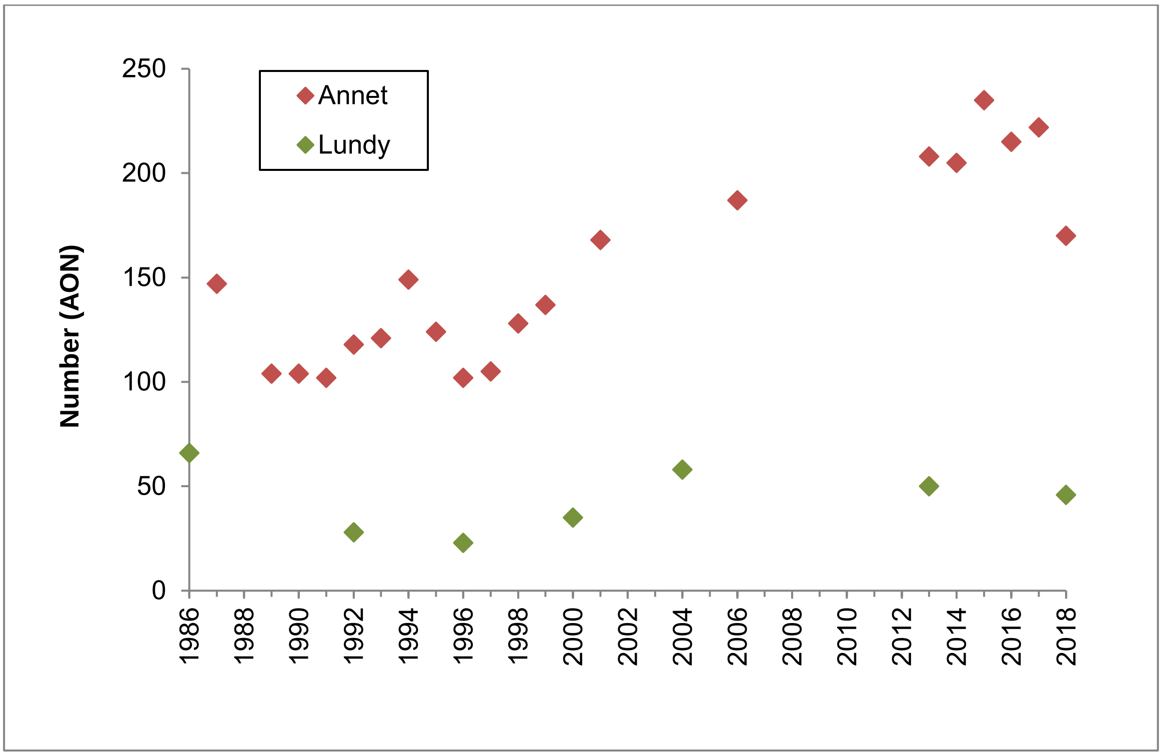


Figure 5. Abundance of great black-backed gull on Annet and Lundy, 1986-2018.

Between Operation Seafarer (1969-70) and the Seabird 2000 census (1998-2002), great black-backed gull numbers in England decreased slightly. The largest concentration of the species is in south-west England, with the Isles of Scilly holding 807 AON during Seabird 2000, over 50% of the English population. A complete survey of the Isles of Scilly in 2015 found 1,017 AON, an increase of 26% since Seabird 2000. On Lundy, where rats *Rattus* sp. were eradicated between 2002 and 2004, numbers have begun to increase, from 35 AON in Seabird 2000 to 46 AON in 2018 (Figure 5).

Productivity

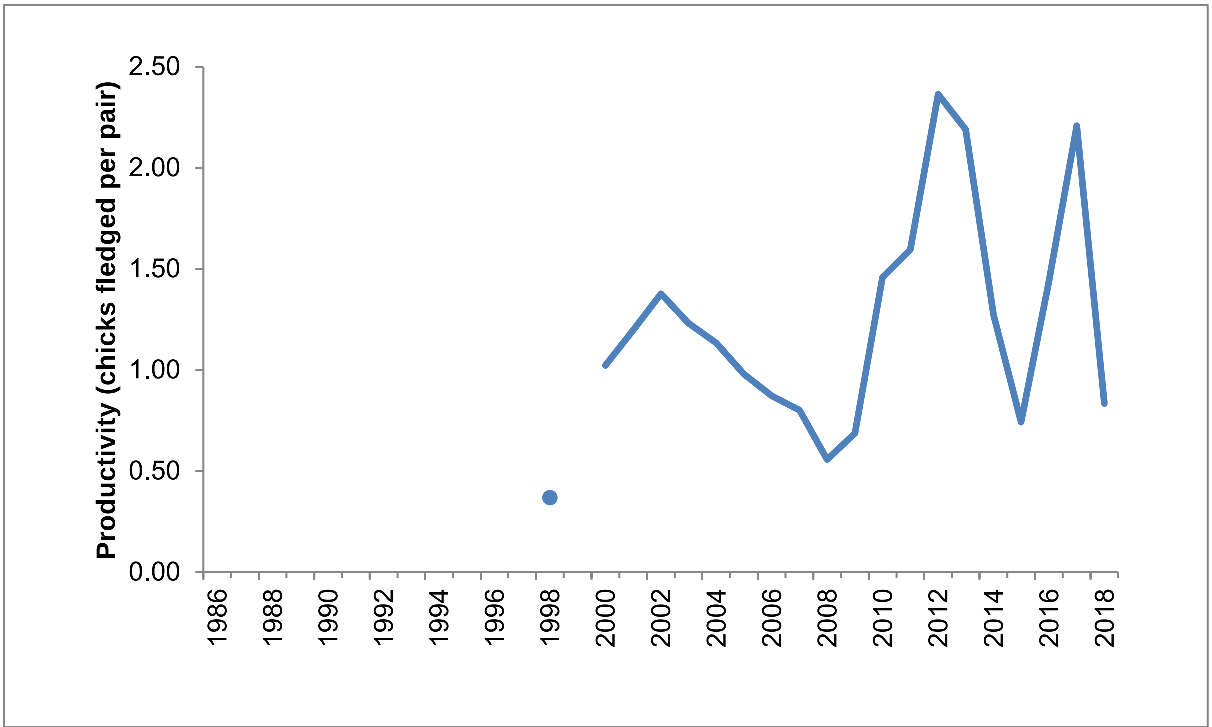


Figure 6. Trend in productivity (no. of chicks fledged per pair) of great black-backed gull in England, 1998-2018. Based on SMP data; view the methods of analysis.

Relatively few data are available on the productivity of great black-backed gulls in England and all data submitted to the SMP have been collected since 1998. Most data come from colonies holding fewer than 10 pairs, the exception being Brownsea Island where the number of nests has increased to double figures in recent years. Great black-backed gulls at this colony have been very successful fledging on average 1.94 chicks per pair between 2010 and 2016.

Wales

Population estimates and change 1969-2002 (census data)

	Operation Seafarer (1969-70)	Seabird Colony Register (1985-88)	Seabird 2000 (1998-2002)
Population estimate (AON*) **Inland** **Total**	905	289	425 2 427
% change since previous census	n/a	-68	+47

* AON = Apparently Occupied Nests

Note: Inland colonies were not counted during the first two national censuses, so, to enable direct comparison, the percentage change refers to coastal colonies only.

Breeding abundance

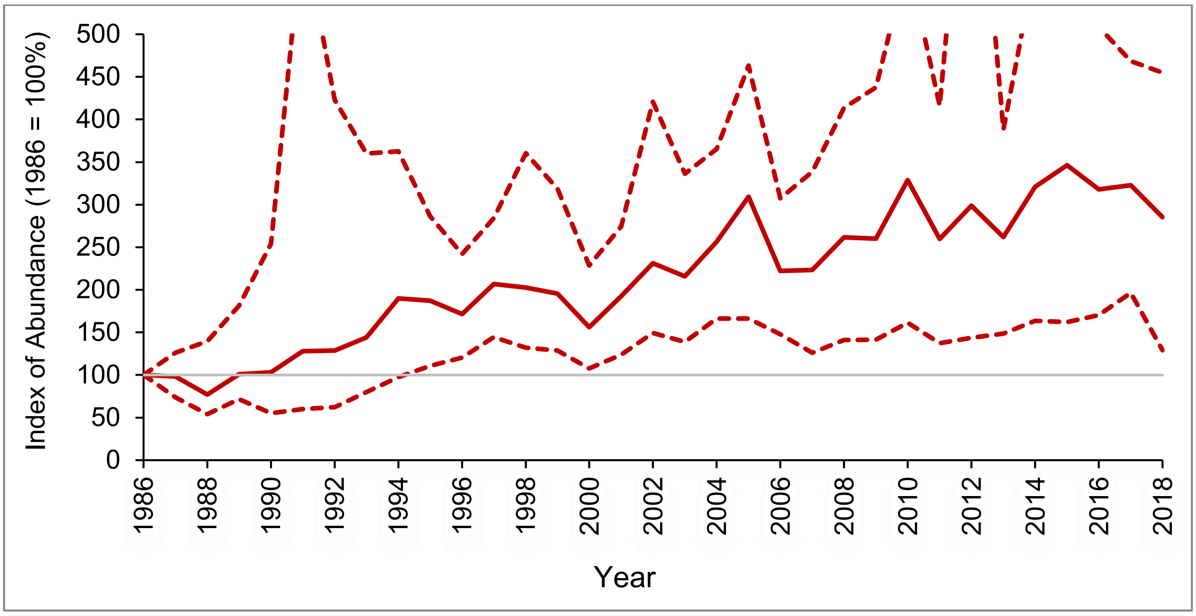


Figure 7. Trend in abundance index (solid line) of great black-backed gull in Wales, 1986-2018 with 95% confidence limits (dotted lines; drawing of upper limit restricted to preserve detail in the abundance index). Based on SMP data; view the methods of analysis.

The trend in abundance for great black-backed gulls in Wales has generally been upward over the last 30 years, although with some fluctuation (see pronounced dips in 2000, 2006, 2011 and 2013). During the Seabird 2000 census, the population was 47% larger than recorded during the Seabird Colony Register (SCR) census. However, despite the increase since the SCR, numbers still lie well below those recorded by Operation Seafarer, when 905 AON were recorded. In 2018, 38 colonies held 276 AON compared to 236 AON during Seabird 2000, an increase of 17%.

Productivity

On average great black-backed gulls at colonies in Wales fledged 1.26 chicks per year per pair between 1986 and 2018; there was no statistically significant variation over time.

Northern Ireland

Population estimates and change 1969-2002 (census data)

	Operation Seafarer (1969-70)	Seabird Colony Register (1985-88)	Seabird 2000 (1998-2002)
Population estimate (AON*)	240	277	71
Inland			5
Total			76

	Operation Seafarer (1969-70)	Seabird Colony Register (1985-88)	Seabird 2000 (1998-2002)
% change since previous census	n/a	+15	-74

* AON = Apparently Occupied Nests

Note: Inland colonies were not counted during the first two national censuses, so, to enable direct comparison, the percentage change refers to coastal colonies only.

Breeding abundance

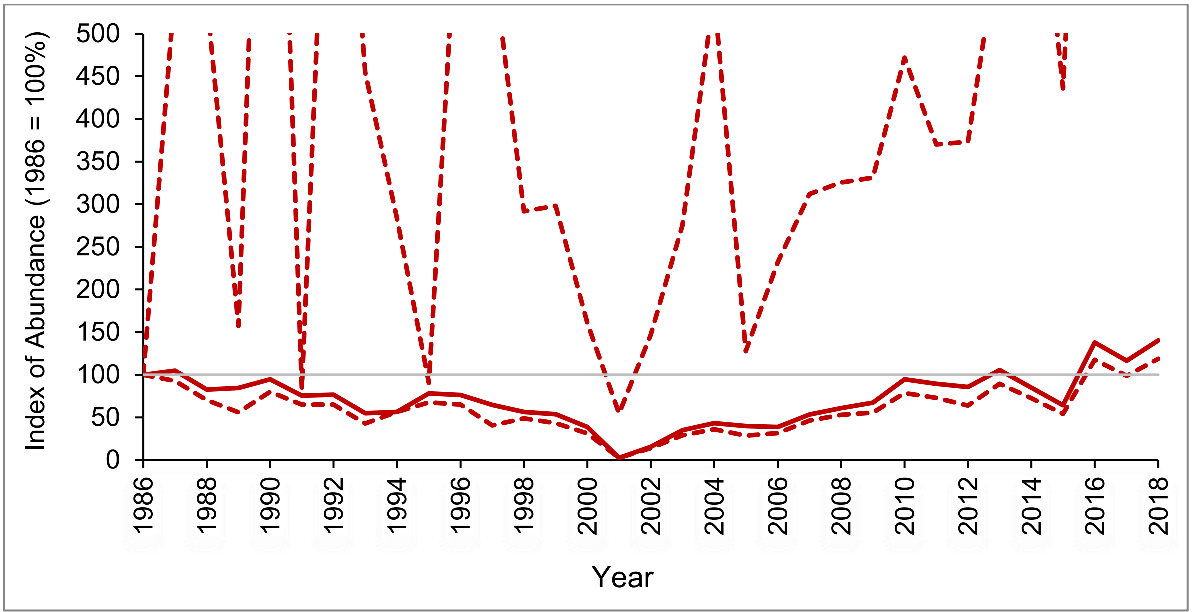


Figure 8. Trend in abundance index (solid line) of great black-backed gull in Northern Ireland, 1986-2018 with 95% confidence limits (dotted lines; drawing of upper limit restricted to preserve detail in the abundance index). Based on SMP data; view the methods of analysis .

Most great black-backed gull colonies in Northern Ireland hold only a few pairs and Great Minnis's Island, on Strangford Lough, is by far the most important, holding over 40% of the population during the Seabird Colony Register census. This colony, which is monitored annually, largely drives the trend shown in Figure 8. It declined by over 50% between 1986 (86 AON) and 2000 (41 AON); and, one year later held only one AON. The colony has gradually increased since then to a peak of 129 AON in 2018, although only 62 AON were counted in 2013[4]. Another 46 AON were recorded at four other colonies in 2018, suggesting that the great black-backed gull population in Northern Ireland has more than doubled since Seabird 2000.

Productivity

Data submitted to the SMP on the productivity of great black-backed gulls in Northern Ireland are sparse; thus, no meaningful average productivity value can be given.

Republic of Ireland

Population estimates and change 1969-2018 (census data)

	Operation Seafarer (1969-70)	Seabird Colony Register (1984-85)	Seabird 2000 (1998-2002)	Republic of Ireland Census (2015-18)
Population estimate (AON*) **Inland** **Total**	3,166	2,921	2,241 2 2,243	3,078 3 3,081
% change since previous census	n/a	-8	-23	+38

* AON = Apparently Occupied Nests

Note: Inland colonies were not counted during the first two national censuses, so, to enable direct comparison, the percentage change refers to coastal colonies only.

Breeding abundance

Great black-backed gulls nesting in the Republic of Ireland declined by 29% between Operation Seafarer and the Seabird 2000 census The decline was thought to be due to a redistribution of breeding birds, rather than a decline per se, with the species adapting to changing environmental conditions[5,6]. During the recent Republic of Ireland Seabird Census, a total of 3,081 AON were recorded, an increase of 38% since Seabird 2000 and very similar to the population recorded by Operation Seafarer. The species nests almost exclusively in coastal counties[7,6] and is well monitored.

Productivity

Data submitted to the SMP on the productivity of great black-backed gulls in the Republic of Ireland are sparse; thus, no meaningful average productivity value can be given.

All Ireland

Population estimates and change 1969-2002 (census data)

	Operation Seafarer (1969-70)	Seabird Colony Register (1985-88)	Seabird 2000 (1998-2002)
Population estimate (AON*) **Inland**	3,406	3,198	2,312 7 2,319

	Operation Seafarer (1969-70)	Seabird Colony Register (1985-88)	Seabird 2000 (1998-2002)
Total			
% change since previous census	n/a	-6	-28

* AON = Apparently Occupied Nests

Note: Inland colonies were not counted during the first two national censuses, so, to enable direct comparison, the percentage change refers to coastal colonies only.

Breeding abundance

The great black-backed gull population for the whole of Ireland declined by 32% between Operation Seafarer and Seabird 2000, although numbers were fairly stable between Operation Seafarer and the Seabird Colony Register census. Northern Ireland holds the smaller proportion of the all-Ireland population and numbers are increasing at its main colony in Strangford Lough. During the recent Republic of Ireland Seabird Census a total of 3,081 AON were counted, an increase of 38% since Seabird 200. The population nests almost exclusively in coastal counties with only two inland sites known to hold a very small number of AON[6]. There were insufficient data from all-Ireland to allow trends to be generated.

Productivity

Data submitted to the SMP on the productivity of great black-backed gulls in colonies throughout Ireland is sparse; thus, no meaningful average productivity value can be given.

Isle of Man

Population estimates and change 1969-2018 (census data)

	Operation Seafarer (1969-70)	Seabird Colony Register (1984-85)	Seabird 2000 (1998-2002)	Isle of Man Census (2017-18)
Population estimate (AON*) **Inland** **Total**	286	380	396 0 396	85 0 85
% change since previous census	n/a	+37	+8	-79

* AON = Apparently Occupied Nests

Note: Inland colonies were not counted during the first two national censuses, so, to enable direct comparison, the percentage change refers to coastal colonies only.

Breeding abundance

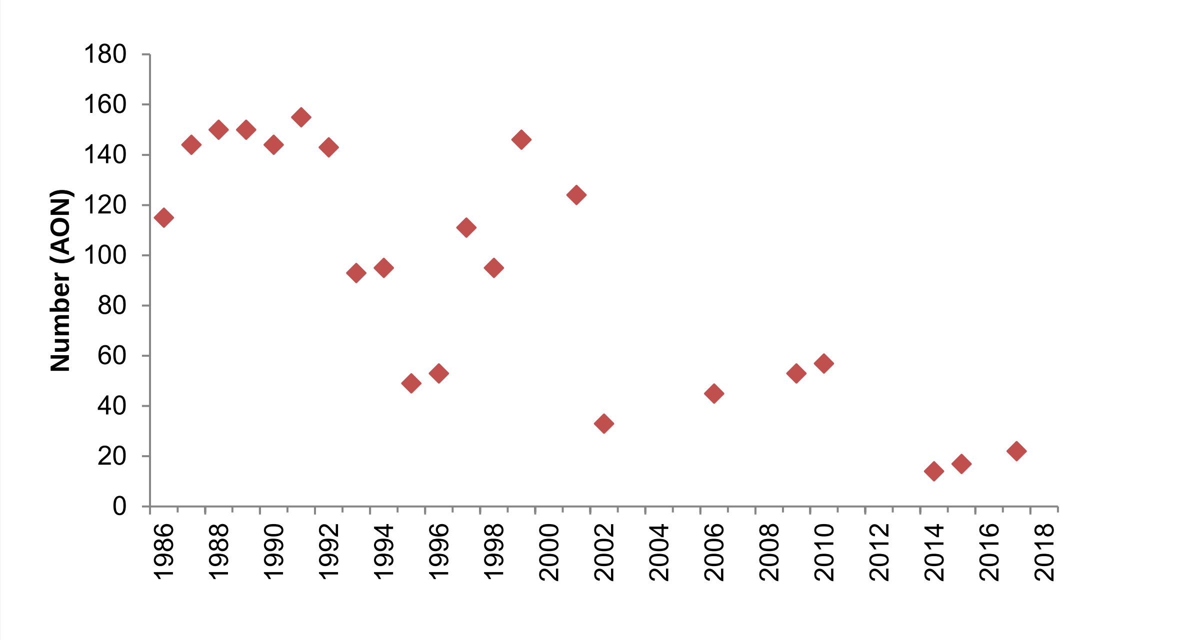


Figure 9. Abundance of great black-backed gull on the Calf of Man, 1986-2017.

Between Operation Seafarer and the Seabird Colony Register censuses, great black-backed gulls nesting on the Isle of Man increased by 37% with little further growth by the time of Seabird 2000. A seabird census of the Isle of Man in 2017 found that numbers of great black-backed gulls had fallen dramatically to 85 AON, a decline of 79% since Seabird 2000[8]. Only one colony, the Calf of Man (Figure 9), has been surveyed regularly since Seabird 2000, when it held 146 AON in 1999. In 2010 it had declined to 57 AON, then 38 AON in 2015 and only 22 AON in 2017, representing a 85% decline since Seabird 2000.

Productivity

Data submitted to the SMP on the productivity of great black-backed gulls on the Isle of Man are sparse; thus, no meaningful average productivity value can be given.

Channel Islands

Population estimates and change 1969-2015 (census data)

	Operation Seafarer (1969-70)	Seabird Colony Register (1984-85)	Seabird 2000 (1998-2002)	Channel Islands Census (2015)
Population estimate (AON*)	200	180	310	446

	Operation Seafarer (1969-70)	Seabird Colony Register (1984-85)	Seabird 2000 (1998-2002)	Channel Islands Census (2015)
% change since previous census	n/a	-10	+72	+44

* AON = Apparently Occupied Nests
Note: Inland colonies were not counted during the first two national censuses, so, to enable direct comparison, the percentage change refers to coastal colonies only.

Breeding abundance

During Seabird 2000, 310 pairs of great black-backed gull were recorded in the Channel Islands. This represented an increase of 72% since the Seabird Colony Register, which had recorded similar numbers to that found during Operation Seafarer. During the Channel Islands Seabird Census in 2015-16, 446 AON were recorded, an increase of 44% since Seabird 2000[9].

Productivity

No systematic data on the productivity of great black-backed gulls on the Channel Islands have been submitted to the SMP.

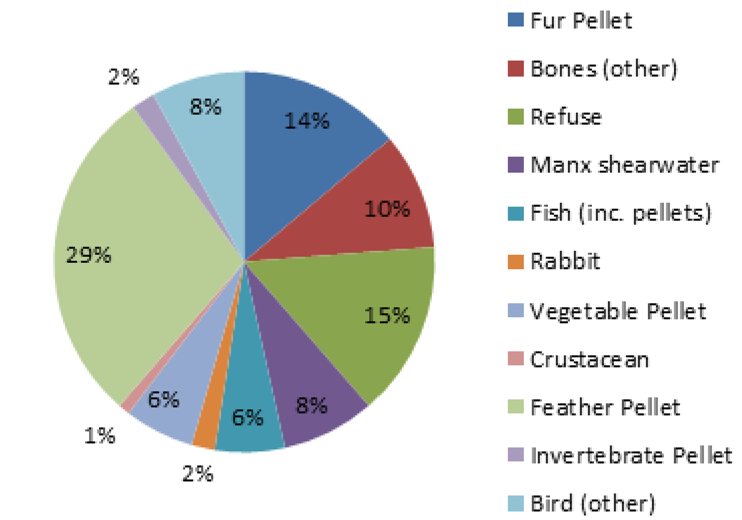
UK phenology, diet, survival rates

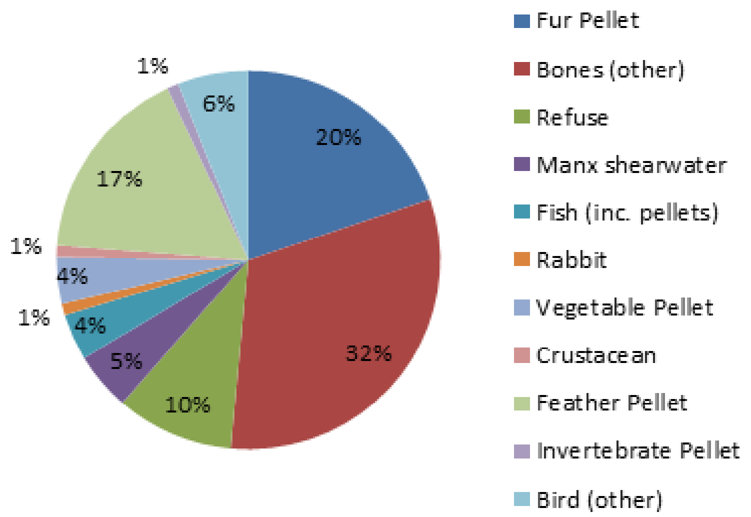
Phenology

No systematic data on phenology (timing of life-cycle events) have been collected as part of the SMP.

Diet

A trial study to monitor the diet of great black-backed gulls breeding on Skomer was initiated in 2008, modified in 2012, and has been subsequently used since then. In recent years, the prey remains around a sample of 25 nests were recorded after gull chicks fledged (from late July to early August). The sample represented nests from differing habitats and from areas of differing Manx shearwater densities. However, from 2012 onwards, the number of prey categories in the diet survey was increased in order to improve the accuracy of recording. Scattered bones, feather and fur pellets were counted separately from Manx shearwaters and rabbits, to avoid including remains in these categories that may have come from other species (e.g. chicken bones from off-island landfill sites). Invertebrate and crustacean remains were counted separately and a new category ‘vegetation pellet’ was added. Overall, these changes mean that comparisons of prey percentages with previous years should be treated with care but still provide a 'snapshot' of great black-backed gull diet in respective breeding seasons[10].


14%
10%
15%
8%
6%
2%
6%
1%
29%
2%
8%
Fur Pellet
Bones (other)
Refuse
Manx shearwater
Fish (inc. pellets)
Rabbit
Vegetable Pellet
Crustacean
Feather Pellet
Invertebrate Pellet
Bird (other)


20%
32%
10%
5%
4%
1%
4%
1%
17%
1%
6%
Fur Pellet
Bones (other)
Refuse
Manx shearwater
Fish (inc. pellets)
Rabbit
Vegetable Pellet
Crustacean
Feather Pellet
Invertebrate Pellet
Bird (other)

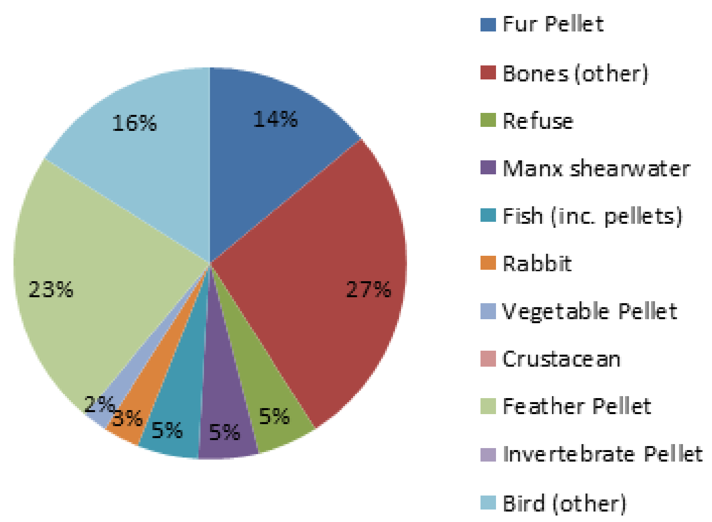

14%
27%
5%
5%
5%
3%
2%
23%
16%
Fur Pellet
Bones (other)
Refuse
Manx shearwater
Fish (inc. pellets)
Rabbit
Vegetable Pellet
Crustacean
Feather Pellet
Invertebrate Pellet
Bird (other)

Figure 10. Frequency of occurrence of food items within a five-metre radius cross-shaped transect around 25 great black-backed gull nests on Skomer, 2016 (top chart), 2017 (middle) and 2018 (bottom).

A wide variety of food items were recorded from 2016 to 2018 of which 8%, 5% and 5% respectively, were identified as Manx shearwaters. Fish remains (including pellets) comprised 6%, 4% and 5% of prey items recorded from 2016 to 2018, respectively. Bones (other), fur pellets and feather pellets were also among the most numerous items in each year. Refuse items were more prevalent in 2016 (15%) compared to 2017 and 2018 (10% and 5% respectively). Refuse was found in 80% of the nests and represented 5% of the prey items found; which is less than found in 2017 (10%), 2016 (15%) and 2015 (9 %). Birds other than Manx Shearwaters were found at 16% of the nests in 2018 and included: Puffins; Guillemots; Razorbills and Kittiwakes. The increased number of prey categories account for an apparent decline in the percentage of Manx shearwater remains found at nests (from a range of 43-58% between 2008-2011 to 5% between 2017 and 2018)[11,12,13].

Manx shearwater remains were recorded at 68% of nest sites studied in 2018 and at 85% of the nests studied in 2016 and 2017. In 2018, a mean of 9.12 Manx Shearwater carcasses were found within a 10m radius of each nest. This value is higher than reported in 2017 (8.56 carcasses per nest) and 2016 (7.52 carcasses per nest). The historical records indicate that on average 7.67 carcasses are found per nest. The number of rabbit carcasses found this year was 1.24 rabbit carcasses per nest. This value is similar to that reported in 2016 (1.32 carcasses per nest) but lower than reported in 2017 (0.44 carcasses per nest)[11,12,13].

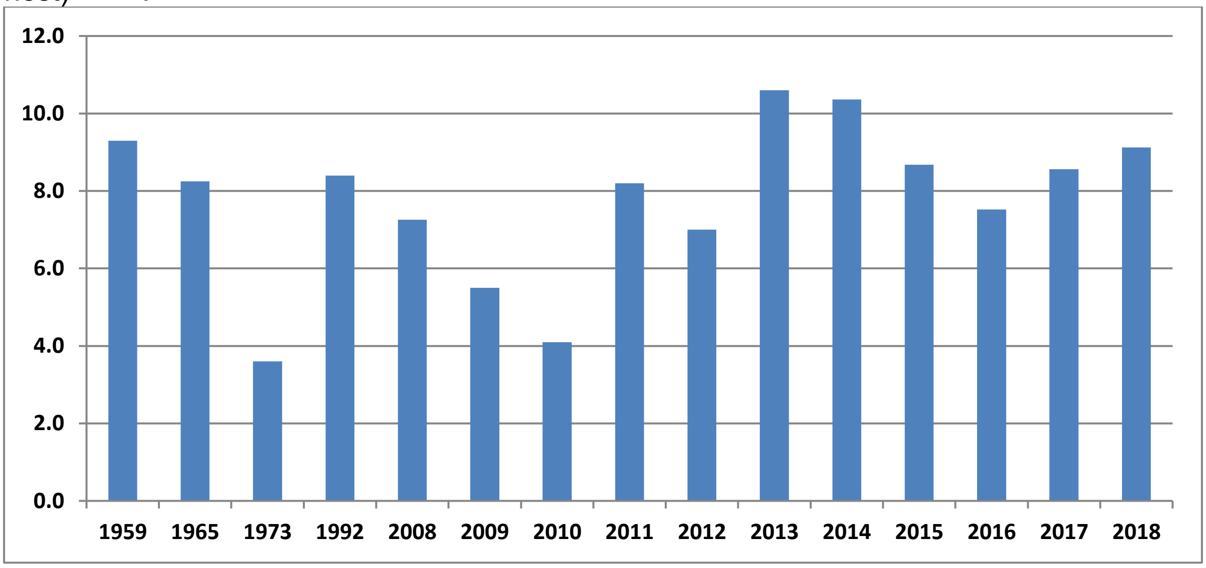


Figure 11. The number of Manx shearwater carcasses found per great black-backed gull nest on Skomer (Dyfed), 1959, 1965, 1973, 1992 and 2008-2018.

Survival

No systematic data have been collected as part of the Seabird Monitoring Programme.

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Little Tern *Sternula albifrons*

Description

The following has been adapted from original text by Georgina Pickerell in [Seabird Populations of Britain and Ireland] (with permission from A&C Black, London).

Little tern is the smallest species of tern breeding in the UK, nesting exclusively on the coast in well-camouflaged shallow scrapes on beaches, spits or inshore islets. They do not forage far from their breeding site, which dictates a necessity for breeding close to shallow, sheltered feeding areas where they can easily locate the variety of small fish and invertebrates that make up their diet. Colonies are found around much of the coastline, but the main concentration is in south and east England, where the species' preference for beaches also favoured by people makes it vulnerable to disturbance.

Conservation status

Little tern is currently identified as a conservation priority in the following:

Amber listed in Birds of Conservation Concern 4 (2015 update)
Wildlife and Countryside Act 1981 - protected under Schedule 1
(further information on Conservation Designations for UK Taxa)
Amber listed in Birds of Conservation Concern in Ireland 2014-2019 (2014 update)
EC Birds Directive - listed in Annex 1 and as a migratory species

International importance

UK Population	% Biogeographic Population	% World Population
1,900 AON*	9.7 (ssp. *albifrons*)	2.2

*AON = Apparently Occupied Nests

The UK population figure (rounded to the nearest hundred) was derived from data in Mitchell, P.I., Newton, S.F., Ratcliffe, N. and Dunn, T.E. (eds.) 2004. *Seabird Populations of Britain and Ireland.* Poyser, London. This was also the source of figures for the Biogeographic and World populations.

UK population estimates and change 1969-2002 (census data)

Complete coverage of little tern colonies has been achieved in each national census. Site fidelity can be low from year to year, in response to predation, disturbance or habitat change. Thus, in order to gain an accurate national estimate of numbers, a simultaneous census was planned to cover all British colonies within a single year. During Seabird 2000, 93% of the population were counted in 2000, a marked improvement on the SCR Census when counts were spread over four years (13% counted in 1985, 21% in 1986, 63% in 1987 and 3% in 1988). There are no known colonies in Northern Ireland.

While the similarity in methods employed in both the SCR Census and Seabird 2000 ensures a valid comparison of their population estimates, the apparent population trend from a comparison of two such widely spaced surveys may be misleading. This is because the proportion of adult little terns choosing to nest in any one year fluctuates. Thus, more accurate trends are obtained from more frequently conducted counts (e.g. annually). Annual monitoring of little tern colonies has been conducted in Britain since 1969 with the colonies monitored currently holding about two-thirds of the national population.

	Operation Seafarer (1969-70)	**Seabird Colony Register (1985-88)**	**Seabird 2000 (1998-2002)**
UK Population estimate (AON*)	1,589	2,517	1,927
% change since previous census	n/a	+58	-23

*AON = Apparently Occupied Nests

For census results for individual countries and Ireland, the Channel Islands and the Isle of Man see under relevant sections below.

Distribution/abundance

The Seabird 2000 census provides the most comprehensive recent assessment of the distribution and abundance of breeding seabirds. Numbers found in different regions, and a map showing the location and size of colonies, is provided in the Seabird 2000 little tern results page.

The locations sampled during the annual Seabird Monitoring Programme provide some information on distribution and are accessible via the Seabird Monitoring Programme online database.

Annual abundance and productivity by geographical area

With reference to the regional accounts below please note the following.

Breeding abundance: graphs of abundance index with 95% CLs are only shown for a region where the trend produced has been deemed accurate (see methods of analysis). Where a trend was thought to be inaccurate, graphs of abundance at major colonies in a region may be shown instead, particularly if such colonies hold greater than 10% of the regional population, are monitored frequently and may thus help illustrate regional population fluctuations outwith national censuses. Occasionally, too few data have been collected regionally to produce either of these.

Productivity: graphs of productivity are only shown if analysis of productivity data produced a significant result for regional and/or year effects (again see methods of analysis). If results were not significant, then a regional mean productivity value is given. However, on some occasions too few data are available from which to provide a meaningful average. Furthermore, for 11 species where the quality of monitoring data available was considered high, population viability analysis was undertaken at the UK level and the results of this are also reported.

United Kingdom

Breeding abundance

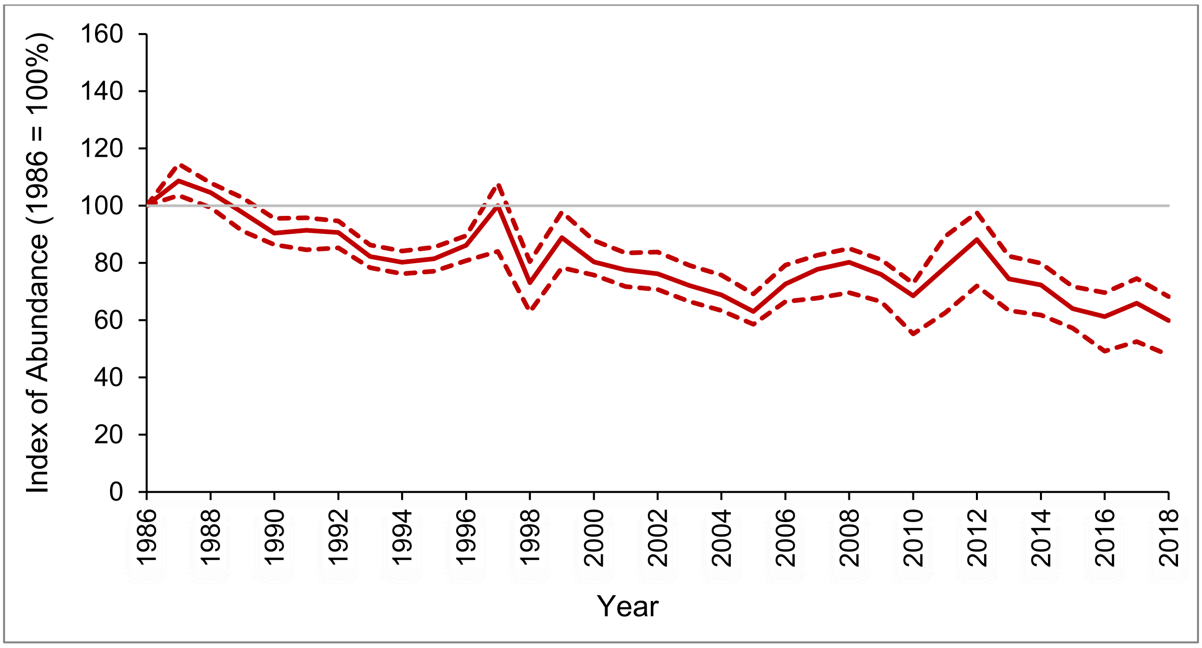

Figure 1. Trend in UK abundance index (solid line) of little tern 1986-2018 with 95% confidence limits (dotted lines). Based on SMP data; view the methods of analysis.

Figure 1 shows that little tern abundance generally declined after the late 1980s through to 2005 but then increased, showing signs of a partial recovery until 2012. In 2018, however, the index was 40% below the baseline, the lowest value ever recorded since 1986. Prior to the period shown above, little tern abundance had been in decline since the mid 1970s[1], following increases during the early 1970s. The decline in numbers since 1986 has coincided with low productivity (see below), which is likely to have contributed to the decrease in abundance via low rates of recruitment into the breeding population.

Productivity

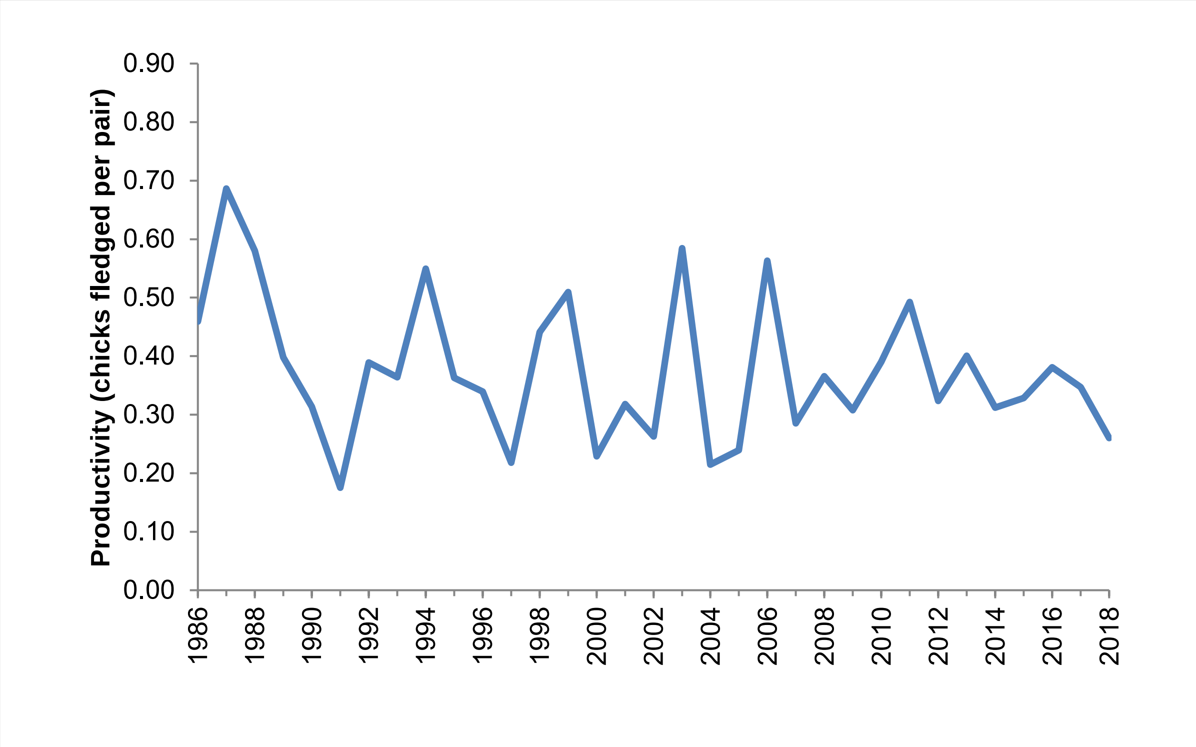

Figure 2. Trend in UK productivity (no. of chicks fledged per pair) of little tern 1986-2018. Based on SMP data; view the methods of analysis.

The productivity of little terns has been relatively low throughout the recording period, although with a great deal of annual fluctuation since the lowest value was recorded in 1991. These low levels of productivity are insufficient to maintain the population by recruitment alone. Simple population models, incorporating annual productivity estimates with constant values for adult survival and age at first breeding, have predicted the observed decline in population size reasonably accurately[2]. Factors contributing to this low productivity include predation of chicks and eggs by foxes *Vulpes Vulpes*, kestrels *Falco tinnunculus* and corvids; nest loss due to bad weather; food shortage; and, most significantly, disturbance by humans. Most little terns nest along the east and south coasts of England, adjacent to some of the most densely populated areas of Britain, although many sites are now guarded in an attempt to limit disturbance. As little terns nest on low-lying ground close to the high water mark, their nests are vulnerable to erosion and tidal inundation, hence much work has been done on site management seeking to provide nesting areas safe from tidal inundation. Predictions of increased storminess and sea-level change under climate change scenarios may lead to increased prevalence of such events, although managed realignment[3] of coastal defences may create new opportunities for nesting.

Analysis of the SMP dataset found mean little tern productivity to be relatively stable at around 0.51 chicks per nest per year between 1986 and 2008[4]. The quality of the dataset indicated that a fall of 10% or less in productivity may not be detected, although a change in success of 25% or more would be detected with confidence. At this rate of productivity, using available life history information (population size, clutch size, age at first breeding and survival rates of different age classes) to parameterise population viability analysis, it is predicted that the population will decline by 41% over 25 years. If productivity were to increase to 0.70, population decline would be averted, and the population would stabilise.

Scotland

Population estimates and change 1969-2002 (census data)

	Operation Seafarer (1969-70)	Seabird Colony Register (1985-88)	Seabird 2000 (1998-2002)
Population estimate (AON*)	308	373	331
% change since previous census	n/a	+17	-11

* AON = Apparently Occupied Nests

Breeding abundance

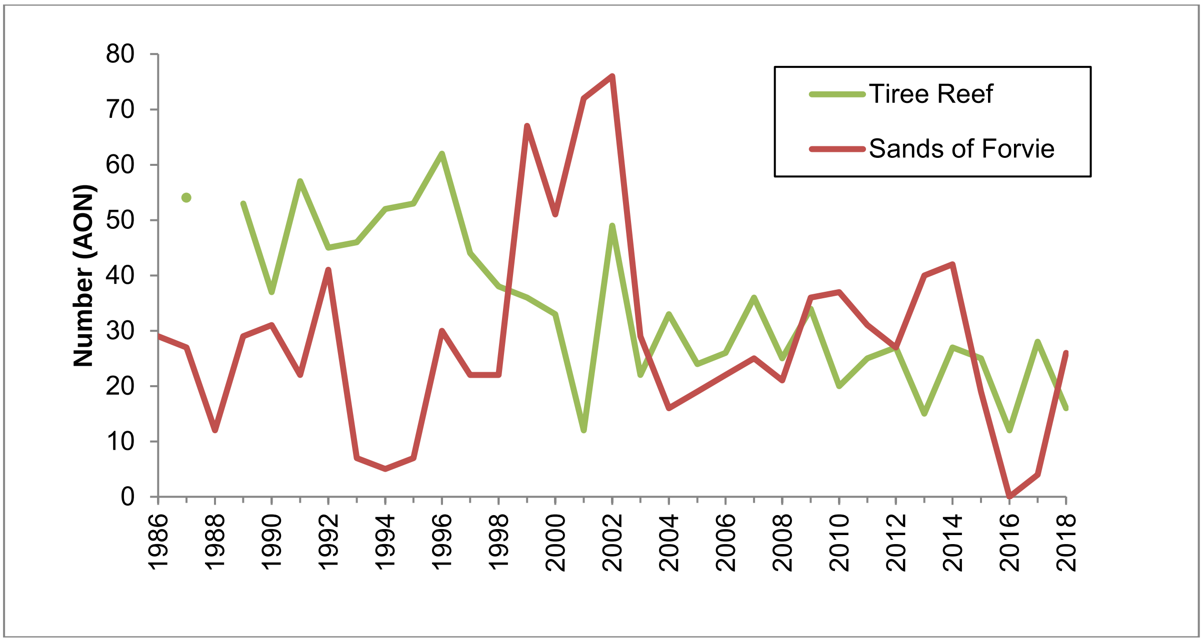

Figure 3. Trend in abundance of little tern at two major Scottish colonies, 1986-2018.

The Scottish little tern population increased between Operation Seafarer and the Seabird Colony Register but had fallen again by the Seabird 2000 census. The few colonies surveyed each year do not, however, allow for an accurate population trend to be generated. Data shown above for two of the largest, and most frequently monitored, colonies indicate contrasting fortunes since Seabird 2000. Numbers at Sands of Forvie are similar to when monitoring began in 1986, whereas at Tiree Reef numbers have been more stable although may now be in decline, with low numbers recorded there in 2001, 2003, 2010, 2013, 2016 and also in 2018. At Sands of Forvie, an electric fence kept out the majority of ground predators, such as Foxes *Vulpes vulpes* and Badgers *Meles meles*, however, little terns failed to breed in 2016. The reasons for this are unclear, although poor spring weather and constant sandblow over the nesting habitat may have been a contributing factor[5].

Productivity

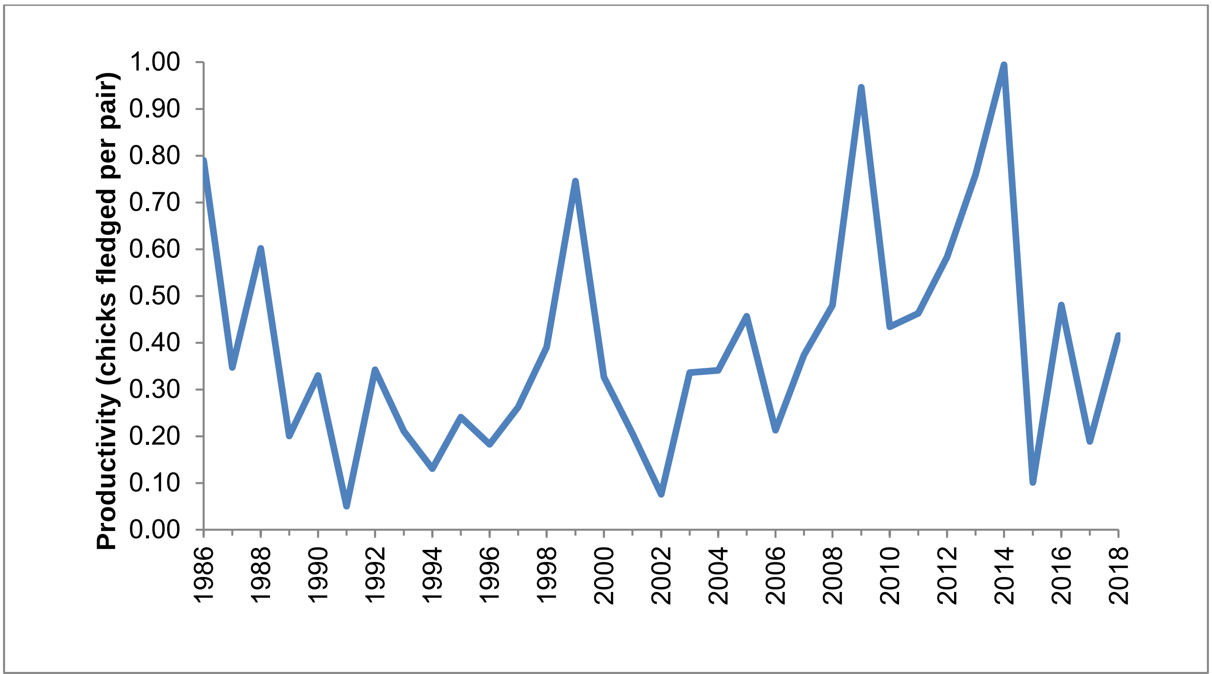

Figure 4. Trend in productivity (no. of chicks fledged per pair) of little tern in Scotland, 1986-2018. Based on SMP data; view the methods of analysis.

Aside from obvious peaks in 1999, 2009 and 2014, little tern productivity at Scottish colonies tends to be rather low and in line with that recorded in England. This low productivity is due to a variety of factors such as predation, poor weather, disturbance and tidal inundation and may be too low to sustain the population without emigration from colonies from other countries. In 2014, little terns had a very productive breeding season while in 2015 productivity fell to the third lowest value recorded. Out of 13 colonies that reported productivity in 2015 only three bred successfully, producing a total of 15 chicks (cf 116 chicks in 2014). Since then, productivity has been fluctuating with only 3-5 colonies breeding in Scotland between 2016 and 2018[3,,5]. At The Reef RSPB reserve, productivity ranged from 0 to 0.25 between 2016 to 2018 with birds failing to breed in 2016. Here, heavy rain associated with Storm Hugo in mid-June 2018 saw most nests being flooded and failing at the egg/early chick phase with only 0.13 chicks fledged per pair. At Sands of Forvie in 2015 and 2017, all chicks failed at egg stage, due to a combination of poor weather and avian predation[3,5]. Productivity of little tern at Sands of Forvie improved again in 2018, when 0.50 chicks fledged.

England

Population estimates and change 1969-2002 (census data)

	Operation Seafarer (1969-70)	Seabird Colony Register (1985-88)	Seabird 2000 (1998-2002)
Population estimate (AON*)	1,247	2,087	1,521

	Operation Seafarer (1969-70)	Seabird Colony Register (1985-88)	Seabird 2000 (1998-2002)
% change since previous census	n/a	+67	-27

* AON = Apparently Occupied Nests

Breeding abundance

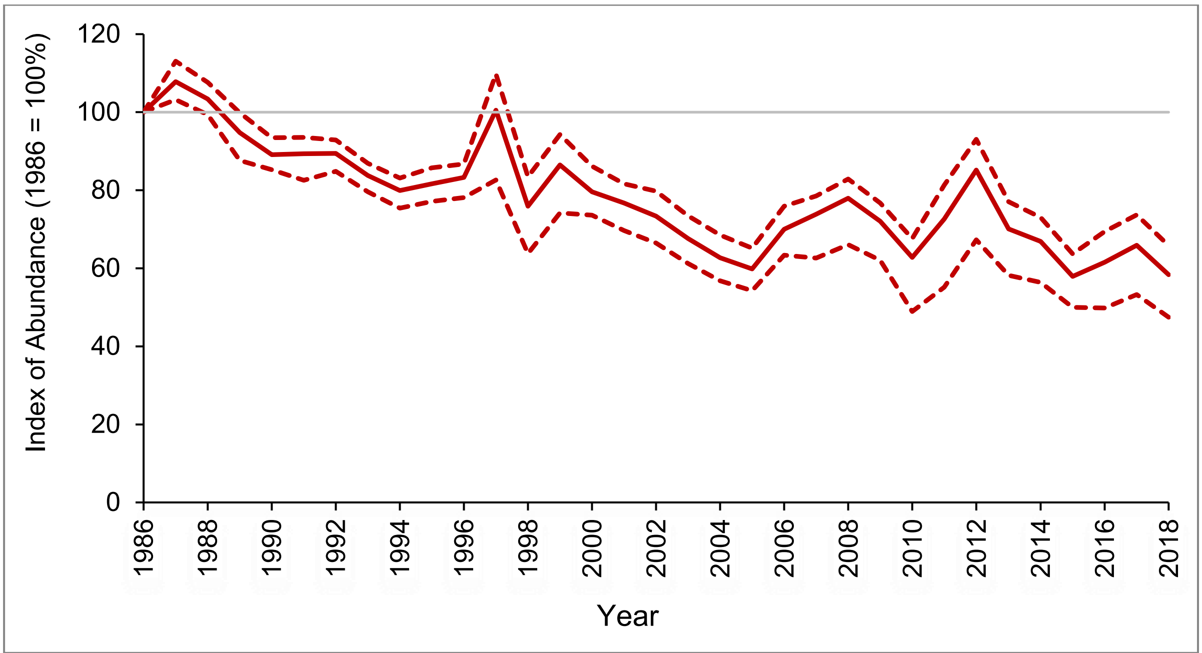

Figure 5. Trend in abundance index (solid line) of little tern in England, 1986-2018 with 95% confidence limits (dotted lines). Based on SMP data; view the methods of analysis.

The trend shown for the UK closely matches that shown for England, where the majority of data have been collected over the years. The declining trend for little terns in England, visible since 1987, has been partially halted in recent years, no doubt through targeted management with many colonies now benefiting from some form of guarding, e.g. fencing, trapping, signage, surveillance and public relations. Prior to this, a large increase, of 67%, had occurred between Operation Seafarer and the Seabird Colony Register. Currently, the total population is below that recorded during Seabird 2000 (1,521 AON), with 981, 1,028 and 928 AON recorded in 2016, 2017 and 2018, respectively, although data are not submitted to the SMP for all colonies.

Productivity

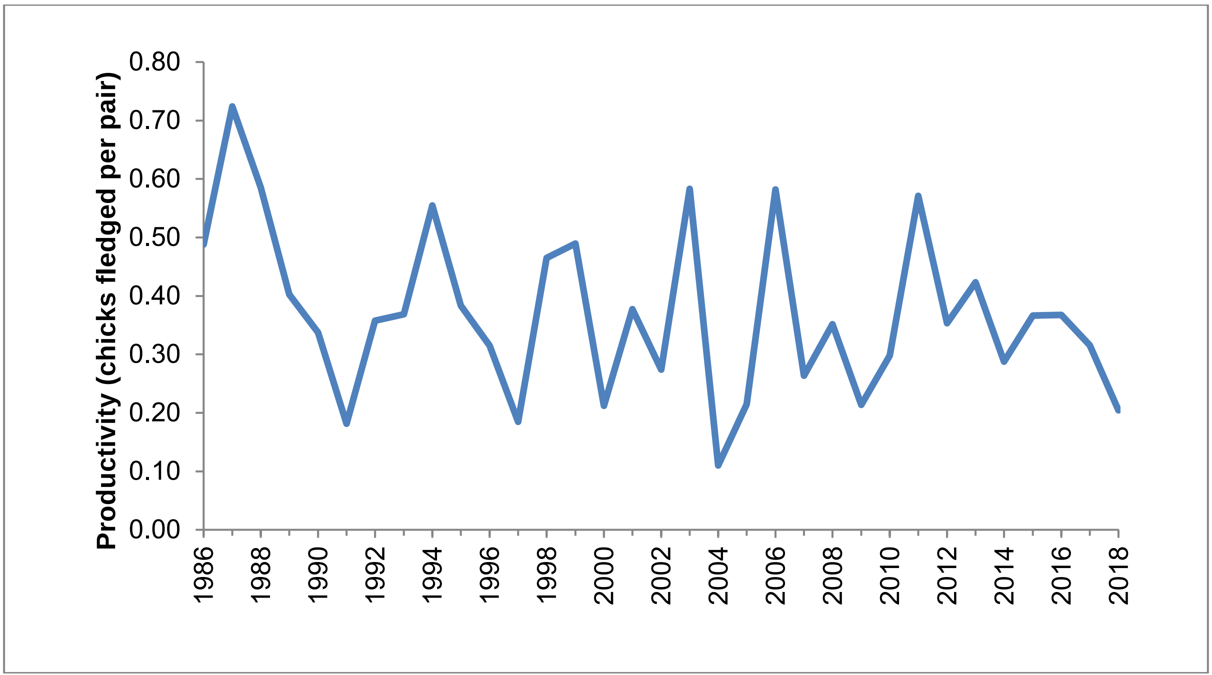

Figure 6. Trend in productivity (no. of chicks fledged per pair) of little tern in England, 1986-2018. Based on SMP data; view the methods of analysis.

Productivity recorded at English colonies has also fluctuated markedly over the years but generally lies between 0.30-0.50 chicks fledged per pair per year; a fairly low value compared to e.g. Wales. As with Scotland, this level of productivity is probably insufficient to sustain population levels, and probably contributes to the decline in the abundance trend. Data from monitored colonies illustrate just how disastrous recent breeding seasons have been. In 2015, 45 colonies were visited but 19 of these held no breeding little terns and a further five failed completely. During April and May 2015, little terns encountered cool and windy weather as well as a lack of suitable small fish[6]. In common with other years, the reasons for failure were high tides, poor weather, disturbance; and predation of eggs, chicks and adults by mammals and other birds. Between 2016 to 2018, data were received from 32 colonies of which 7, 10 and 10 respectively did not hold any breeding little terns and a further 8, 6 and 6 colonies respectively failed completely.

Wales

Population estimates and change 1969-2002 (census data)

	Operation Seafarer (1969-70)	**Seabird Colony Register (1985-88)**	**Seabird 2000 (1998-2002)**
Population estimate (AON*)	28	55	75
% change since previous census	n/a	+96	+36

* AON = Apparently Occupied Nests

Breeding abundance

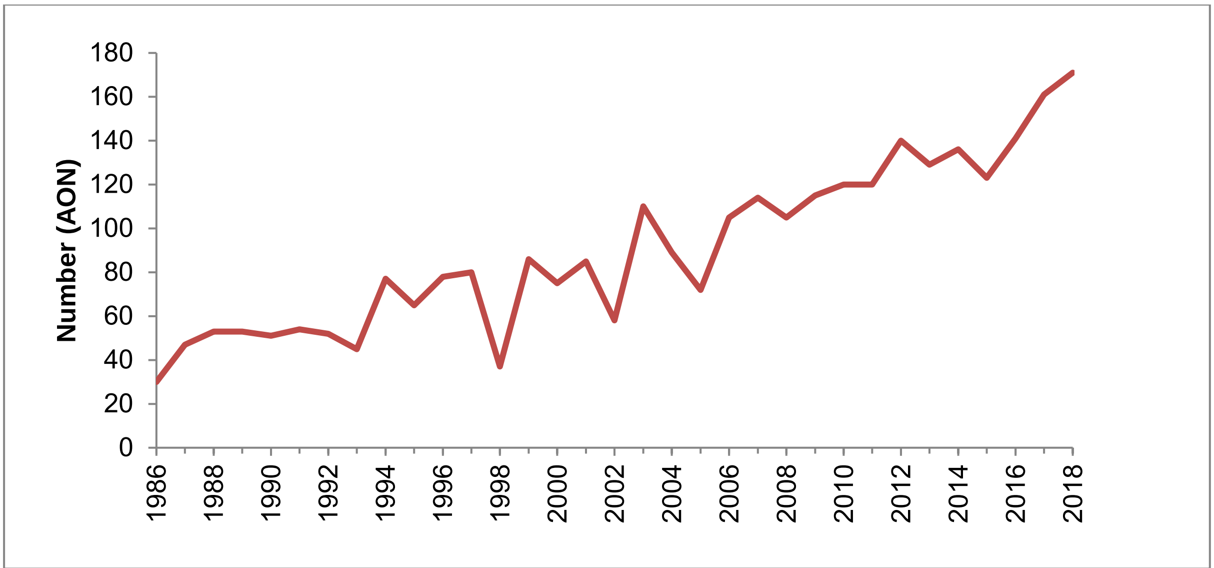

Figure 7. Abundance of little terns at Gronant, 1986-2018.

Although the population of little terns in Wales increased between each of the national censuses, the number of colonies since Seabird 2000 has declined to only two. At Gronant, numbers have fluctuated over the years, but the general trend is upward over time, possibly due to recent successful breeding seasons and subsequent increased recruitment into the colony. In recent years, the colony has consistently held four times the number of pairs it did in 1986. In 2015, numbers at Gronant were slightly below the 2014 figure at 136 AON, with one pair breeding at Point of Ayr (<4km to the East). Numbers at Gronant decreased in 2015 to 123 AON, however, since then they have increased to 171 AON in 2018.

Productivity

At Gronant, an average of 1.00 chicks per pair were fledged each year between 1986 and 2018. Peaks in productivity were recorded in 1992, 2003, 2004 and 2010, all ranging between 1.78 and 1.92. In 2015, productivity was just above the average at 0.80, with 99 chicks fledged from 123 pairs. In addition, two chicks also fledged at Ary of Point, which was the first time for Wales in over 25 years that both sites bred successfully. The 2016 breeding season was an excellent, with Gronant producing a total of 170 chicks fledged from 141 pairs. This was followed by another productive season in 2017 when 202 chicks fledged from 161 pairs, taking productivity above 1.20 for the first time since 2010. In 2018, less chicks fledged and, therefore, productivity reduced to 1.12 chicks fledged per little tern pair.

Northern Ireland

Population estimates and change 1969-2002 (census data)

	Operation Seafarer (1969-70)	Seabird Colony Register (1985-88)	Seabird 2000 (1998-2002)
Population estimate (AON*)	6	2	0
% change since previous census	n/a	-67	-100

* AON = Apparently Occupied Nests

Breeding abundance

Six AON were recorded during Operation Seafarer, declining to two AON by the time of the Seabird Colony Register with none recorded during Seabird 2000. No little terns have been recorded breeding in Northern Ireland since then.

Productivity

No systematic data on the productivity of little terns in Northern Ireland were submitted to the SMP before the species ceased to breed in the country.

Republic of Ireland

Population estimates and change 1969-2018 (census data)

	Operation Seafarer (1969-70)	Seabird Colony Register (1984-85)	Seabird 2000 (1998-2002)	Republic of Ireland Census (2015-18)
Population estimate (AON*)	309	280	206	388
% change since previous census	n/a	-9	-26	+39

* AON = Apparently Occupied Nests

Breeding abundance

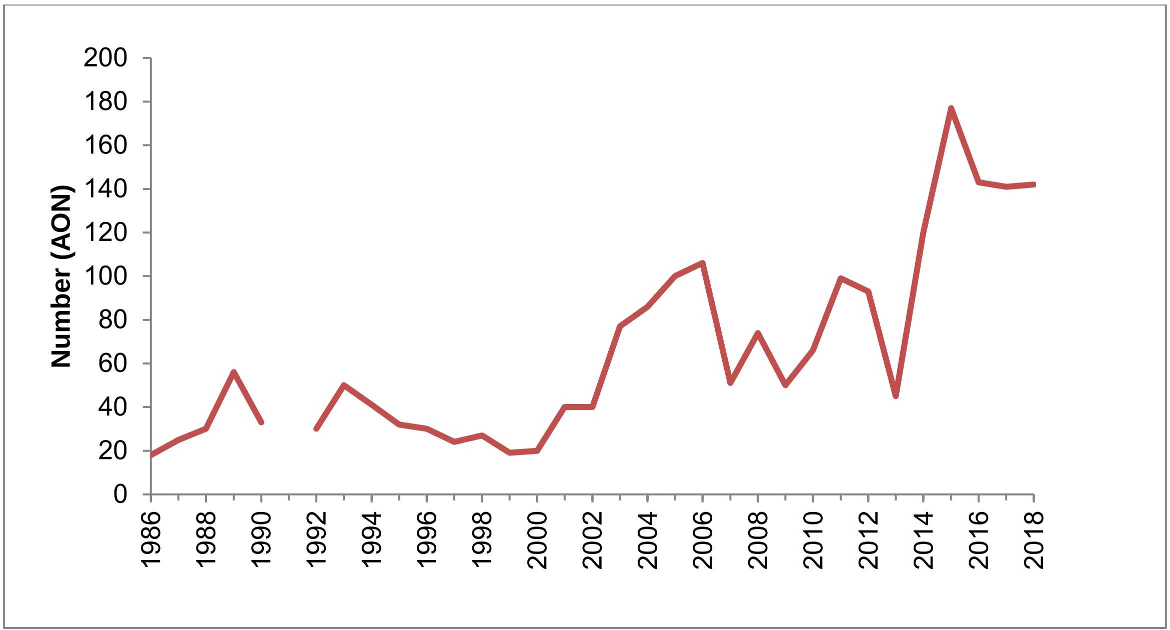

Figure 8. Abundance of little terns at Kilcoole, 1986-2018.

The little tern population in the Republic of Ireland declined 33% between the Operation Seafarer and Seabird 2000 censuses. While guarding colonies has succeeded in halting the population decline of little terns, their reduction in range has continued. Their vulnerability to disturbance has seen a shift towards fewer, larger colonies in areas where they are free from human disturbance, mostly in fenced off areas or on offshore islands[3]. Since the SCR, only the colony at Kilcoole, which accounts for over one third of the national population, has been monitored regularly (Figure 8). Numbers there trebled from 18 to 56, immediately after the Seabird Colony Register census but had declined again to 20 AON by Seabird 2000. In 2018, Kilcoole had increased again to 142 AON reflecting the recent Republic of Ireland Seabird Census which recorded 388 little tern AON, an increase of 123% compared to Seabird 2000[7].

Productivity

There has been no statistically significant difference in little tern productivity in the Republic of Ireland since monitoring began with an average of 0.46 chicks fledged per pair between 1986 and 2015. 2013 and 2014 were successful breeding seasons, although in 2015 little tern colonies were affected by predation and inclement weather. In 2018, Kilcoole fledged 1.17 chicks per pair after surges associated with Storm Hector destroyed 45 nests. However, many of these pairs re-laid and successfully reared late chicks through to fledging[8]. For the first time in three years, little terns bred again at Baltray in 2018, fledging 0.75 chicks per pair[9].

All Ireland

Population estimates and change 1969-2002 (census data)

	Operation Seafarer (1969-70)	Seabird Colony Register (1985-88)	Seabird 2000 (1998-2002)
Population estimate (AON*)	315	282	206
% change since previous census	n/a	-10	-27

* AON = Apparently Occupied Nests

Breeding abundance

Little terns only breed in the Republic of Ireland, so all data and text presented for that country is also pertinent to the situation for the whole of Ireland.

Productivity

Little terns only breed in the Republic of Ireland, so all data and text presented for that country is also pertinent to the situation for the whole of Ireland.

Isle of Man

Population estimates and change 1969-2018 (census data)

	Operation Seafarer (1969-70)	Seabird Colony Register (1984-85)	Seabird 2000 (1998-2002)	Isle of Man Census (2017-18)
Population estimate (AON*)	19	60	20	28
% change since previous census	n/a	+275	-67	+40

* AON = Apparently Occupied Nests

Breeding abundance

The Isle of Man little tern population has never been large, with only 19 AON known at the time of Operation Seafarer. Three times as many were present during the Seabird Colony Register, with the peak count of 94 AON occurring shortly after this in 1988, although this had fallen to 20 AON by Seabird 2000. In 2013, trapping of nesting adults resulted in four controls which had fledged as juveniles in 2010; three from other colonies around the Irish Sea and one from a colony on the east coast of Scotland. Immigration may, therefore, be one factor driving the increase in numbers at this colony. A seabird census of the Isle of

Man between 2017-18 recorded 28 AON, a 40% increase compared to the number counted during Seabird 2000[10].

Productivity

Few systematic data on the productivity of little terns on the Isle of Man have been collected as part of the SMP.

Channel Islands

Little terns do not breed on the Channel Islands.

UK phenology, diet, survival rates

No data have been collected as part of the Seabird Monitoring Programme.

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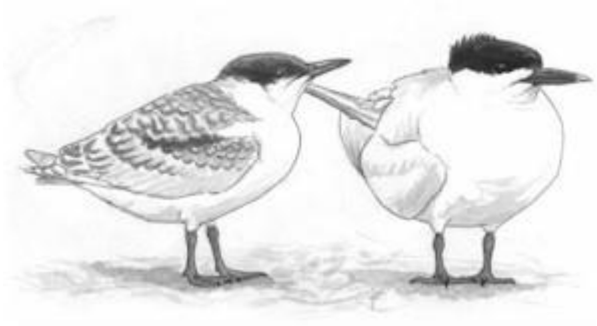
Sandwich Tern *Sterna sandvicensis*

Description



The following has been adapted from original text by Norman Ratcliffe in Seabird Populations of Britain and Ireland (with permission from A&C Black, London).

Sandwich terns exhibit the most erratic population trends and distribution of any seabird breeding in the UK. The population fluctuates dramatically among years due to large variations in the proportion of mature birds attempting to breed and distribution varies owing to mass movements between colonies. The species is distributed widely but patchily around the coasts of the British Isles, broadly reflecting the availability of favoured nesting habitat: low-lying offshore islands, islets in bays or brackish lagoons, spits or remote mainland dunes. Despite frequent changes in the sites used, the broad distribution in the UK has changed little over the last 30 years. Sandwich terns are among the most gregarious of all seabirds, with the population confined to a small number of relatively large colonies in which birds nest at very high densities.

Tern populations in NW Europe were brought to the brink of extirpation at the end of the 19th century by egg collection for food and hunting of adults for the millinery trade, but recovered in response to protective legislation in the early 20th century. Sandwich terns in the UK increased from the 1920s to the mid-1980s, with protection from increasing recreational disturbance on beaches as well as from persecution probably facilitating this recovery. Annual counts of the main colonies demonstrated that there was a sustained increase between the first two national surveys, but that the population fluctuated erratically around this trend.

Conservation status

Sandwich tern is currently identified as a conservation priority in the following:

Amber listed in Birds of Conservation Concern 4 (2015 update)
(further information on Conservation Designations for UK Taxa)
Amber listed in Birds of Conservation Concern in Ireland 2014-2019 (2014 update)
EC Birds Directive - listed in Annex 1 and as a migratory species

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International importance

UK Population	% Biogeographic Population	% World Population
12,500 AON*	16.9 (ssp. *sandvicensis*)	9.6

*AON = Apparently Occupied Nests

The UK population figure (rounded to the nearest hundred) was derived from data in Mitchell, P.I., Newton, S.F., Ratcliffe, N. and Dunn, T.E. (eds.) 2004. *Seabird Populations of Britain and Ireland.* Poyser, London. This was also the source of figures for the Biogeographic and World populations.

UK population estimates and change 1969-2002 (census data)

Coverage of Sandwich tern colonies was comprehensive during all three of the national surveys, and so long-term trends will be real rather than artifacts of survey coverage. However, the size of the breeding population fluctuates erratically from year to year so trends based on comparison of two widely spaced surveys must therefore be viewed with caution, since one of them may have coincided with a year of temporarily depressed population size. Because whole colonies may move site within a year or two in response to changing conditions, such movements have the potential to produce severe bias in national population estimates that rely on summing counts from colonies surveyed in different years. To minimise this, all Sandwich tern colonies in the UK (except for one) were surveyed in 2000. During the SCR census, counts of colonies within regions were often taken from different years so, if colonies moved, some pairs may have been double counted and others omitted.

	Operation Seafarer (1969-70)	Seabird Colony Register (1985-88)	Seabird 2000 (2000-2001)
UK Population estimate (AON*)	11,068	14,766	12,490
% change since previous census	n/a	+33	-15

*AON = Apparently Occupied Nests

For census results for individual countries and Ireland, the Channel Islands and the Isle of Man, see under relevant sections below.

Distribution/abundance

The Seabird 2000 census provides the most comprehensive recent assessment of the distribution and abundance of breeding seabirds. Numbers found in different regions, and a map showing the location and size of colonies, is provided in the Seabird 2000 Sandwich tern results pages.

The locations sampled during the annual Seabird Monitoring Programme provide some information on distribution and are accessible via the Seabird Monitoring Programme online database.

Annual abundance and productivity by geographical area

With reference to the regional accounts below please note the following.

Breeding abundance: graphs of abundance index with 95% confidence limits are only shown for a region where the trend produced has been deemed accurate (see methods of analysis). Where a trend was thought to be inaccurate, graphs of abundance at major colonies in a region may be shown instead, particularly if such colonies hold greater than 10% of the regional population, are monitored frequently and may thus help illustrate regional population fluctuations outwith national censuses. Occasionally, too few data have been collected regionally to produce either of these.

Productivity: graphs of productivity are only shown if analysis of productivity data produced a significant result for regional and/or year effects (again see methods of analysis). If results were not significant, then a regional mean productivity value is given. However, on some occasions too few data are available from which to provide a meaningful average. Furthermore, for 11 species where the quality of monitoring data available was considered high, population viability analysis was undertaken at the UK level and the results of this are also reported.

United Kingdom

Breeding abundance

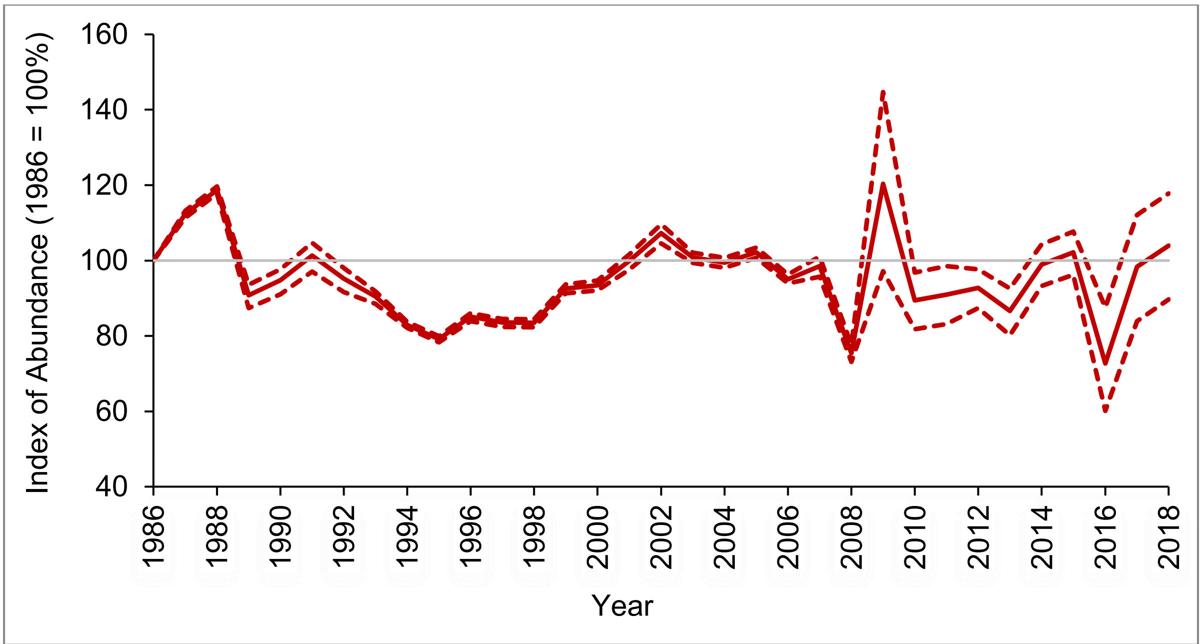

Figure 1. Trend in UK abundance index (solid line) of Sandwich tern 1986-2018 with 95% confidence limits (dotted lines). Based on SMP data; view the methods of analysis.

Between censuses in 1969-70 and 1985-88, the United Kingdom population increased from 10,500 pairs to 14,800, probably as a result of increased legal protection, helping to reduce disturbance from recreation. The breeding abundance of Sandwich terns in the UK declined from 20% above the 1986 baseline in 1988 to 20% below in 1995. It then increased to 8% above the baseline in 2002 and then fluctuated considerably until 2015 when it was at the same level as 1986. In 2016, the index decreased to 23% below the baseline but increased again to 4% above in 2018. The spike in the index in 2009 is due to an influx of Sandwich terns, apparently from continental Europe, nesting at Minsmere (Suffolk); 550 AON were recorded there in 2009, compared to only one pair the year before and none several years before and after 2009. Sandwich terns are increasing again at Minsmere with 1 AON counted in 2014 and 32 AON in 2018.

Productivity

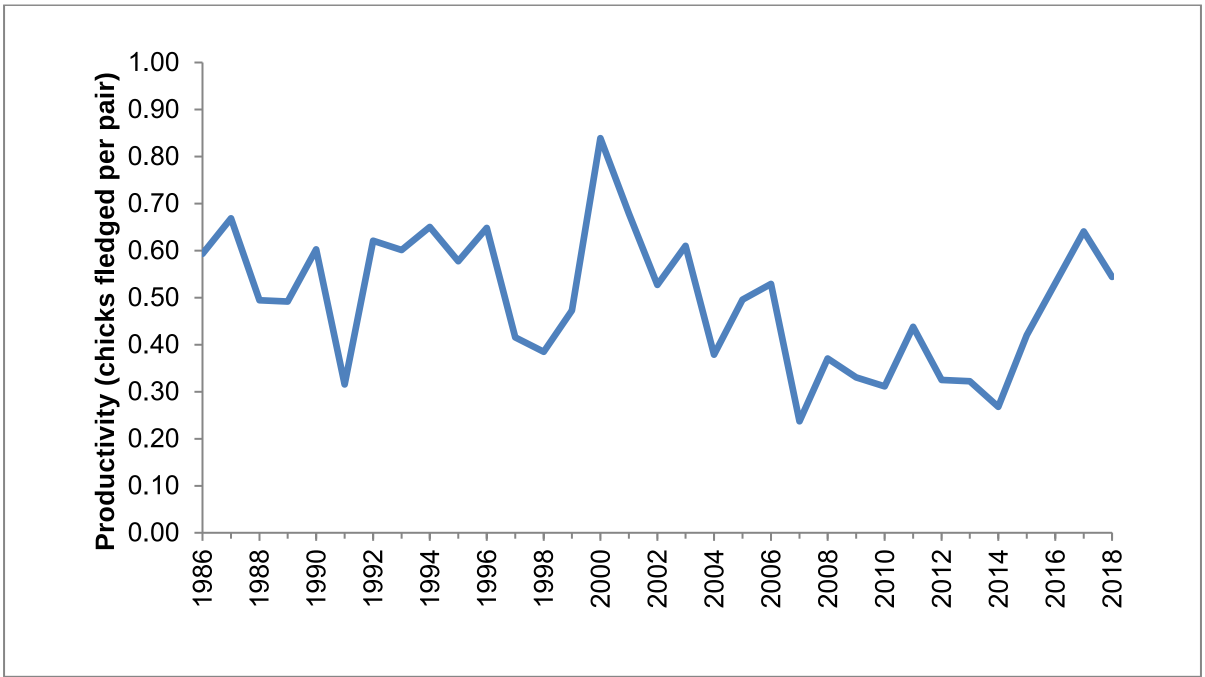

Figure 2. Trend in UK productivity (no. of chicks fledged per pair) of Sandwich tern 1986-2018. Based on SMP data; view the methods of analysis.

A marked decline in productivity is obvious since 2000 when Sandwich terns fledged a record number of chicks. In the 14 years prior to 2000 it could be argued that productivity showed no clear trend, although in 1991 and between 1997 and 1999 it was low. Few chicks fledged in these years due to bad weather, predation and disturbance by a variety of mammals and gulls; food shortage was implicated at only one colony. Predation on eggs and chicks by foxes *Vulpes vulpes* is probably the most prevalent factor determining productivity, and abandonment of a colony is often the result of predation[1]. Fox populations are thought to have increased during the past few decades due to less intensive management by gamekeepers. Nature reserve managers use electric fences to exclude foxes but these are not always successful. As Sandwich terns nest on low-lying ground close to the tide edge, their nests are also vulnerable to tidal inundation; predictions of increased storminess and sea-level change under climate change scenarios may lead to increased prevalence of such events.

Analysis of the SMP dataset found productivity of Sandwich terns averaged 0.66 chicks per nest per year between 1986 and 2008 and remained relatively stable[2]. The quality of the dataset meant any change of 10% or more could be detected with confidence. Using existing life history information (population size, clutch size, age at first breeding and survival rates of different age classes) to parameterise population viability analysis, it was predicted that, if this level of breeding performance were to remain unchanged, the population of Sandwich terns would decline by 62% over 25 years. Such a decline could be averted, and the population could be stabilised, if productivity rose to 1.10. In 2018, average UK productivity was 0.54 chicks fledged per pair.

Scotland

Population estimates and change 1969-2002 (census data)

	Operation Seafarer (1969-70)	Seabird Colony Register (1985-88)	Seabird 2000 (1998-2002)
Population estimate (AON*)	2,465	2,286	1,068
% change since previous census	n/a	-7	-53

* AON = Apparently Occupied Nests

Breeding abundance

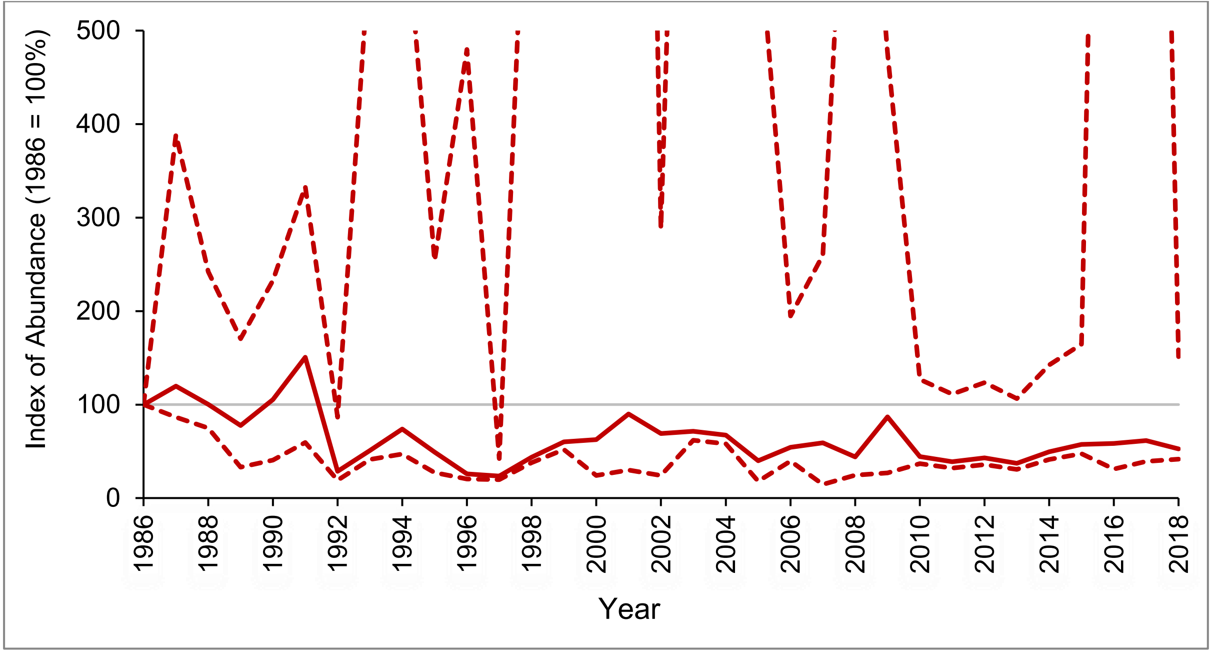

Figure 3. Trend in abundance index (solid line) of Sandwich tern in Scotland, 1986-2018 with 95% confidence limits (dotted lines; drawing of upper limit restricted to preserve detail in the abundance index). Based on SMP data; view the methods of analysis.

The Scottish population of Sandwich terns changed little between the national censuses in 1969-70 and 1985-88 but a large decline then occurred as numbers fell by 53% by the Seabird 2000 census. The majority of the Scottish population nest at the Sands of Forvie, a well monitored colony, which held almost half of Scotland's Sandwich terns during Seabird 2000. The trend between 1987 and 1998 is largely governed by the decline observed at

Sands of Forvie, caused by several years of fox predation[3]. Since 1999, numbers have increase at Sands of Forvie, fluctuating between 1,315 and 565 AON. However, other large colonies became extinct during this period, most by the mid to late 1990s (e.g. Loch of Strathbeg, Inchmickery and McDermott's), while at others (e.g. Long Craig and Isle of May) nesting became sporadic. Gulls extirpated the colony on Inchmickery but causes of decline or extinction have not been ascertained for other colonies. In 2018, the index was 47% below the 1986 baseline.

Productivity

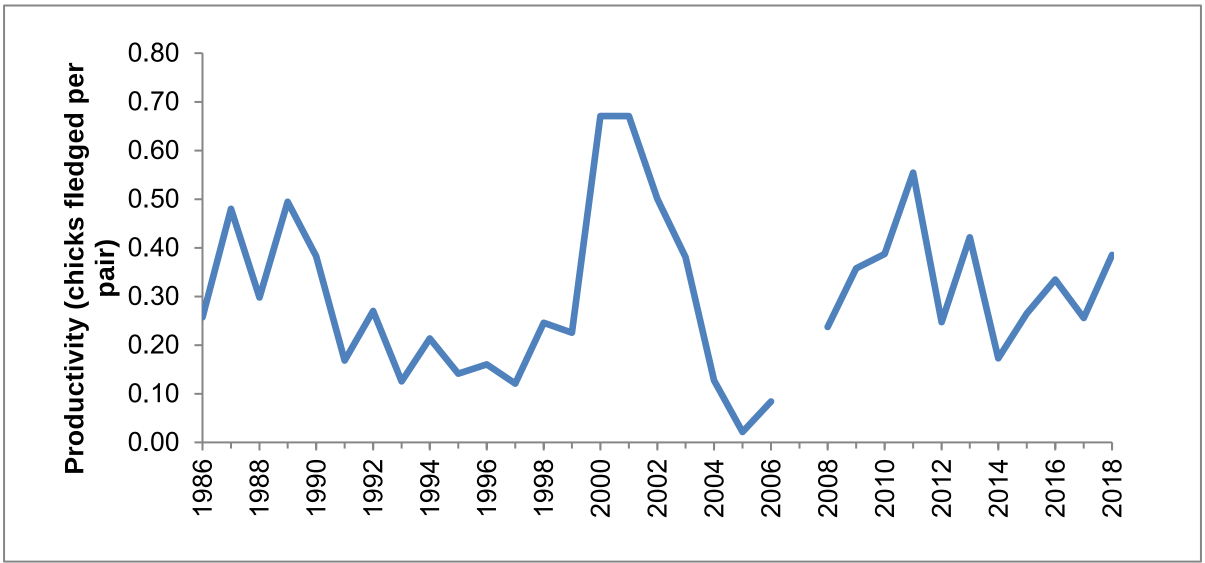

Figure 4. Trend in productivity (no. of chicks fledged per pair) of Sandwich tern in Scotland, 1986-2018. Based on SMP data; view the methods of analysis.

The productivity of Sandwich terns at colonies monitored in Scotland has fluctuated considerably since recording began. 2000 and 2001 were the only years on record with relatively high levels of productivity, with the average being 0.67 chicks fledged per pair. In 2018, Sandwich terns at Sands of Forvie again occupied a breeding colony among black-headed gulls. In 2018, productivity at this colony rose slightly to 0.73 chick per pair (624 chicks from 852 pairs), the highest since 2013 when 0.80 chicks fledged per pair.

England

Population estimates and change 1969-2002 (census data)

	Operation Seafarer (1969-70)	Seabird Colony Register (1985-88)	Seabird 2000 (1998-2002)
Population estimate (AON*)	7,392	9,844	9,018
% change since previous census	n/a	+33	-8

* AON = Apparently Occupied Nests

Breeding abundance

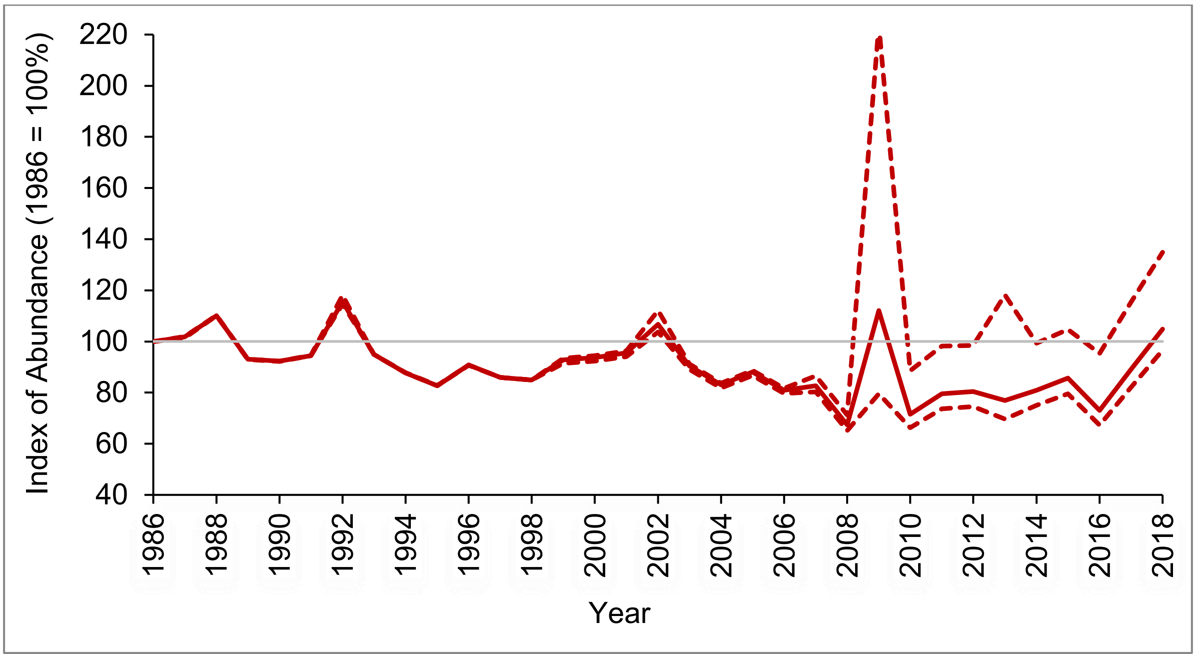

Figure 5. Trend in abundance index (solid line) of Sandwich tern in England, 1986-2018 with 95% confidence limits (dotted lines). Based on SMP data; view the methods of analysis.

In contrast to Scotland, Sandwich tern numbers in England have generally fared better, with an increase between Operation Seafarer and the Seabird Colony Register. Numbers have since been fairly stable, although between 2002 and 2008 there was evidence of a slight decline. The index spikes in 2009 when over 500 pairs nested at Minsmere, possibly as a result of birds abandoning a colony on the continent. The index declined again in 2010 but by 2018 had risen to 5% above the 1986 baseline. The Minsmere colony was abandoned in 1977 and again from 2010 to 2013, with one pair attempting to breed there in 2014 and none in 2015. Since 2016 terns are breeding there again but in very low numbers (11-32 AON). Several other sites now hold no breeding Sandwich terns (e.g. Dungeness, Foulness, Foulney, Havergate, Chichestera and North Solent). The largest colonies in England are on the Farne Islands, Coquet Island, Blakeney Point and Scolt Head where over 8,500 Sandwich terns nested in 2018. These colonies probably now hold over 70% of the English population.

Productivity

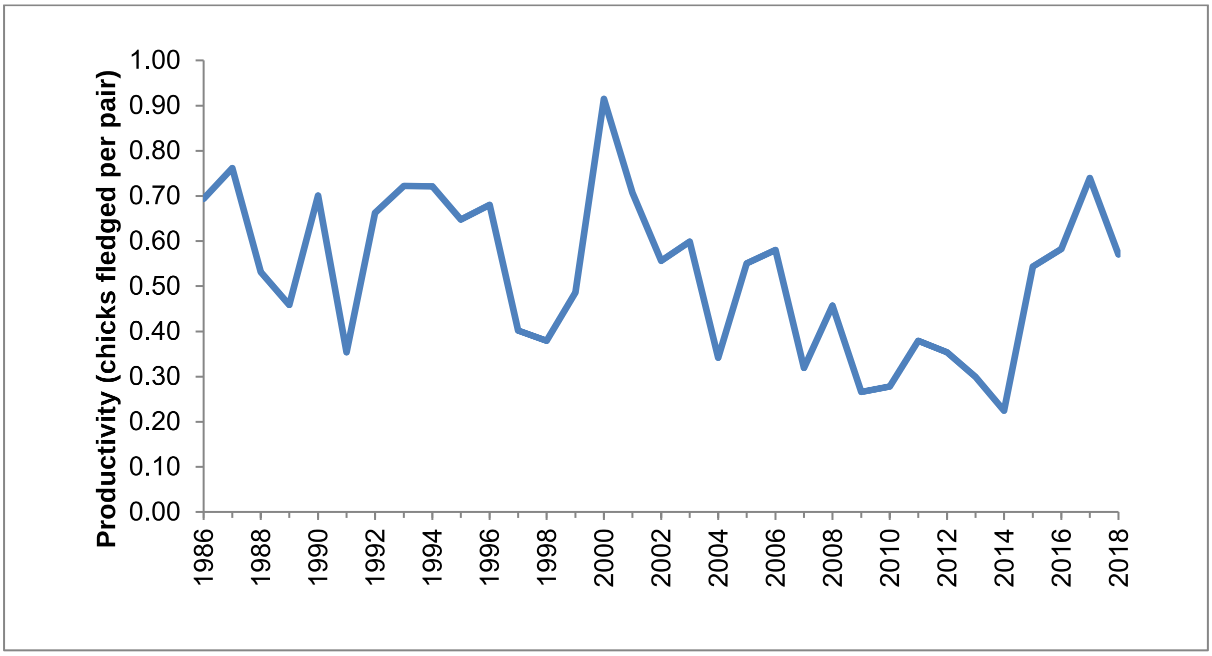

Figure 6. Trend in productivity (no. of chicks fledged per pair) of Sandwich tern in England, 1986-2018. Based on SMP data; view the methods of analysis.

Annual average productivity at English colonies is usually higher than that recorded in Scotland but is very variable due to the influences of predation and tidal inundation. However, after peak productivity was recorded in 2000 there was a downward trend culminating in very low levels of chick production in 2014. Productivity in colonies across England then increased until 2017, although declined slightly in 2018 to 0.57 chicks fledged per pair. Scolt Head Island NNR had four very successful breeding seasons, with an average of 0.87 chicks fledged per pair between 20015 and 2018. In contrast, neighbouring Blakeney Point only fledged an average of 0.13 chicks per pair across the same four years. A similar scenario happened in 2000, when all nests at Blakeney Point failed and Scolt Head showed one of the highest productivity since monitoring began in 1986.

Wales

Population estimates and change 1969-2002 (census data)

	Operation Seafarer (1969-70)	**Seabird Colony Register (1985-88)**	**Seabird 2000 (1998-2002)**
Population estimate (AON*)	0	450	450
% change since previous census	n/a	n/a	0

* AON = Apparently Occupied Nests

Breeding abundance

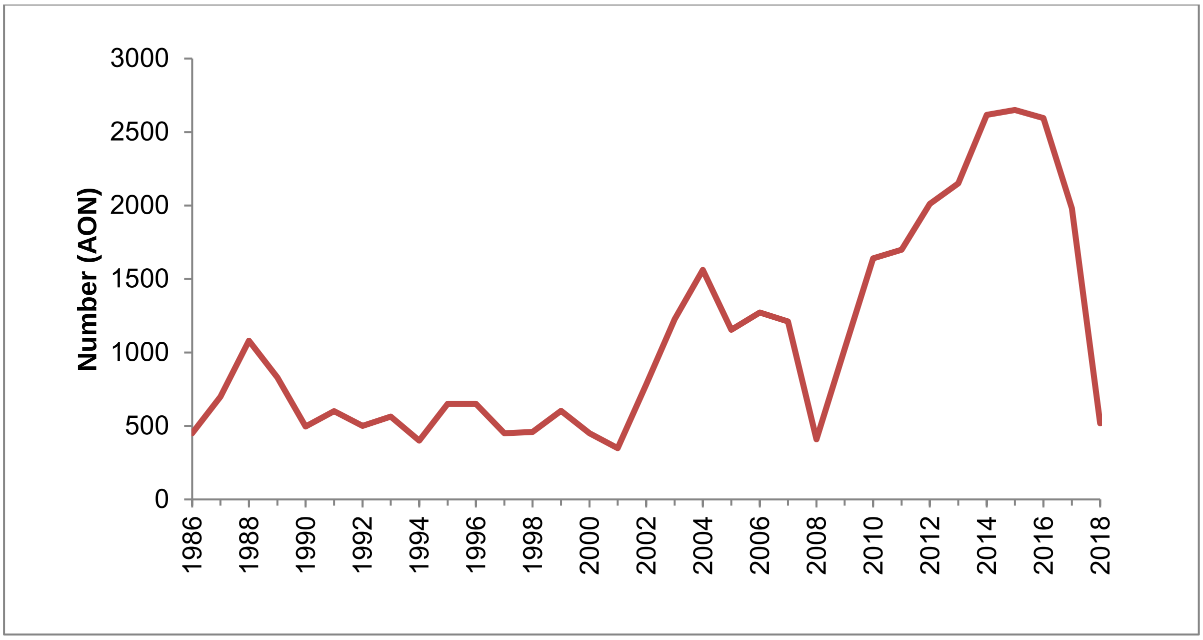

Figure 7. Abundance of Sandwich tern at Cemlyn Lagoon, 1986-2018.

Sandwich terns are confined to just one location in Wales, Cemlyn Lagoon on Anglesey. No birds were recorded there during Operation Seafarer, although there was an influx of 50 AON mid-season in 1970, which were possibly birds displaced from elsewhere. By the time of the Seabird Colony Register, 450 AON were nesting at the lagoon and, aside from a peak of short duration from 1987-1989, numbers remained relatively stable until Seabird 2000. Numbers then increased substantially from 2001 onward, with the colony regularly holding over 2,000 pairs (although only 409 pairs nested in 2008) up to a peak in 2015 (2,650 AON). The 2017 and 2018 breeding seasons have both seen a reduction in numbers, with 1980 and 519 AON being recorded respectively.

Productivity

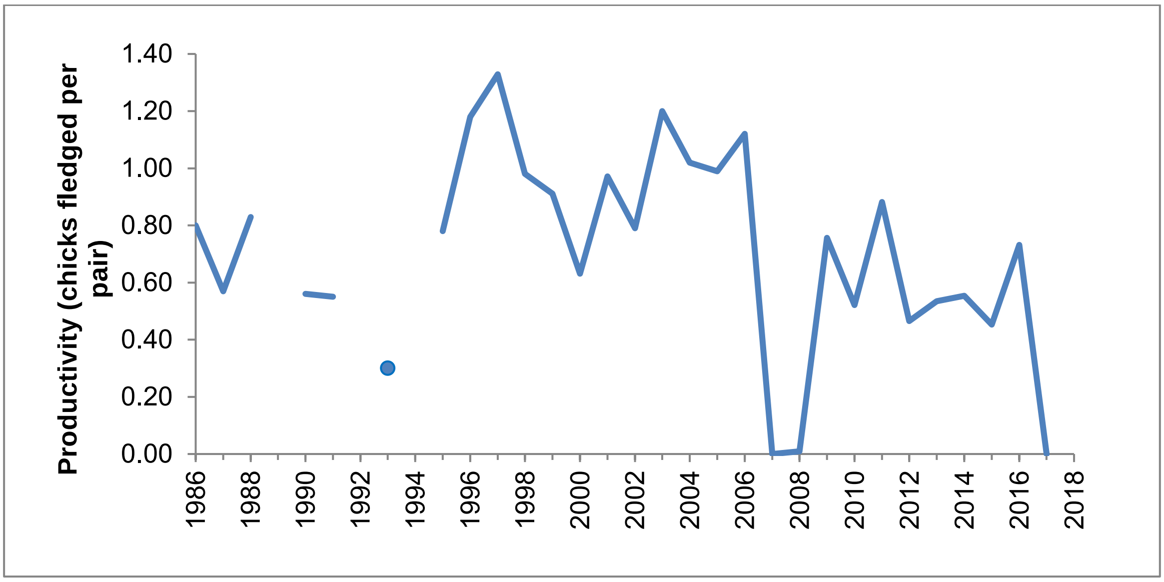

Figure 8. Trend in productivity (no. of chicks fledged per pair) of Sandwich tern at Cemlyn, Wales, 1986-2017. Based on SMP data; view the [methods of analysis](#).

Sandwich terns nesting at Cemlyn have been relatively successful compared with other British colonies, with an average of over one chick per pair being fledged in 1997, 2003 and 2006. This may explain the increased numbers nesting at the site since 2002, as young from successful breeding seasons themselves return to nest at the colony. In 2007 and 2008, there was almost complete failure with very few young fledged due to predation and desertion of nests. Between 2009 and 2017, average productivity was 0.73 chicks fledged per pair however, from 2014 to 2017 it was between 0.45 and 0.55 chicks fledged per pair. Productivity increased in 2016 to 0.73 chicks fledged per pair but declined again in 2017 with no chicks fledged from 1,980 AON, due to some predation but mostly repeated disturbance by otters *Lutra lutra* (Chris Wynne pers. comm.). In 2018, productivity was not recorded.

Northern Ireland

Population estimates and change 1969-2002 (census data)

	Operation Seafarer (1969-70)	Seabird Colony Register (1985-88)	Seabird 2000 (1998-2002)
Population estimate (AON*)	1,211	2,186	1,954
% change since previous census	n/a	+80	-11

* AON = Apparently Occupied Nests

Breeding abundance

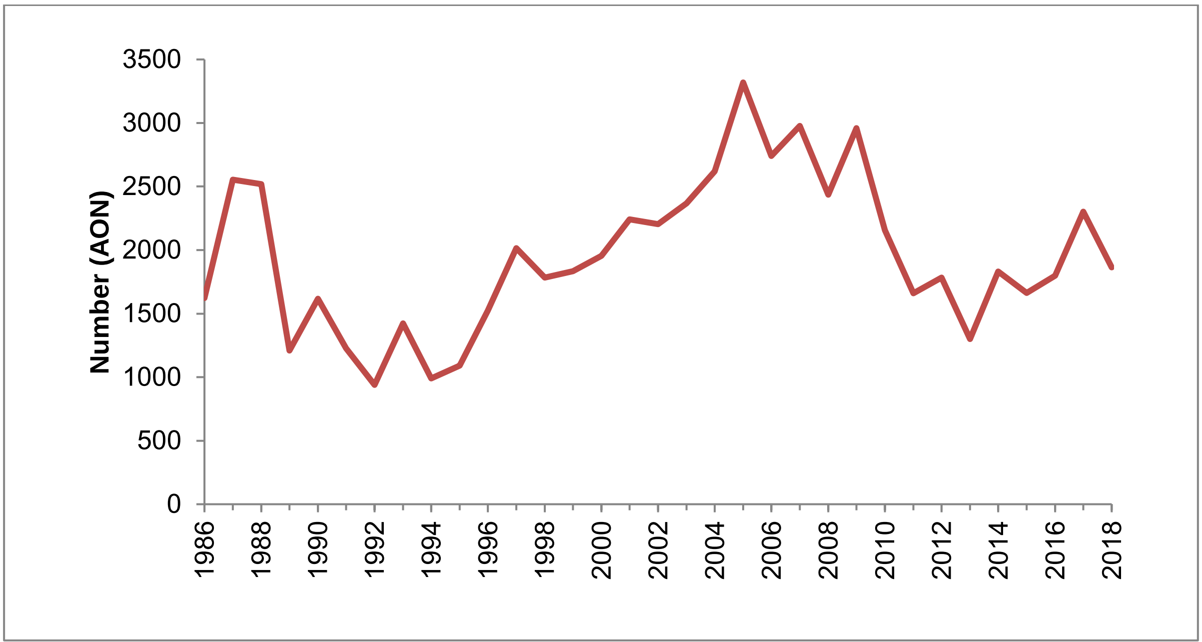

Figure 9. Abundance of Sandwich tern at five colonies in Northern Ireland, 1986-2018.

Sandwich tern has the most complete monitoring record over the longest period of any seabird species in Northern Ireland. National census data show that numbers of Sandwich terns nesting in Northern Ireland increased between Operation Seafarer and the Seabird Colony Register by 80% but then fell by 11% to Seabird 2000. The decline between 1987 and 2000 is reflected by data from five well monitored colonies (Cockle Island, Carlingford Lough, Strangford Lough, Larne Lough and Lower Lough Erne), presented above (Figure 9). Previous reports stated that Strangford Lough was abandoned in 1986 and 1988 but this appears to be in error; in actual fact, 1,418 nested in 1986 and 2,228 in 1988. Comprehensive monitoring of these five colonies between censuses suggest total numbers in Northern Ireland declined after the SCR until the early 1990s, before increasing steadily until 2005, reaching a peak of 3,319 AON. Numbers then declined rapidly until 2013 when just 1299 AON were recorded but have recovered slightly, with 1863 AON being recorded in 2018.

Productivity

Few systematic data on the productivity of Sandwich terns in Northern Ireland have been collected as part of the SMP. On average, 0.30 chicks have been fledged per pair per year between 1990 and 2018.

Republic of Ireland

Population estimates and change 1969-2018 (census data)

	Operation Seafarer (1969-70)	Seabird Colony Register (1984-85)	Seabird 2000 (1998-2002)	Republic of Ireland Census (2015-18)
Population estimate (AON*)	1,005	1,281	1,762	2,519
% change since previous census	n/a	+27	+38	+97%

* AON = Apparently Occupied Nests

Breeding abundance

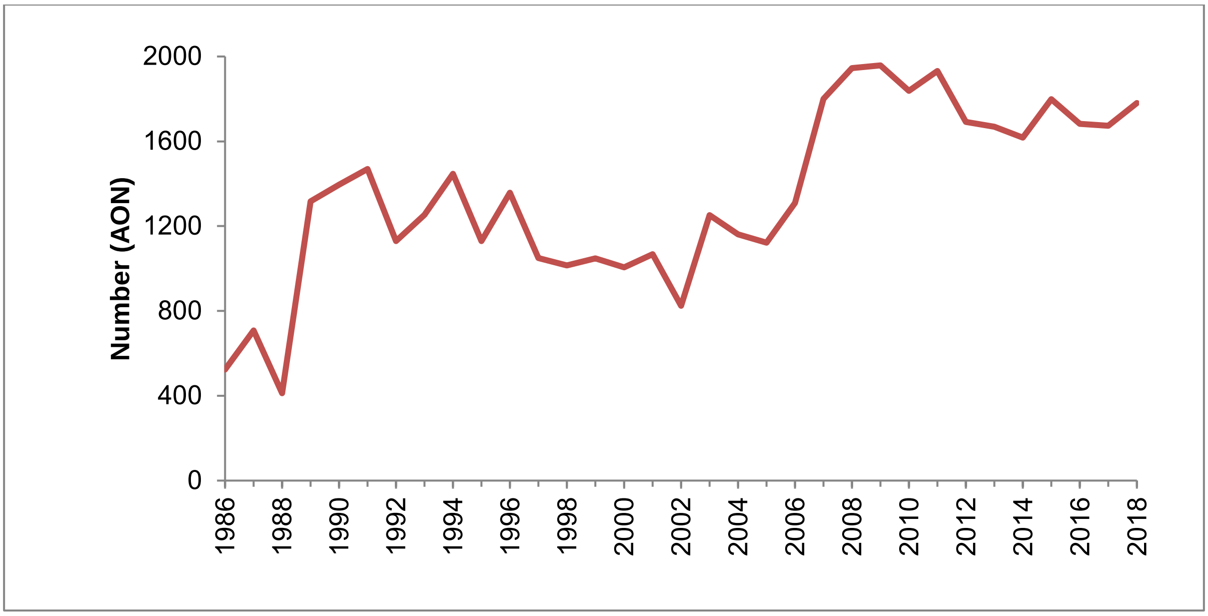

Figure 10. Abundance of Sandwich tern at Lady's Island Lake, 1986-2018.

Operation Seafarer recorded 1,005 AON of Sandwich tern in the Republic of Ireland. This number increased during each subsequent census with 1,762 AON being recorded during Seabird 2000. A recent seabird census in the Republic of Ireland recorded 2,519 AON, an increase of 37% since Seabird 2000. Sandwich terns breed in small numbers in colonies along the Atlantic coastline, and at the larger colonies at Lough Swilly and Lady's Island Lake in the southeast which hold approximately 84% of the national population. Numbers at the largest colony, Lady's Island Lake (Figure 10), have increased substantially during the last decade with a peak of 1,958 AON in 2009. There was a slight decline thereafter with 1,617 AON recorded in 2014, however, numbers have increased again with 1,780 AON recorded in 2018.

Productivity

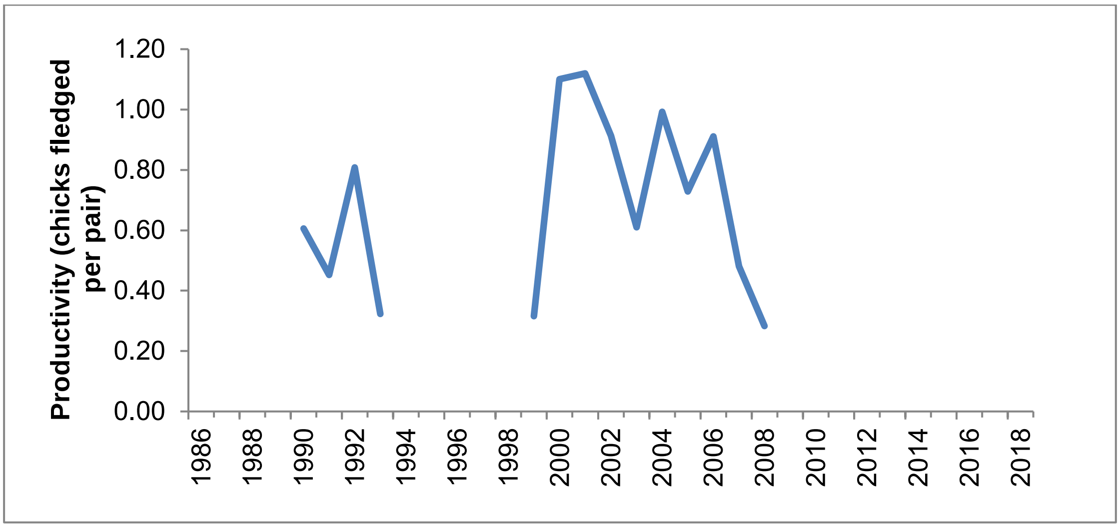

Figure 11. Trend in productivity (no. of chicks fledged per pair) of Sandwich tern in the Republic of Ireland, 1990-2008. Based on SMP data; view the methods of analysis .

Few systematic data on the productivity of Sandwich terns in the Republic of Ireland have been collected as part of the SMP. Breeding Sandwich terns in the Republic of Ireland show the typical fluctuating fortunes found at colonies in the United Kingdom. Particularly low productivity was recorded in 1993, 1999 and 2008, but in most years since 2000 Sandwich terns have been relatively productive. No productivity data have been submitted to the SMP since 2008.

All Ireland

Population estimates and change 1969-2002 (census data)

	Operation Seafarer (1969-70)	Seabird Colony Register (1985-88)	Seabird 2000 (1998-2002)
Population estimate (AON*)	2,216	3,467	3,716
% change since previous census	n/a	+56	+7

* AON = Apparently Occupied Nests

Breeding abundance

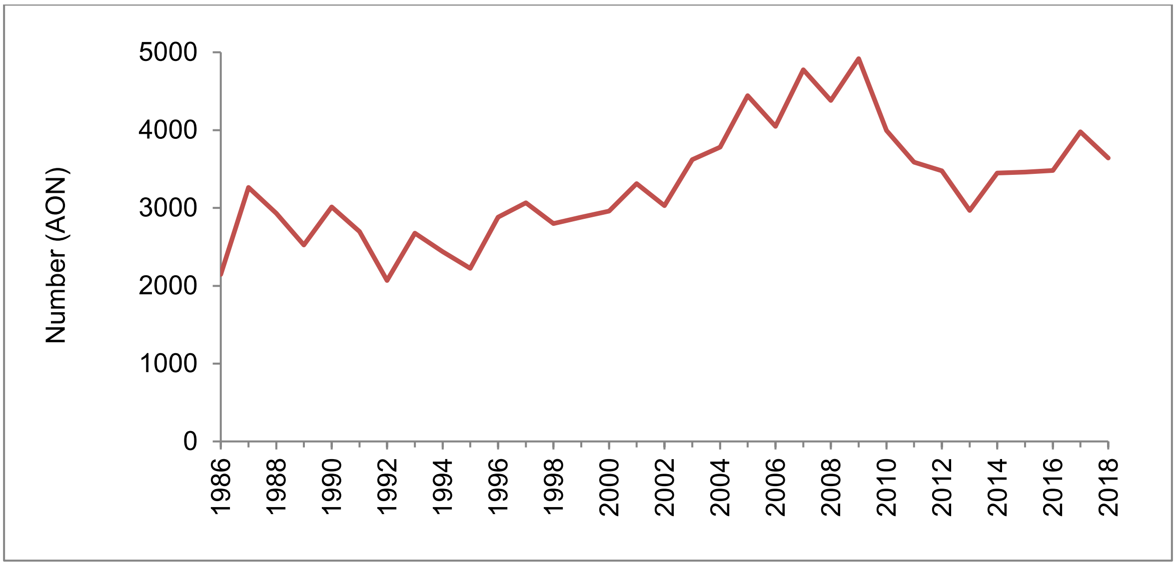

Figure 12. Abundance of Sandwich tern at six colonies throughout Ireland, 1986-2018.

National census data show a 56% increase in Sandwich tern numbers between Operation Seafarer and the Seabird Colony Register (SCR). The Seabird 2000 census recorded similar numbers to the SCR but, in the decade following that census, the five main colonies in Northern Ireland and at Lady's Island Lake in Republic of Ireland all increased, with a peak combined count in 2009 of 4,918 AON. Numbers then declined to 2,968 AON in 2013 but have risen again with 3,643 AON being recorded in 2018. A recent seabird census in the Republic of Ireland recorded 2,519 Sandwich tern AON. Taking smaller colonies in Northern

Ireland that have not been counted recently (of which there are very few) into account, the total Irish population at present probably lies between 3,643 and 3,700 AON.

Productivity

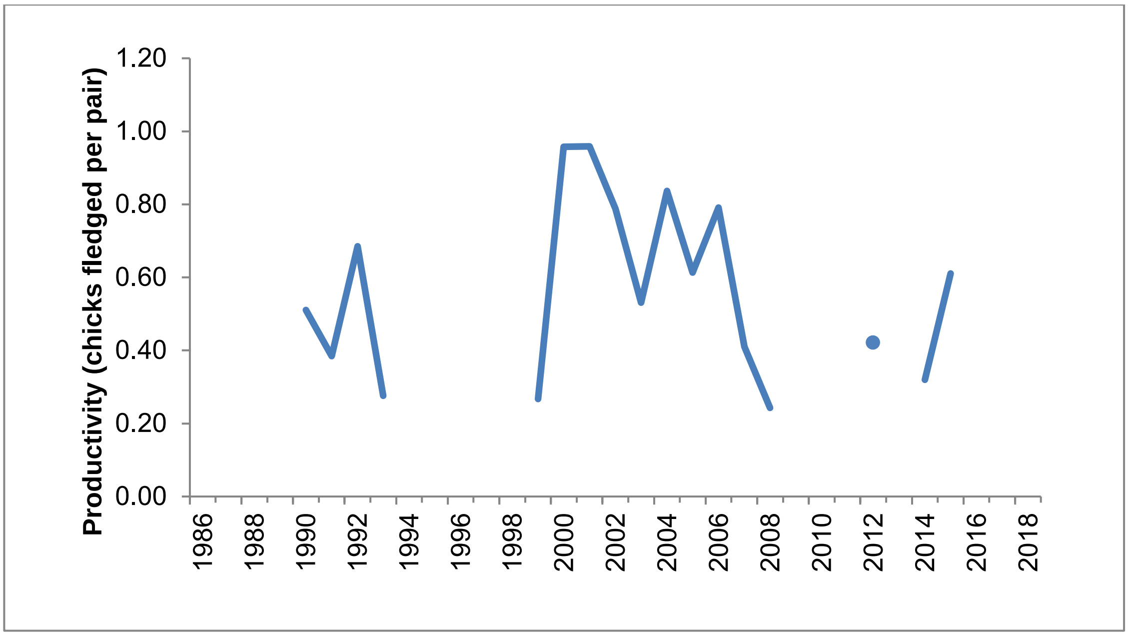

Figure 13. Trend in productivity (no. of chicks fledged per pair) of Sandwich tern throughout Ireland, 1986-2018. Based on SMP data; view the methods of analysis .

The trend in breeding performance shown for the whole of Ireland closely matches that shown for the Republic of Ireland where most data have been collected, but with slightly lower average values. Low levels of productivity were recorded in 1993, 1999 and 2008 but, in most years since 2000, Sandwich terns have been relatively productive. No productivity data have been submitted since 2008.

Isle of Man

Sandwich tern does not breed on the Isle of Man.

Channel Islands

Sandwich tern does not breed on the Channel Islands.

UK phenology, diet, survival rates

No data have been collected as part of the Seabird Monitoring Programme.

References

1 Ratcliffe, N., Pickerell, G. and Brindley, E. 2000. Population trends of Little and Sandwich Terns *Sterna albifrons* and *S. sandvicensis* in Britain and Ireland from 1969 to 1998. Atlantic Seabirds, **2**, 211-26.

2 Cook, A.S.C.P. and Robinson, R.A. 2010. How representative is the current monitoring of breeding success in the UK? BTO Research Report No. 573, BTO, Thetford.

3 Short, D. 2014. Breeding of four species of tern and Black-headed Gull at Forvie National Nature Reserve, 2013. Unpublished report, Scottish Natural Heritage.

Common Tern *Sterna hirundo*

Description

The following has been adapted from original text by Norman Ratcliffe in Seabird Populations of Britain and Ireland (with permission from A&C Black, London).

Common terns are not the most abundant UK tern species, but are probably the most familiar because their breeding range extends around much of the British Isles coastline plus inland on lakes, reservoirs and gravel pits along the large river valleys of SE and Central England, notably the Thames, Ouse, Humber and Trent, and along rivers in SE Scotland. They are absent from most of Wales and SW England, and are largely replaced in the Northern and Western Isles by Arctic terns.

All tern populations in NW Europe were brought to the brink of extirpation at the end of the 19th century by hunting of adults for the millinery trade, but recovered in response to protective legislation in the early 20th century. However, over the last three decades, the UK common tern population has remained broadly stable.

Conservation status

Common tern is currently identified as a conservation priority in the following:

Amber listed in Birds of Conservation Concern 4 (2015 update)
 (further information on Conservation Designations for UK Taxa)
Amber listed in Birds of Conservation Concern in Ireland 2014-2019 (2014 update)
EC Birds Directive - listed in Annex 1 and as a migratory species

International importance

UK Population	% Biogeographic Population	% World Population
11,800 AON*	4.2 (ssp. *hirundo*)	2.2

*AON = Apparently Occupied Nests

The UK population figure (rounded to the nearest hundred) was derived from data in Mitchell, P.I., Newton, S.F., Ratcliffe, N. and Dunn, T.E. (eds.) 2004. *Seabird Populations of Britain and Ireland.* Poyser, London. This was also the source of figures for the Biogeographic and World populations.

UK population estimates and change 1969-2002 (census data)

All terns breeding in Britain and Ireland show a low degree of site faithfulness from one year to the next; in response to predation or habitat change, and especially in areas where islands and other suitable habitat are plentiful, adults may move *en masse* between different sites. Hence, in order to gain an accurate national estimate of tern numbers, a simultaneous census was planned to cover all colonies in Britain within a single year. Thus, the majority of British tern colonies were surveyed in 2000, including extensive surveys of Orkney and Shetland. The main exception was in the Western Isles; most Lewis and Harris tern colonies were surveyed in 1999, with those from the Sound of Harris to Barra Head surveyed in 2002. In Northern Ireland, results from the All-Ireland tern survey conducted in 1995 were utilised. During the SCR, counts were made in different years within regions, and inter-colony movements may have caused greater inaccuracies. Also, survey coverage of the Northern Isles was poor. This was overcome by inclusion of data from the 1980 survey of terns in Orkney and Shetland. Coverage of inland sites was probably more extensive during Seabird 2000, so the assessment of changes in range and status inland should be made with caution.

Breeding populations can also fluctuate among years owing to variations in the proportion of mature birds attempting to nest. However, comparison with annual counts from sites throughout the UK indicated that counts during the SCR and Seabird 2000 were not atypically low. As such, trends estimated between the two surveys should be reasonably robust.

	Operation Seafarer (1969-70)	**Seabird Colony Register (1985-88)**	**Seabird 2000 (1998-2002)**
UK Population estimate (AON*)	11,978	13,053	11,838
% change since previous census	n/a	+9	-9

*AON = Apparently Occupied Nests

For census results for individual countries and Ireland, the Channel Islands and the Isle of Man see under relevant sections below.

Distribution/abundance

The Seabird 2000 census provides the most comprehensive recent assessment of the distribution and abundance of breeding seabirds. Numbers found in different regions, and a map showing the location and size of colonies, is provided in the Seabird 2000 common tern results page.

The locations sampled during the annual Seabird Monitoring Programme provide some information on distribution and are accessible via the Seabird Monitoring Programme online database.

Annual abundance and productivity by geographical area

With reference to the regional accounts below please note the following.

Breeding abundance: graphs of abundance index with 95% confidence limits are only shown for a region where the trend produced has been deemed accurate (see methods of analysis). Where a trend was thought to be inaccurate, graphs of abundance at major colonies in a region may be shown instead, particularly if such colonies hold greater than 10% of the regional population, are monitored frequently and may thus help illustrate regional population fluctuations outwith national censuses. Occasionally, too few data have been collected regionally to produce either of these.

Productivity: graphs of productivity are only shown if analysis of productivity data produced a significant result for regional and/or year effects (again see methods of analysis). If results were not significant, then a regional mean productivity value is given. However, on some occasions too few data are available from which to provide a meaningful average. Furthermore, for 11 species where the quality of monitoring data available was considered high, population viability analysis was undertaken at the UK level and the results of this are also reported.

United Kingdom

Breeding abundance

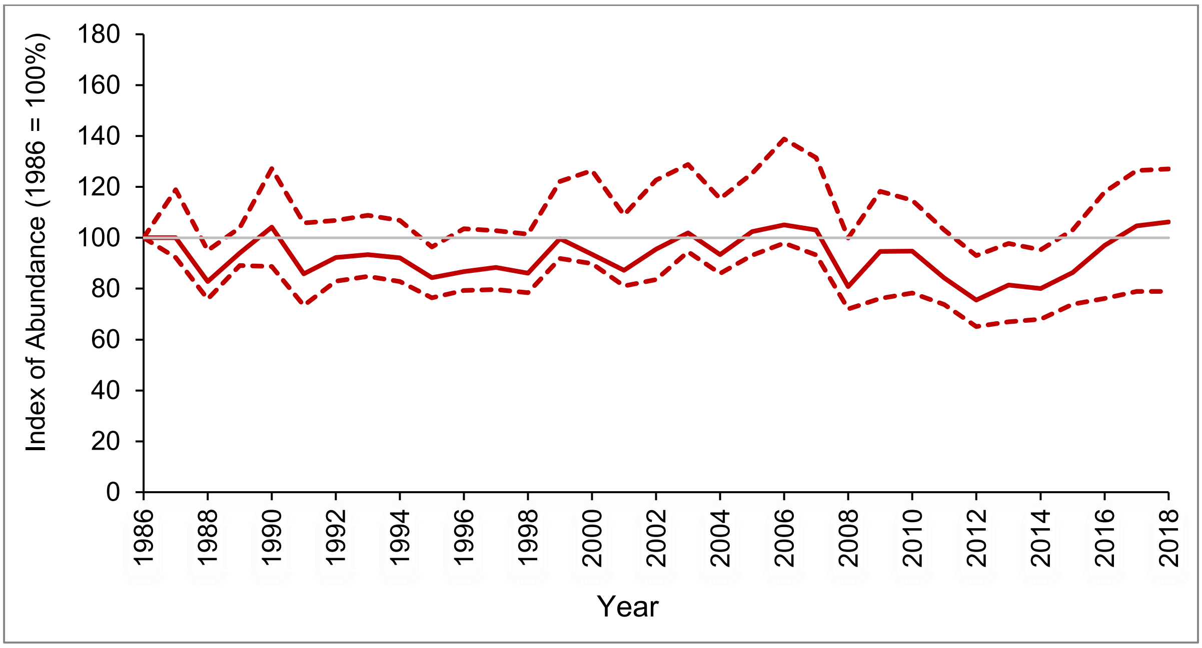

Figure 1. Trend in UK abundance index (solid line) of common tern 1986-2018 with 95% confidence limits (dotted lines). Based on SMP data; view the methods of analysis.

Between the Operation Seafarer (1969-70) and Seabird Colony Register (1985-88) censuses, common terns in the UK increased by 9%, although had returned to Operation Seafarer levels by the time of the Seabird 2000 census. Since then, the abundance trend has shown a similar pattern, where numbers increase and then decrease again over respective five to six-year periods. The lowest ever recorded index value occurred in 2012 when it was at 25% below the 1986 baseline. Since then, the index has risen and was 6% above the baseline in 2018, the highest value recorded to date. Trends at finer spatial scales have varied considerably and are likely to reflect varying pressures facing common terns in different habitats across their wide geographic range. Increased predation by species such as American mink *Neovison vison*[1] and red fox *Vulpes vulpes* have caused declines in some areas, although conservation management to ameliorate these problems is being undertaken. Common terns have also benefited from habitat creation in the form of gravel pits; tern rafts in reservoirs; islets in industrial lagoons; structures in ports; and from habitat improvement on reserves through control of vegetation succession and gull competition. Maintaining the population is likely to depend on the continuation of such management in perpetuity.

Productivity

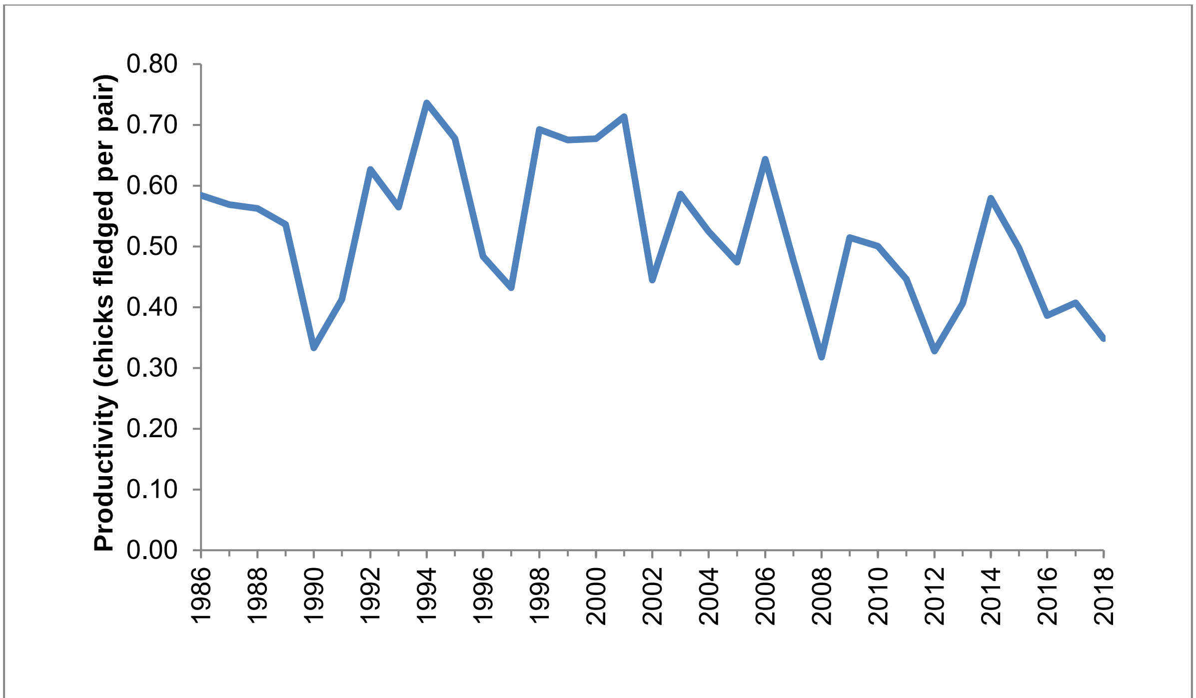

Figure 2. Trend in UK productivity (no. of chicks fledged per pair) of common tern 1986-2018. Based on SMP data; view the methods of analysis.

Like most of the other tern species, the productivity of common terns has fluctuated over the recording period and, although the species has never been as successful as roseate tern, seldom has it been as unproductive as Arctic tern. There rarely is a single reason for years of poor productivity, which are usually due to several factors such as predation[2], bad weather and poor feeding conditions, although common terns have a broader diet than many tern species and are less affected by changes in prey availability. As common terns often nest on low-lying ground close to the tide edge, their nests are vulnerable to erosion and tidal inundation; predictions of increased storminess and sea-level change under climate change scenarios may lead to increased prevalence of such events, though managed realignment of coastal defences may create new opportunities for nesting.

Scotland

Population estimates and change 1969-2002 (census data)

	Operation Seafarer (1969-70)	Seabird Colony Register (1985-88)	Seabird 2000 (1998-2002)
Population estimate (AON*)	4,285	6,784	4,784
% change since previous census	n/a	+58	-29

* AON = Apparently Occupied Nests

Breeding abundance

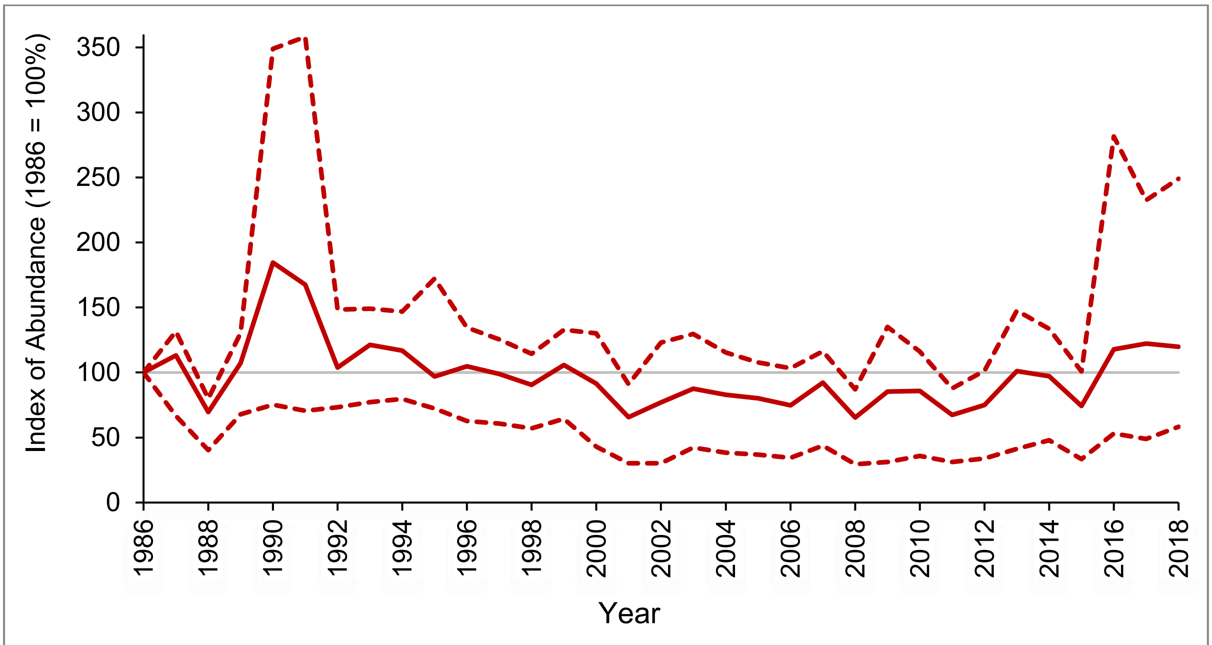

Figure 3. Trend in abundance index (solid line) of common tern in Scotland, 1986-2018 with 95% confidence limits (dotted lines). Based on SMP data; view the methods of analysis.

Numbers of common terns in Scotland during the Seabird Colony Register (SCR) were 58% higher than during Operation Seafarer but by Seabird 2000 had fallen by 29%. The index above suggests common tern abundance actually continued to rise after the SCR and peaked in the early 1990s with a prolonged decline evident thereafter up to Seabird 2000 and beyond (with some fluctuation). In 2013, the index increases to the baseline recorded in 1986 before decreasing again to 26% below the baseline in 2015. It then rose again in 2016 and has remained stable between 18% and 22% above the baseline since then. The largest colonies of common terns in 2018 were at Leith Docks (514 AON), Invergordon Town and Docks (289 AON) and Sands of Forvie (278 AON). As for many tern species, maintaining population levels depends on the management at most breeding sites, with predator control, habitat creation and disturbance reduction being key to their success.

__Productivity__

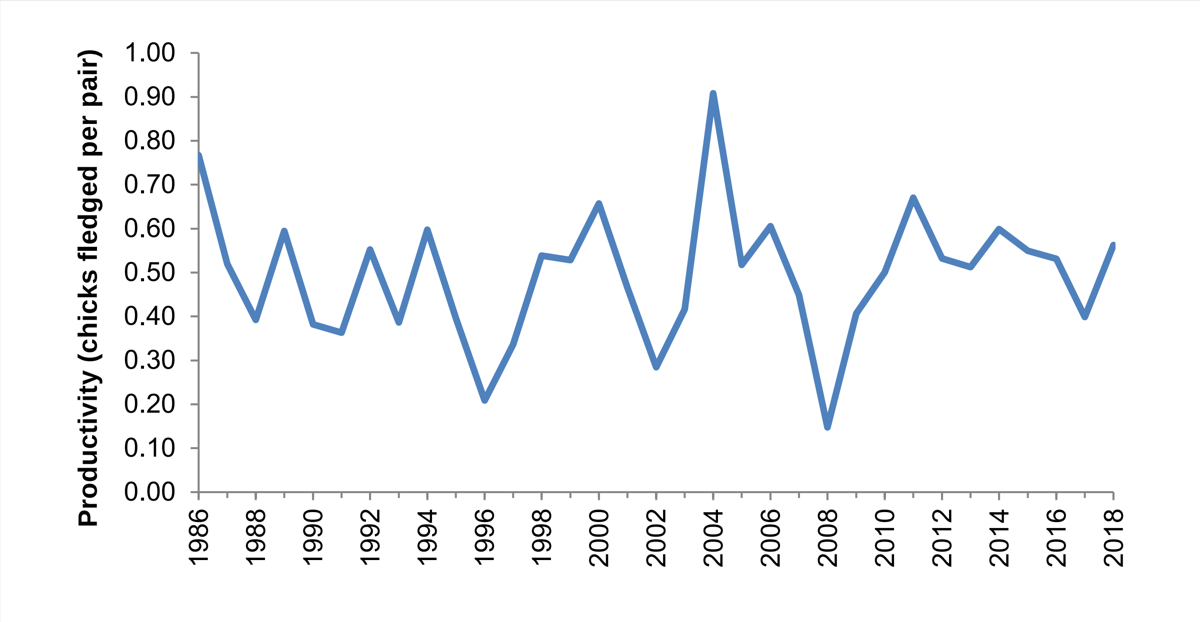

Figure 4. Trend in productivity (no. of chicks fledged per pair) of common terns in Scotland, 1986-2018. Based on SMP data; view the methods of analysis.

Although productivity of common terns in Scotland has fluctuated somewhat over the recording period, there are very few years when the species has nested successfully; in most years, productivity fell below 0.60 chicks fledged per pair. Productivity was particularly low in 1996, 2002 and 2008 due to the additive effects of predation, bad weather and poor feeding conditions. In 2014, detailed studies in Lochaber, and Argyll and Bute, found that colonies that had suffered predation (by American mink and large gulls) fledged 0.52 chicks per nest (n=135 nests) compared to 0.93 chicks fledged per nest (n=393 nests) from colonies with no, or little, predation. In 2017, average productivity of common terns decreased to 0.4 chicks fledged per pair, although in 2018 had increased again to 0.57.

England

__Population estimates and change 1969-2002 (census data)__

	Operation Seafarer (1969-70)	Seabird Colony Register (1985-88)	Seabird 2000 (1998-2002)
Population estimate (AON*)	6,099	4,659	4,676
% change since previous census	n/a	-24	<+1

* AON = Apparently Occupied Nests

Breeding abundance

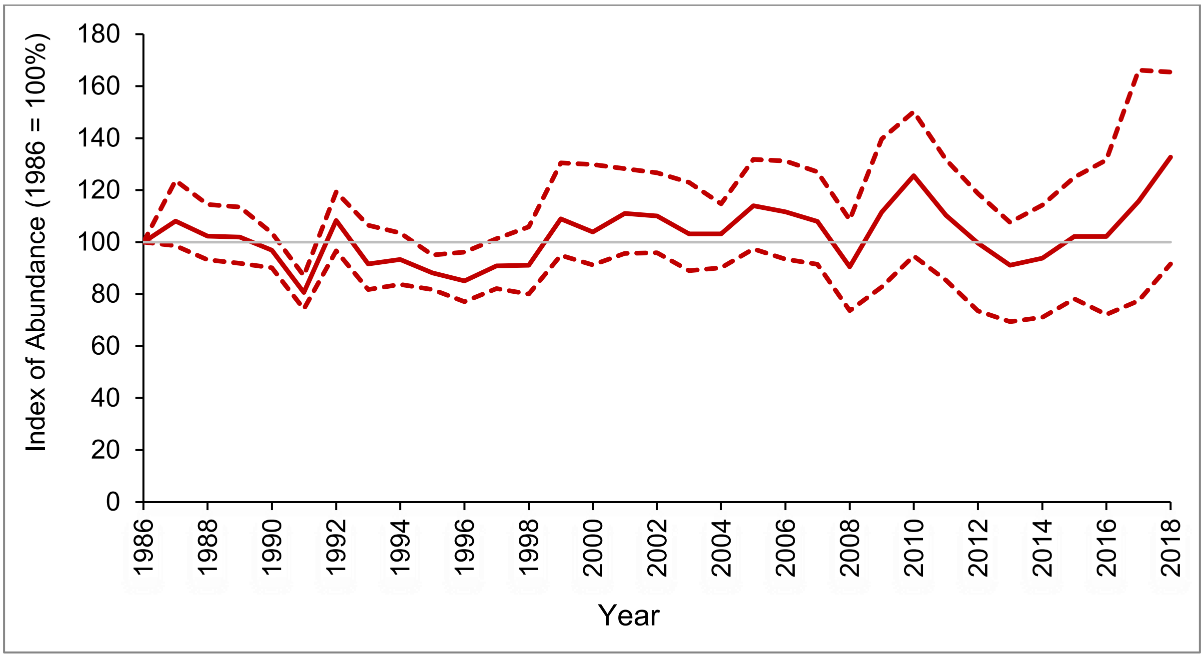

Figure 5. Trend in abundance index (solid line) of common tern in England, 1986-2018 with 95% confidence limits (dotted lines). Based on SMP data; view the methods of analysis.

Common tern numbers in England decreased by 24% between Operation Seafarer and Seabird Colony Register (SCR) censuses, in contrast to populations in Scotland and Wales, with Seabird 2000 recording approximately the same number as the SCR. The abundance trend in Figure 5 shows considerable fluctuation since Seabird 2000, although has usually been close to the 1986 baseline. In 2018, the index rose to its highest level to date, at 33% above the 1986 baseline, suggesting that the English common tern breeding population may now be larger than it was at the time of Seabird 2000. The largest colonies in England, between 2017 and 2018, were Coquet Island (1667 AON in 2018), Saltholme (291 AON in 2018) and Scroby Sands (250 AON in 2017). The species has benefited from habitat creation in the form of gravel pits; tern rafts in reservoirs; islets in industrial lagoons; structures in ports; and from management to maintain habitat on reserves through control of vegetation succession and to reduce competition with, and predation by, gulls.

Productivity

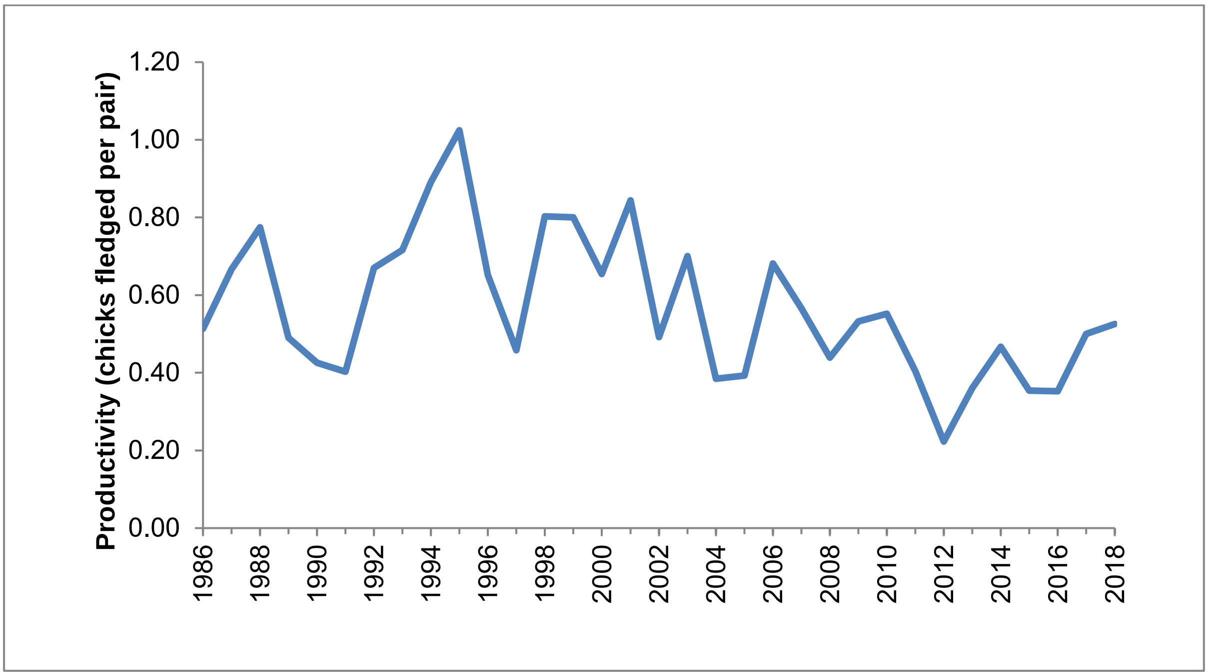

Figure 6. Trend in productivity (no. of chicks fledged per pair) of common terns in England, 1986-2018. Based on SMP data; view the methods of analysis.

The productivity of common terns in England has fluctuated considerably since 1986 but appears to have been in decline since the mid-1990s, with 2018 averaging at 0.73 chicks fledged per pair. Peak productivity was recorded in 1995 (1.02) however, it has seldom been high and, although poor in some years, common terns in England usually fare better than those breeding at Scottish colonies.

Wales

Population estimates and change 1969-2002 (census data)

	Operation Seafarer (1969-70)	Seabird Colony Register (1985-88)	Seabird 2000 (1998-2002)
Population estimate (AON*)	292	514	674
% change since previous census	n/a	+76	+31

* AON = Apparently Occupied Nests

Breeding abundance

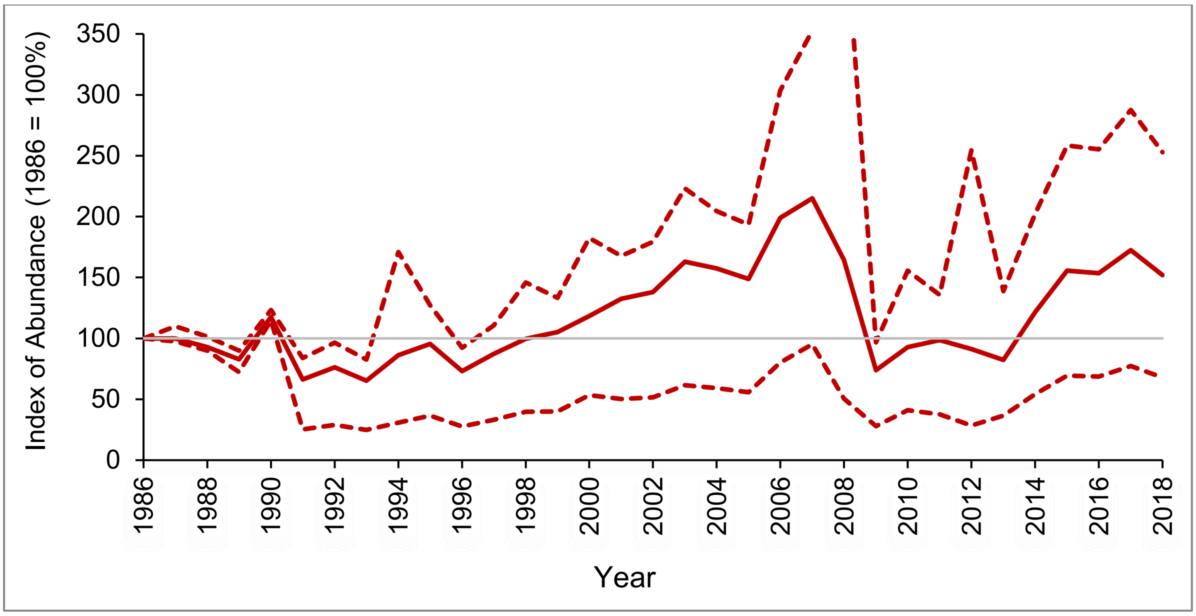

Figure 7. Trend in abundance index (solid line) of common tern in Wales, 1986-2018 with 95% confidence limits (dotted lines; drawing of upper limit restricted to preserve detail in the abundance index). Based on SMP data; view the methods of analysis.

The abundance of common terns in Wales has decreased steeply since a peak value in 2017 of 115% above the 1986 baseline was recorded. It dipped below the 1986 baseline between 2009 and 2013 and then increased until 2017 where it was 72% above the 1986 baseline, the third highest value recorded to date. In 2018, the index had decreased again but was still 52% above the baseline. The decline in 2017 was largely due to the abandonment of the largest colony at Shotton Steelworks where common terns last successfully bred in 2008 (624 AON). Data received from the same three colonies (Shotton Steelworks, The Skerries and Cemlyn Lagoon) in 2016, 2017 and 2018, recorded a total of 698, 820 and 662 breeding pairs respectively, figures which are likely to be fairly representative of the current Welsh population.

Productivity

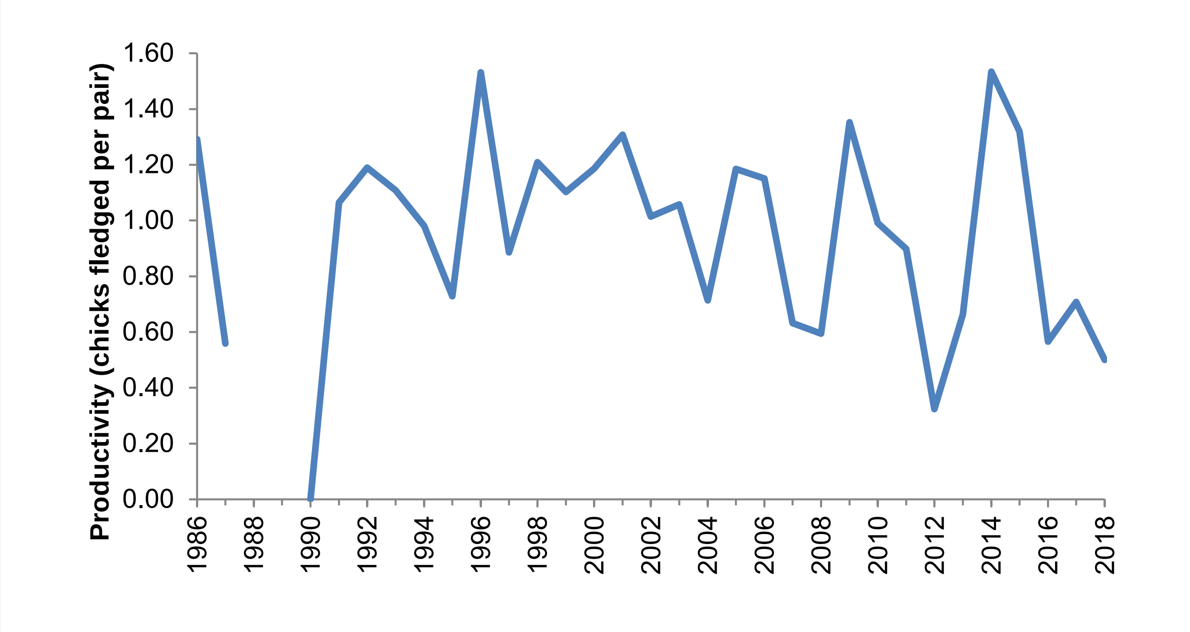

Figure 8. Trend in productivity (no. of chicks fledged per pair) of common terns in Wales, 1986-2018. Based on SMP data; view the methods of analysis.

Common terns at Welsh colonies are among the most productive in the UK, regularly fledging more than one chick per pair. Near complete failure was recorded in 1990 with the next poorest breeding season occurring in 2012. No real trend is apparent over the recording period as productivity has fluctuated widely. However, 2014 was the most productive breeding season since 1996 with 1.53 chicks per pair, with 2015 slightly lower at 1.32. For the first time since 2008, common terns bred at Shotton Steelworks in 2014 and fledged 2.1 chicks per pair. The following year was also a successful year, with an increase in breeding pairs and high productivity at 1.6 chicks fledged per pair. This was due to a combination of new fox-deterrent security measures around the Shotton Steelworks colony and an abundant food supply in the Dee estuary. Volunteers have also been tirelessly working to improve suitable nesting space for the terns at this site. The Shotton Steelworks colony has faced a number of threats over recent years, the greatest being the rapid expansion of black-headed gulls using the site and extensive weed growth which discourages the terns from nesting (Peter Coffey pers. comm.). On average this colony produced 1.33 chicks fledged per pair between 2014-2018.

Northern Ireland

Population estimates and change 1969-2002 (census data)

	Operation Seafarer (1969-70)	**Seabird Colony Register (1985-88)**	**Seabird 2000 (1998-2002)**
Population estimate (AON*)	1,302	1,096	1,704

	Operation Seafarer (1969-70)	Seabird Colony Register (1985-88)	Seabird 2000 (1998-2002)
% change since previous census	n/a	-16	+55

* AON = Apparently Occupied Nests

Breeding abundance

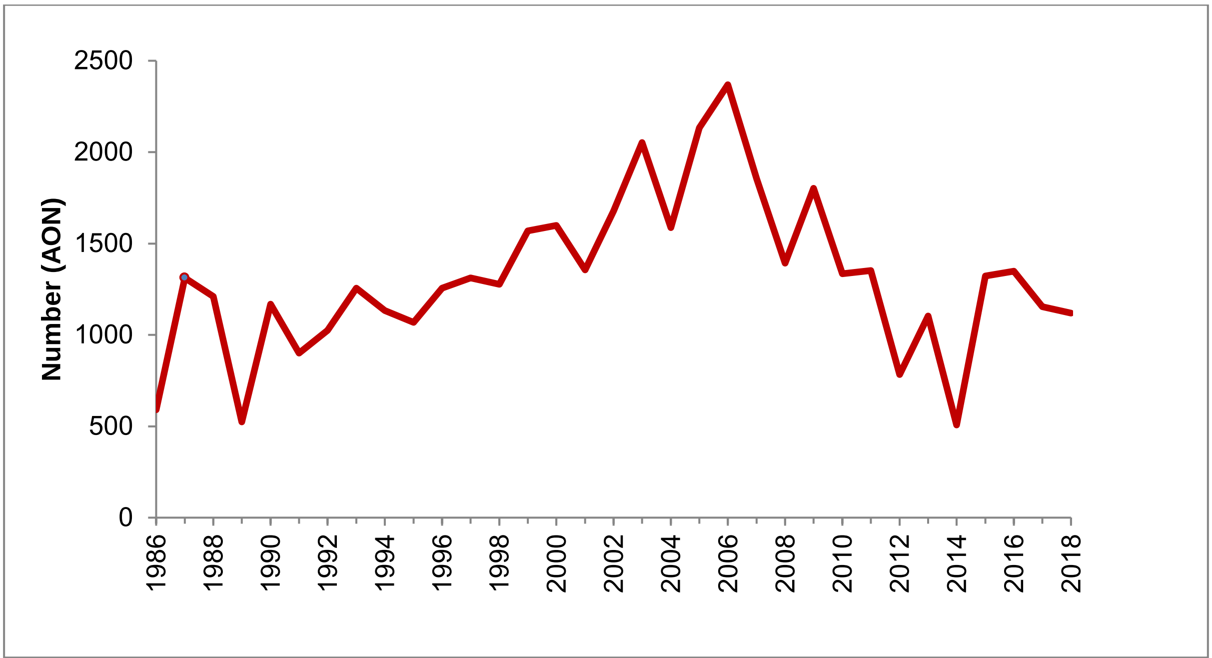

Figure 9. Abundance of common terns at six colonies in Northern Ireland, 1986-2018.

The number of common terns breeding in Northern Ireland increased by 55% between the Seabird Colony Register and Seabird 2000 censuses, from 1,096 to 1,704 AON. In 2006, the six largest colonies in the east of Northern Ireland (Cockle Island, Carlingford Lough, Strangford Lough and Copeland Island, Larne Lough and Belfast Lough), held 2,369 AON (*cf.* 1,570 in 2000), representing an increase in the national population, although numbers at these colonies declined to 1,119 AON in 2018 (Figure 9). A further six colonies, where monitoring is less frequent, held 433 AON in 2018; therefore, all 11 colonies totalled 1,552 AON. The few other extant colonies that were found during the comprehensive coverage of Seabird 2000 are unlikely to hold more than 400-500 AON in total. Hence, it is likely that the population of breeding common terns in Northern Ireland is now slightly larger than recorded during the last census.

Productivity

Productivity data for common terns in Northern Ireland showed no statistically significant variation over time. An average of 0.68 chicks were fledged per pair per year between 1999 (the first year the SMP has data for) and 2018. Common tern productivity has been recorded at Portmore Lough since 2014 and has averaged 1.05 chicks fledged per pair.

Republic of Ireland

Population estimates and change 1969-2018 (census data)

	Operation Seafarer (1969-70)	Seabird Colony Register (1984-85)	Seabird 2000 (1998-2002)	Republic of Ireland Census (2015-18)
Population estimate (AON*)	2,804	1,574	2,485	5,058
% change since previous census	n/a	-44	+58	+104

* AON = Apparently Occupied Nests

Breeding abundance

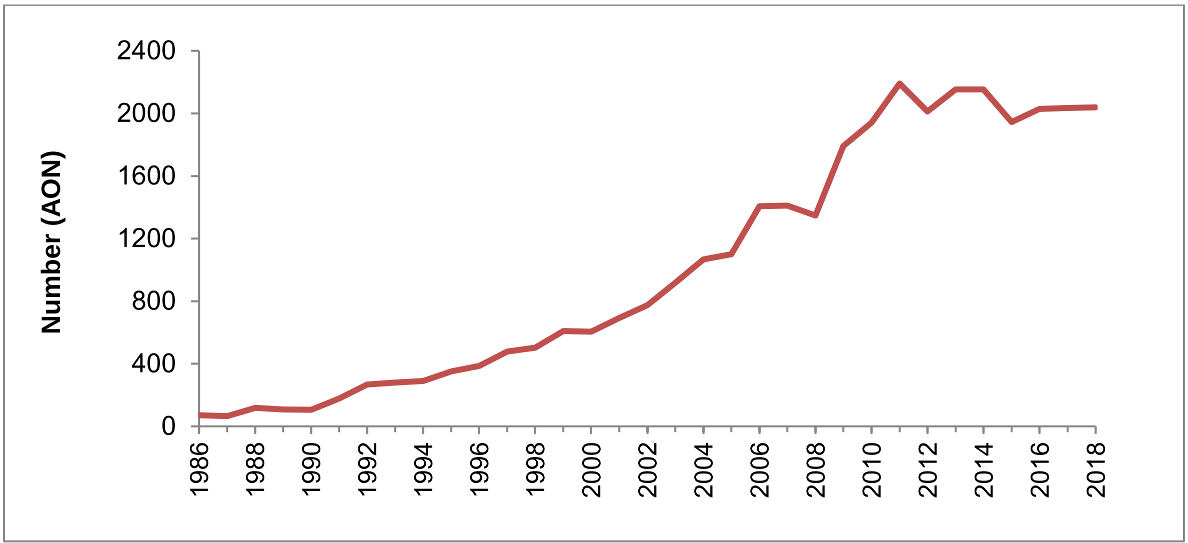

Figure 10. Abundance of common terns on Rockabill, 1986-2018.

Between Operation Seafarer and the Seabird Colony Register common terns in the Republic of Ireland declined by 44% and, although the population had increased again by 1998-2002, Seabird 2000 still recorded fewer AON than during this first census. At the largest, Rockabill, numbers increased almost exponentially from 1986 onwards (Figure 10), possibly due to immigration from other colonies around the Irish Sea, although have now become more stable with 2,039 AON recorded there in 2018 (*cf.* peak of 2,191 in 2011). A recent seabird census of the Republic of Ireland recorded 5,058 AON, an increase of 104% since Seabird 2000[7]. This increase in the national population may have begun in the late 1990s. There is little doubt that the strong national increase in the common terns population is driven by the long-standing and on-going direct conservation actions at Lady's Island[5] Lake and Rockabill[6]. There were insufficient data submitted to the SMP to allow a national trend to be generated.

Productivity

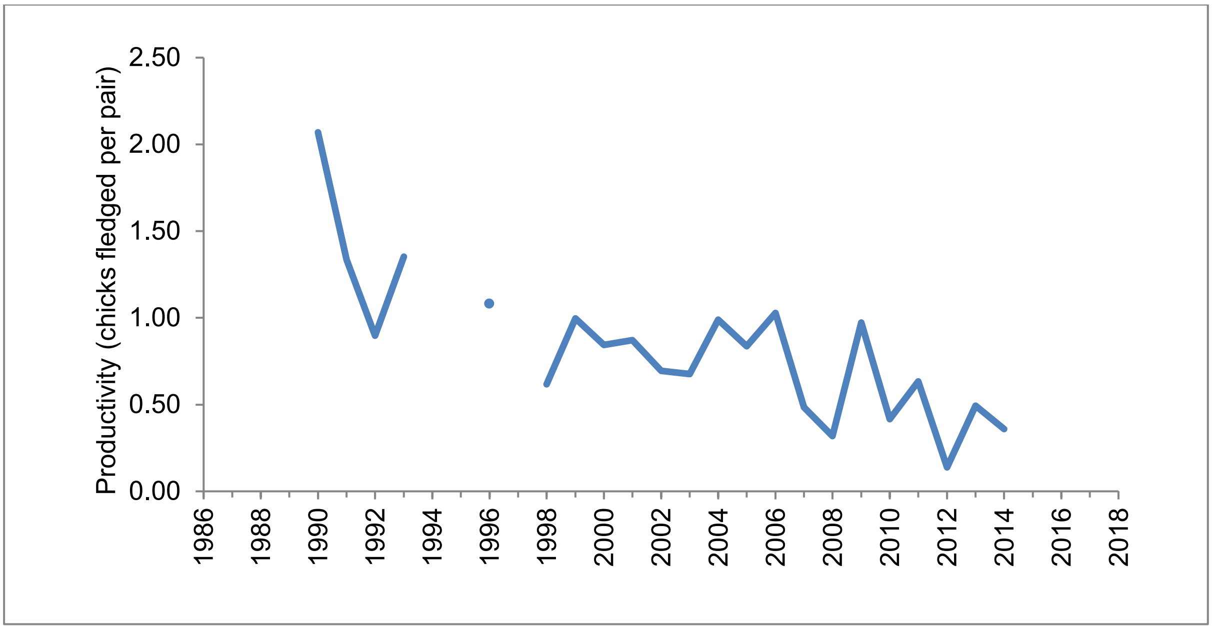

Figure 11. Trend in productivity (no. of chicks fledged per pair) of common terns in the Republic of Ireland, 1986-2014. Based on SMP data; view the methods of analysis.

Productivity in the Republic of Ireland was very high in the early 1990s but, since 1998, has been more typical of levels recorded in Britain. Productivity has been very low, seldom above 0.50 chicks fledged per pair, in several years since 2007. No data on common tern productivity has been provided to the SMP since 2014.

All Ireland

Population estimates and change 1969-2002 (census data)

	Operation Seafarer (1969-70)	**Seabird Colony Register (1985-88)**	**Seabird 2000 (1998-2002)**
Population estimate (AON*)	4,106	2,670	4,189
% change since previous census	n/a	-35	+57

* AON = Apparently Occupied Nests

Breeding abundance

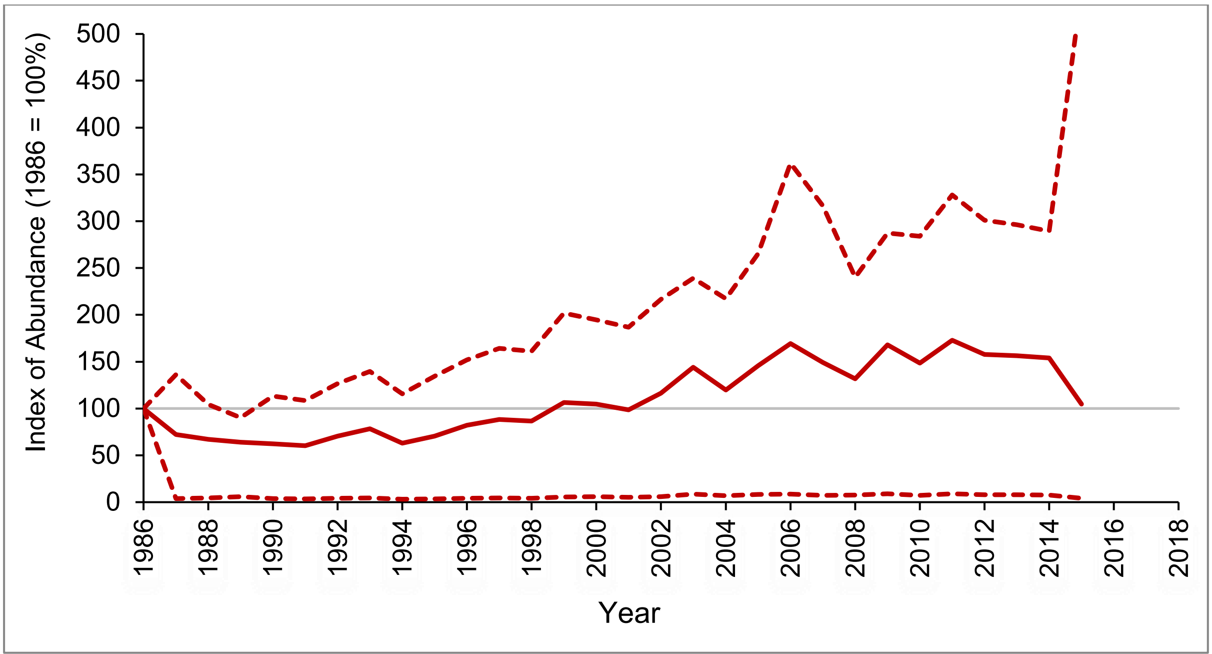

Figure 12. Trend in abundance index (solid line) of common tern throughout Ireland, 1986-2015 with 95% confidence limits (dotted lines; drawing of upper limit restricted to preserve detail in the abundance index). Based on SMP data; view the methods of analysis.

The total Irish population of common terns during Seabird 2000 was similar to that recorded by Operation Seafarer 30 years previously, although numbers decreased between these two censuses. The common tern abundance trend for the whole of Ireland shown in Figure 12 was upward between 1986 and 2006, then increased from Seabird 2000 until 2014 but has declined since then. Rockabill, the largest colony in the Republic of Ireland, has increased substantially during the last 28 years from 70 AON in 1986 to over 2,000 AON in 2018. However, in Northern Ireland, numbers had similarly increased until a peak in 2006 but then declined steeply until 2015. A recent seabird census of the Republic of Ireland recorded 5,058 AON, an increase of 185% since Seabird 2000. Therefore, it is very likely that the all-Ireland population of common terns is increasing.

Productivity

The trend in productivity of common terns throughout Ireland is similar to that shown for the Republic of Ireland, where 54% of the data have been collected however, only 10 productivity records have been supplied to the SMP between 2009 and. Productivity was very high in 1990 but very low in seven years in the last decade. Between 1998 and 2006 productivity appears to have been relatively stable, albeit with some fluctuation, but apparently has declined since then. No data from the Republic of Ireland on common tern productivity was provided to the SMP since 2014.

Isle of Man

Population estimates and change 1969-2018 (census data)

	Operation Seafarer (1969-70)	Seabird Colony Register (1984-85)	Seabird 2000 (1998-2002)	Isle of Man Census (2017-18)
Population estimate (AON*)	1	7	0	0
% change since previous census	n/a	+600	0	0

* AON = Apparently Occupied Nests

Breeding abundance

Only a few pairs of common terns have bred on the Isle of Man. One AON was recorded during Operation Seafarer which had risen to seven during the Seabird Colony Register. No AON were recorded on the Isle of Man during Seabird 2000 and none have been reported nesting since[8].

Productivity

No systematic data on the productivity of common terns on the Isle of Man have been submitted to the SMP.

Channel Islands

Population estimates and change 1969-2015 (census data)

	Operation Seafarer (1969-70)	Seabird Colony Register (1984-85)	Seabird 2000 (1998-2002)	Channel Islands Census (2015)
Population estimate (AON*)	107	227	174	250
% change since previous census	n/a	+112	-23	+44

* AON = Apparently Occupied Nests

Breeding abundance

Common terns are the only species of tern to breed in the Channel Islands. During Seabird 2000, 174 AON were recorded which represented a decline of 23% since the Seabird Colony Register. Prior to this, numbers had doubled from 107 AON in 1969-70. On Jersey common terns breed on the islands of Les Ecrehous and Les Minquiers. On Guernsey, a colony on Alderney has been regularly monitored since Seabird 2000 with numbers increasing from 20 to 32 AON. During a recent Channel Island Seabird Census 250 AON were counted, an increase of 44% compared to Seabird 2000[9].

Productivity

Data submitted to the SMP on the productivity of common terns in the Channel Islands are sparse; thus, no meaningful value can be provided.

UK phenology, diet, survival rates

No data have been collected as part of the Seabird Monitoring Programme.

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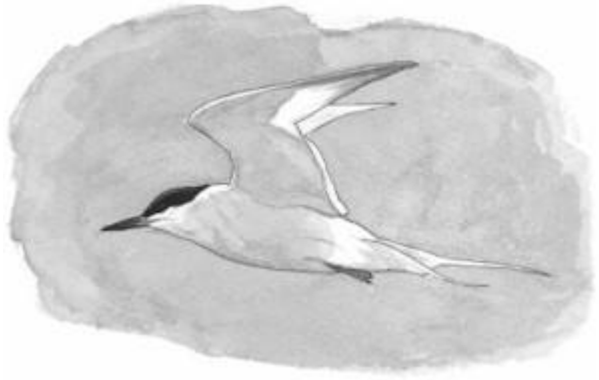
Roseate Tern *Sterna dougallii*

Description



The following has been adapted from original text by Stephen F. Newton in Seabird Populations of Britain and Ireland (with permission from A&C Black, London).

The roseate tern population in the UK experienced the most dramatic decline of any seabird species between Operation Seafarer (1969-70) and the SCR Census (1985-88). It also has one of the most restricted ranges of any seabird around the British Isles, with most of the population breeding in just a few colonies. Consequently, the species is of high conservation concern and is one of six red-listed seabirds in the United Kingdom. Roseate terns have probably always been rare and localised in the UK owing to their specialised foraging and nesting habitat requirements. Driven to the brink of extinction by exploitation for the millinery trade during the 19th century, the population recovered through the early 20th century as a result of protective legislation and management. Numbers peaked in the late 1960s, but declined thereafter possibly due to poor immature survival rates, and this may have been partially attributable to deliberate trapping in the Ghanaian wintering grounds. Factors such as predation and nesting habitat loss (due to erosion, competition with gulls and/or disturbance) may have also played a role.

Conservation efforts are directed towards education programmes in the wintering areas in NW Africa and management of breeding sites. However, recovery is evident only at the largest colony, with smaller peripheral colonies declining to low levels or being abandoned despite intensive efforts to maintain them. Movements of birds among colonies within the metapopulation has been an important determinant of regional population trends during the past three decades. Therefore, maintaining or enhancing the species range is likely to depend on conservation efforts to promote growth of relict colonies, restore breeding at abandoned sites, and create new colonies.

Conservation status

Roseate Tern is currently identified as a conservation priority in the following:

Red listed in Birds of Conservation Concern 4 (2015 update)
Wildlife and Countryside Act 1981 - protected under Schedule 1
UK BAP - priority species (further information on Conservation Designations for UK Taxa)
Amber listed in Birds of Conservation Concern in Ireland 2014-2019 (2014 update)
OSPAR List of Threatened and/or Declining Species and Habitats
EC Birds Directive - e.g. listed in Annex 1 and as a migratory species

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International importance

UK Population	% Biogeographic Population	% World Population
56 AON*	2.6 (ssp. *dougallii*)	<0.1

*AON = Apparently Occupied Nests

The UK population figure was derived from data in Mitchell, P.I., Newton, S.F., Ratcliffe, N. and Dunn, T.E. (eds.) 2004. *Seabird Populations of Britain and Ireland.* Poyser, London. This was also the source of figures for the Biogeographic and World populations.

UK population estimates and change 1969-2002 (census data)

Roseate terns are restricted to a small number of well-known colonies in the UK, all of which have been counted near annually since 1969, such that their populations are monitored in more detail than any other seabird breeding here. Roseate terns were surveyed during Seabird 2000 by systematically counting all nests situated along transect lines set up through colonies. Nests are usually hidden in long vegetation, among boulders, in rabbit burrows or in nest boxes and so counts of AONs from a vantage point will miss a large proportion of nests. The species may move among colonies between years in response to predation or habitat change and so, to avoid double-counting or missing some pairs, all colonies were counted in 2000. During the SCR Census (1985-88) counts were conducted in different years at some colonies. In order to be comparable with Seabird 2000, only counts from the SCR Census conducted in 1986 were used; this was when the most comprehensive survey coverage of colonies was achieved during the period 1985-88.

	Operation Seafarer (1969-70)	Seabird Colony Register (1986)	Seabird 2000 (2000)
UK Population estimate (AON*)	955	323	56
% change since previous census	n/a	-66	-83

*AON = Apparently Occupied Nests

For census results for individual countries and Ireland, the Channel Islands and the Isle of Man see under relevant sections below.

Distribution/abundance

The Seabird 2000 census provides the most comprehensive recent assessment of the distribution and abundance of breeding seabirds. Numbers found in different regions, and a map showing the location and size of colonies, is provided in the Seabird 2000 roseate tern results pages.

The locations sampled during the annual Seabird Monitoring Programme provide some information on distribution and are accessible via the [Seabird Monitoring Programme online database].

Annual abundance and productivity by geographical area

With reference to the regional accounts below please note the following.

Breeding abundance: graphs of abundance index with 95% confidence limits are only shown for a region where the trend produced has been deemed accurate (see methods of analysis). Where a trend was thought to be inaccurate, graphs of abundance at major colonies in a region may be shown instead, particularly if such colonies hold greater than 10% of the regional population, are monitored frequently and may thus help illustrate regional population fluctuations outwith national censuses. Occasionally, too few data have been collected regionally to produce either of these.

Productivity: graphs of productivity are only shown if analysis of productivity data produced a significant result for regional and/or year effects (again see methods of analysis). If results were not significant, then a regional mean productivity value is given. However, on some occasions too few data are available from which to provide a meaningful average. Furthermore, for 11 species where the quality of monitoring data available was considered high, population viability analysis was undertaken at the UK level and the results of this are also reported.

United Kingdom

Breeding abundance

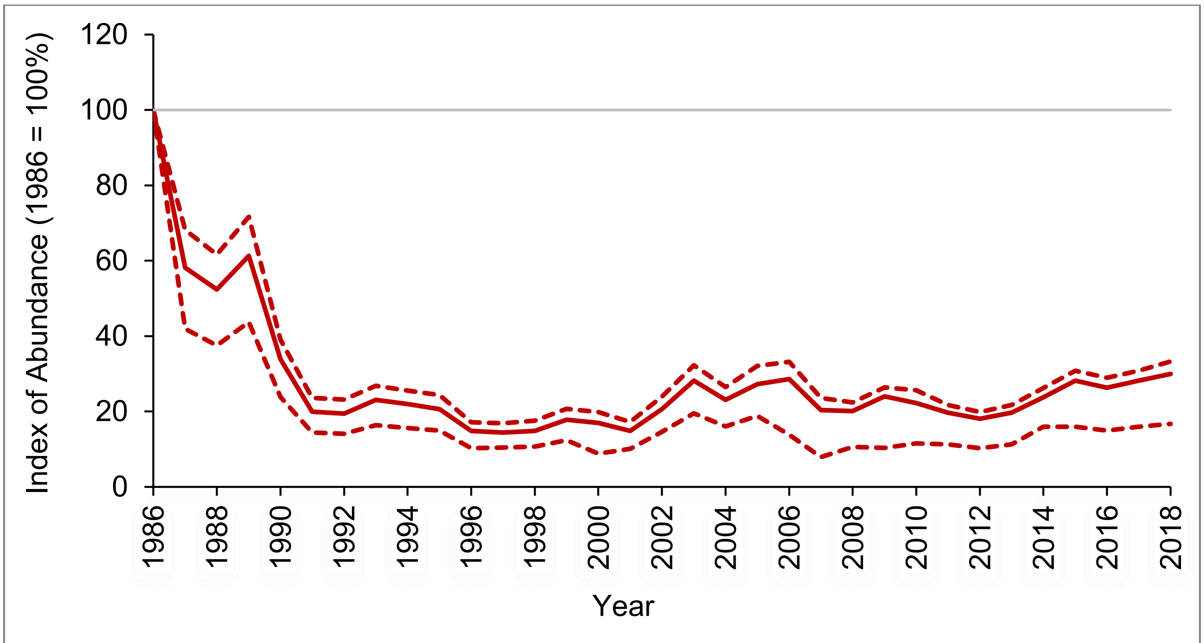

Figure 1. Trend in UK abundance index (solid line) of roseate tern 1986-2018 with 95% confidence limits (dotted lines). Based on SMP data; view the methods of analysis.

The UK roseate tern population has undergone a long-term decline, decreasing from 950 pairs in 1969-70 to 320 in 1985-88 and falling further between 1986 and 1991. This is most likely to have been due to mortality of immature birds in their wintering grounds in west Africa[1], which reduced subsequent recruitment into the breeding population. On the wintering grounds, boys trapped and killed mainly immature birds for food, sport or profit, and while education programmes in the late 1980s and early 1990s reduced mortality rates, these need to be maintained or a resurgence in trapping is likely[2]. Food supply in the species' wintering grounds is also likely to have affected immature survival rates. The above conservation measures (and providing shelter and protection from avian predators in the form of nest boxes at some colonies) have resulted in the UK population starting to recover. Just 56 AON were recorded by Seabird 2000 but by 2018 the UK population had risen to 120 AON. However, recovery has mostly been confined to just Coquet Island and, although numbers are increasing there, full recovery of the UK population remains a long way off.

Productivity

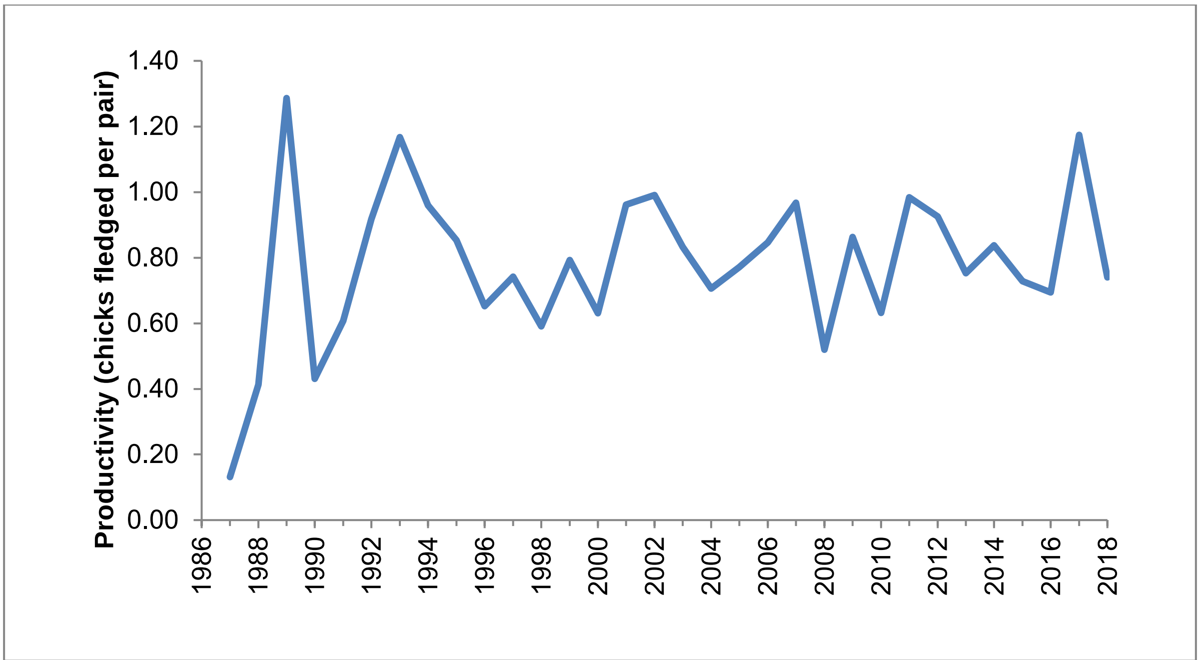

Figure 2. Trend in UK productivity (no. of chicks fledged per pair) of roseate tern 1987-2018. Based on SMP data; view the methods of analysis.

Although productivity was low in two years in the late 1980s when the population was declining, the number of chicks fledged in UK roseate tern colonies has generally been moderate to high throughout the reporting period. This is partly due to increased conservation effort. Predation of chicks was the likely cause of low productivity in 1987 and 1988, and poor weather affected west coast colonies in 1990, but the cause of low productivity in 2008 was not reported. In 2017, productivity was at the second highest value ever recorded, 1.17 chicks fledged per pair, while in 2018 the index decreased to 0.74.

Scotland

Population estimates and change 1969-2002 (census data)

	Operation Seafarer (1969-70)	Seabird Colony Register (1985-88)	Seabird 2000 (1998-2002)
Population estimate (AON*)	134	18	14
% change since previous census	n/a	-87	-22

* AON = Apparently Occupied Nests

Breeding abundance

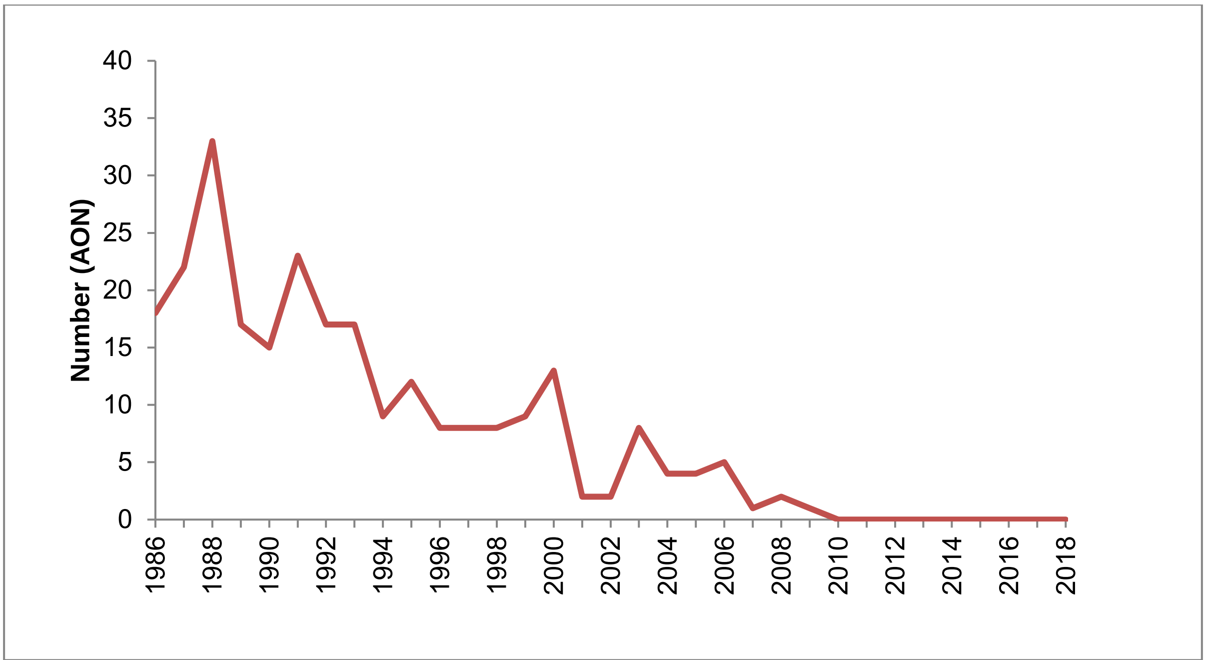

Figure 3. Abundance of roseate tern on the Forth Islands, 1986-2018.

The three national censuses show a large decline in roseate numbers from 134 AON in 1969-70 to 14 AON during Seabird 2000. In the Firth of Forth, the stronghold of the species in Scotland, the decline recorded there since the late 1980s was fairly steady, albeit with some fluctuation (Figure 3). Three islands in the Forth formerly held colonies of roseate terns, although the largest colony had effectively disappeared by the early 1990s due to increased competition for nesting habitat with herring gulls and breeding at another isle was sporadic. Only one colony has been active in recent years, but it too has disappeared due to flooding, predation and disturbance. Elsewhere in Scotland, single pairs occasionally frequent other tern colonies just maintaining its status as a breeding species in the country.

Productivity

Productivity data at Scottish colonies showed no statistically significant variation over time, although was low, averaging 0.34 chicks fledged per pair per year between 1992 and 2007.

England

Population estimates and change 1969-2002 (census data)

	Operation Seafarer (1969-70)	**Seabird Colony Register (1985-88)**	**Seabird 2000 (1998-2002)**
Population estimate (AON*)	355	34	36
% change since previous census	n/a	-90	+6

* AON = Apparently Occupied Nests

Breeding abundance

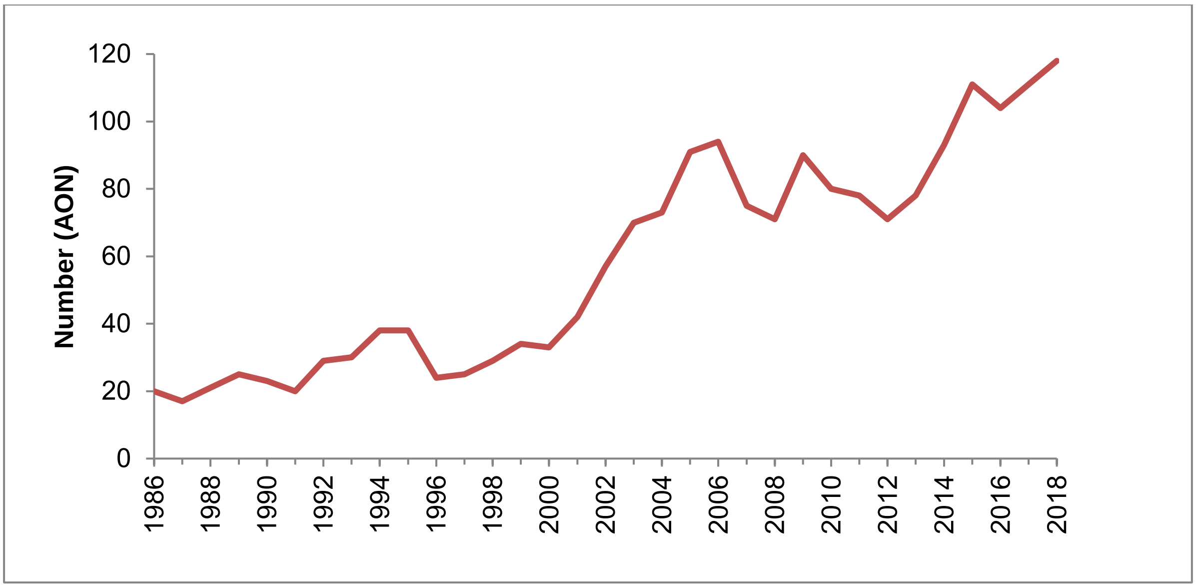

Figure 4. Abundance of roseate tern on Coquet Island, 1986-2018.

In contrast to Scotland, the one extant roseate tern colony in England, on Coquet Island, has fared better. National census results show that a large decline occurred in England between Operation Seafarer and the Seabird Colony Register, both in terms of the number of birds and number of colonies. Numbers have increased since then, but the species is now confined to Coquet. The rate of increase at this colony was slow at first (from 17 to 38 AON between 1986 and 2000) but increased rapidly from 2000 onward, with numbers reaching 94 AON in 2006. Since then, the population has been fluctuating between 71 and 94 AON until 2015 when it increased steeply to 111. In 2018, there were 118 AON at the colony. Active management on Coquet, via the provision of nestboxes for shelter and protection from avian predators, together with habitat management, has undoubtedly helped the species thrive there, perhaps to the detriment of other nearby colonies as birds abandon them in favour of Coquet.

Productivity

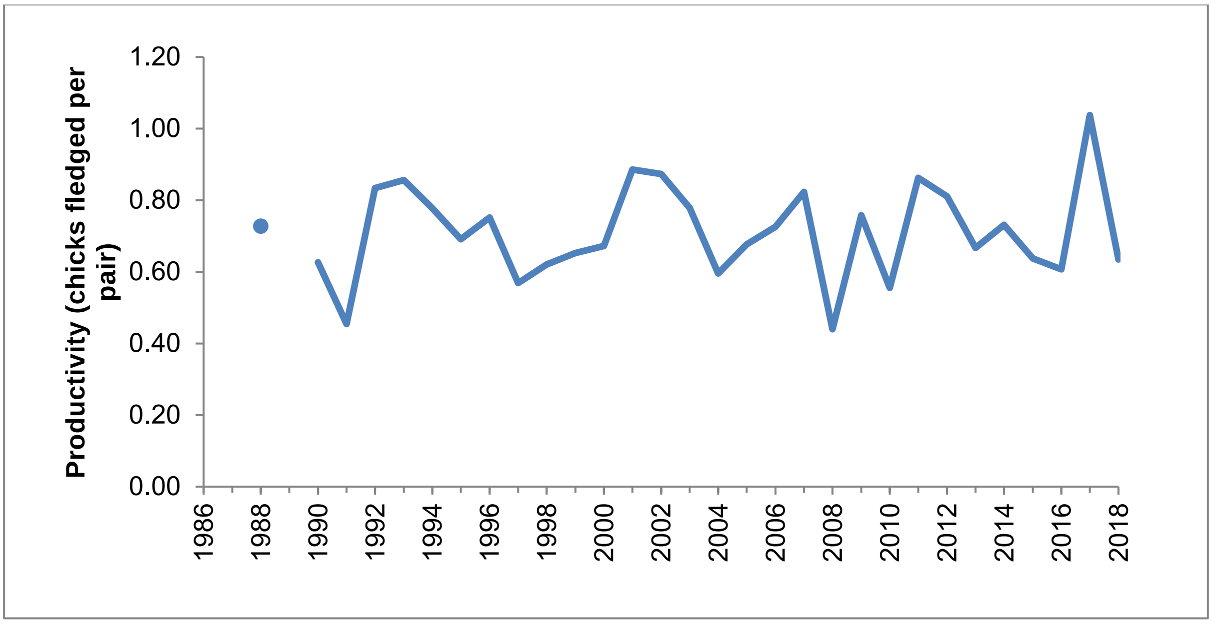

Figure 5. Trend in productivity (no. of chicks fledged per pair) of roseate tern at colonies in England, 1988-2018. Based on SMP data; view the methods of analysis.

The productivity of roseate terns at colonies in England shows no definitive trend. Mean productivity usually lies below 0.90 chicks fledged per pair, in contrast to the colonies in the Republic of Ireland which seldom fledge less than 1.00 chick per pair per year. Despite the low success, numbers have been increasing (Figure 5), although breeding roseate terns are now confined in England to just one colony (*c.* five colonies known during 1985-88), with sporadic sightings at others during the summer months.

Wales

Population estimates and change 1969-2002 (census data)

	Operation Seafarer (1969-70)	**Seabird Colony Register (1985-88)**	**Seabird 2000 (1998-2002)**
Population estimate (AON*)	202	209	2
% change since previous census	n/a	+3	-99

* AON = Apparently Occupied Nests

Breeding abundance

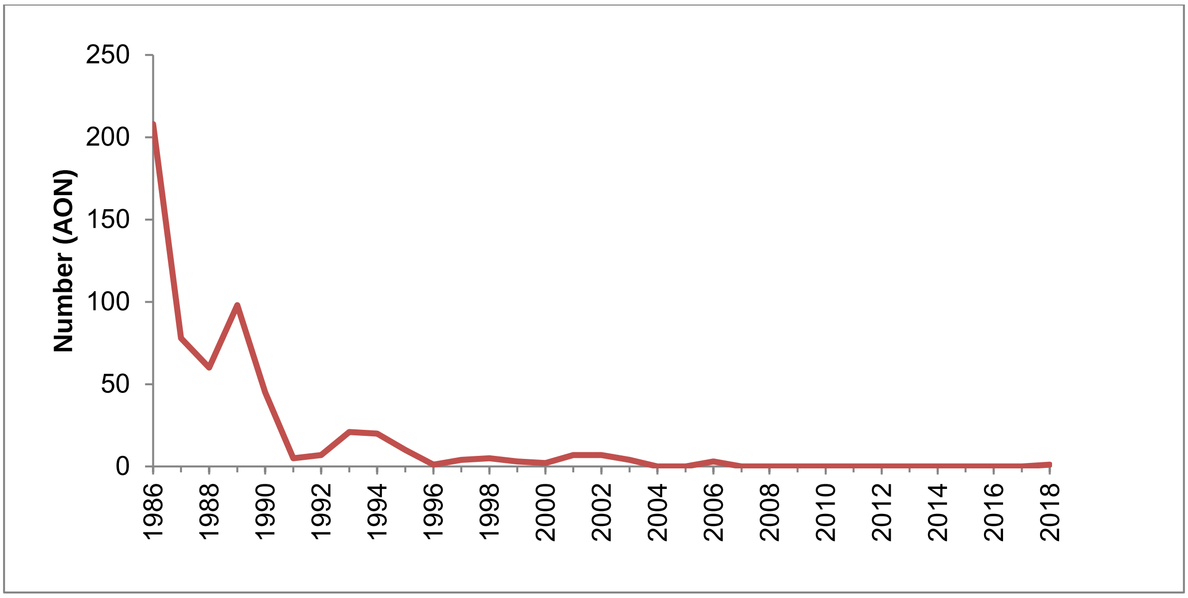

Figure 6. Abundance of roseate tern at colonies in Wales, 1986-2018.

The decline in roseate tern numbers in Wales was steep after the Seabird Colony Register, although prior to this numbers appeared stable in contrast to other populations in Britain and Ireland. By 1991, very few breeding pairs were left and, although there was a slight increase in 1993 and 1994, numbers soon decreased again and have never recovered. Ringing studies showed the decline was probably due to terns deserting colonies in Wales (and Northern Ireland) and emigrating to those in the Republic of Ireland where active management had created sites of higher quality. No roseate terns have nested in Wales since 2006.

Productivity

Productivity data at Welsh colonies showed no statistically significant variation over time, averaging 0.68 chicks fledged per pair per year between 1987 and 2006 (the last year for which the SMP has data).

Northern Ireland

Population estimates and change 1969-2002 (census data)

	Operation Seafarer (1969-70)	Seabird Colony Register (1985-88)	Seabird 2000 (1998-2002)
Population estimate (AON*)	264	62	4
% change since previous census	n/a	-76	-94

* AON = Apparently Occupied Nests

Breeding abundance

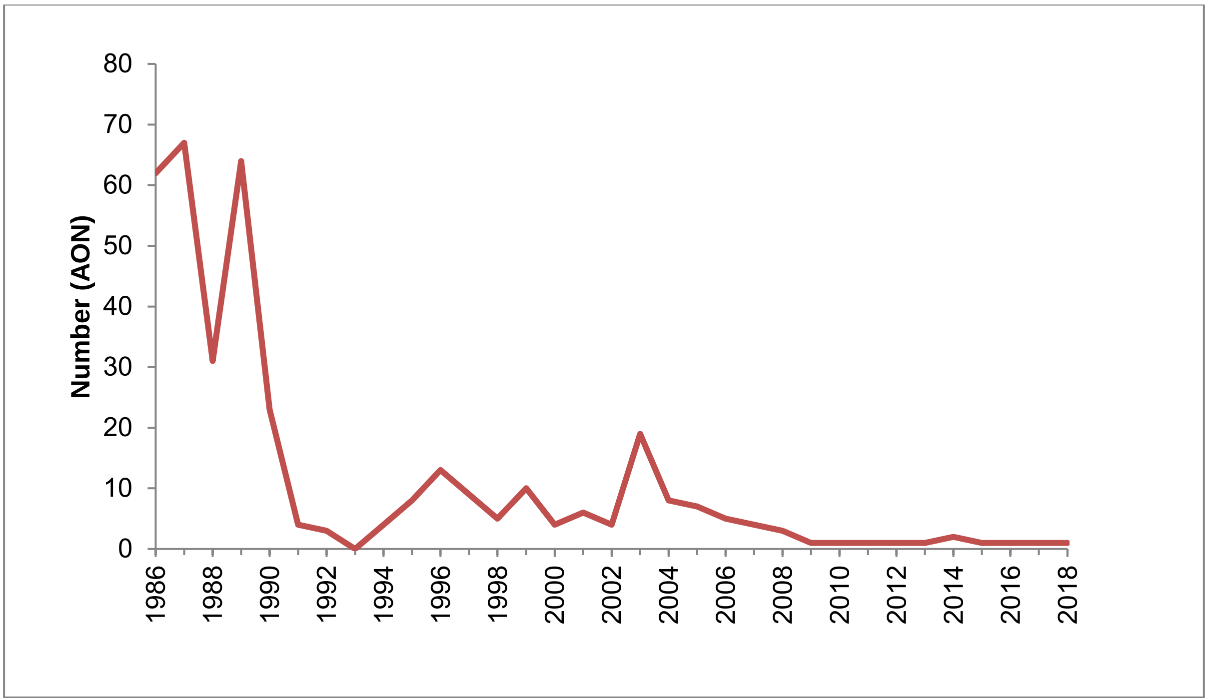

Figure 7. Abundance of roseate tern at three colonies in Northern Ireland, 1986-2018.

In common with Scotland and England, the roseate tern population of Northern Ireland declined between Operation Seafarer and the Seabird Colony Register censuses, although the nearby Welsh population was stable during this period. Then, in conjunction with Welsh colonies, a steep fall in numbers occurred so that few were left breeding by 1991. Emigration of birds to higher quality breeding sites in the Republic of Ireland was at least part of the reason for the decline. From the mid-1990s, the population fluctuated without showing any prolonged recovery and from 2003 declined again. Since 2009, only one AON has been recorded each year, except for 2014 when two AON were recorded. Single non-breeding birds have also been recorded at some other sites in recent years.

Productivity

There is no statistically significant variation over time in productivity data collected at colonies in Northern Ireland which were slightly more successful than Scottish colonies. Roseate tern productivity averaged 0.66 chicks fledged per pair per year between 1991 (the first year in the SMP with data) and 2018.

Republic of Ireland

Population estimates and change 1969-2018 (census data)

	Operation Seafarer (1969-70)	Seabird Colony Register (1984-85)	Seabird 2000 (1998-2002)	Republic of Ireland Census (2015-18)
Population estimate (AON*)	1,429	227	734	1,820
% change since previous census	n/a	-84	+223	+148

* AON = Apparently Occupied Nests

Breeding abundance

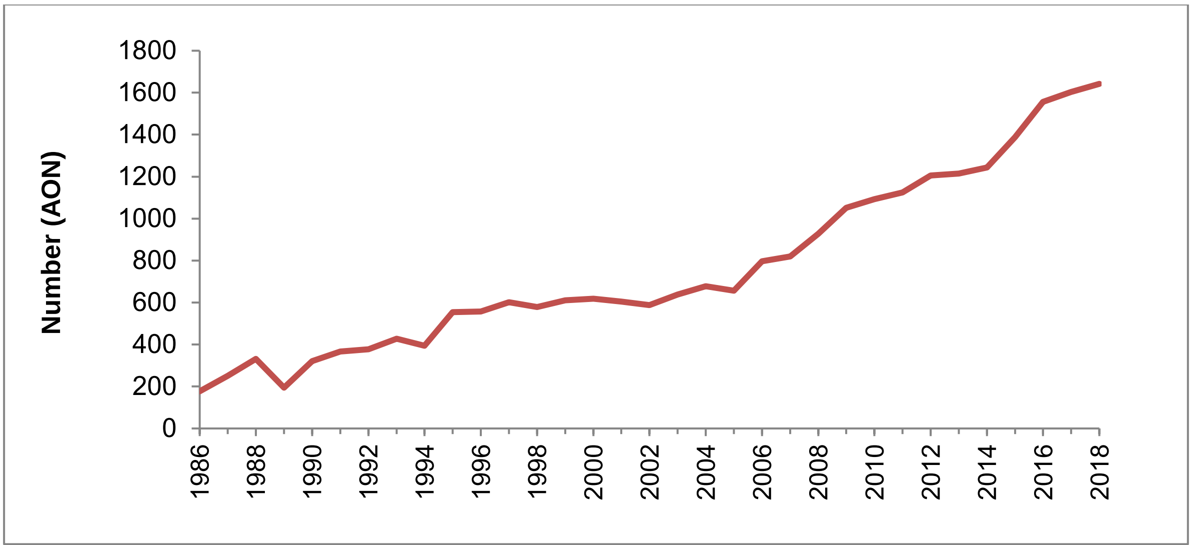

Figure 8. Abundance of roseate tern at Rockabill in the Republic of Ireland, 1986-2018.

After the near ubiquitous decline recorded throughout Britain and Ireland between Operation Seafarer and the Seabird Colony Register, roseate tern numbers in the Republic of Ireland have undergone a healthy increase which continues to the present. However, breeding is now confined to three colonies one of which, Rockabill (Figure 8) which holds almost 90% of the population. As on Coquet (England), the provision of nest boxes, in conjunction with other management techniques (e.g. predator control and habitat creation), have been of benefit to the species[3,4]. A recent seabird census in the Republic of Ireland recorded 1,820 AON, an increase of 148% since Seabird 2000 and 28% higher than recorded during Operation Seafarer.

Productivity

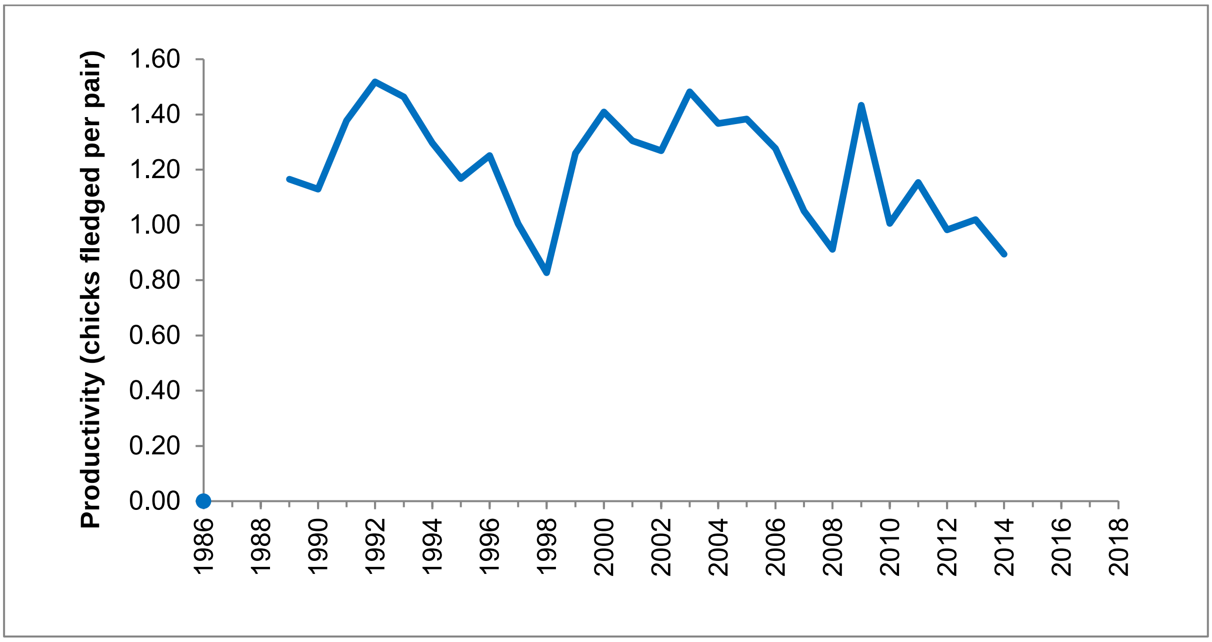

Figure 9. Trend in productivity (no. of chicks fledged per pair) of roseate tern in the Republic of Ireland, 1986-2014. Based on SMP data; view the methods of analysis.

Roseate terns at colonies in the Republic of Ireland have generally been productive over the years, usually fledging more than one chick per pair each year. However, in 1997, 1998, 2008, 2012 and 2014 productivity was lower than this, largely as a result of losses of eggs and chicks due to poor weather. No productivity data from the Republic of Ireland have been submitted to the SMP since 2015.

All Ireland

Population estimates and change 1969-2002 (census data)

	Operation Seafarer (1969-70)	Seabird Colony Register (1985-88)	Seabird 2000 (1998-2002)
Population estimate (AON*)	1,693	289	738
% change since previous census	n/a	-83	+155

* AON = Apparently Occupied Nests

Breeding abundance

Within Ireland, the roseate tern nests predominantly in the Republic of Ireland. Thus, all data and text for the Republic of Ireland is also pertinent to the status of the species for the whole of Ireland. No data from the Republic of Ireland have been submitted to the SMP since 2015.

Productivity

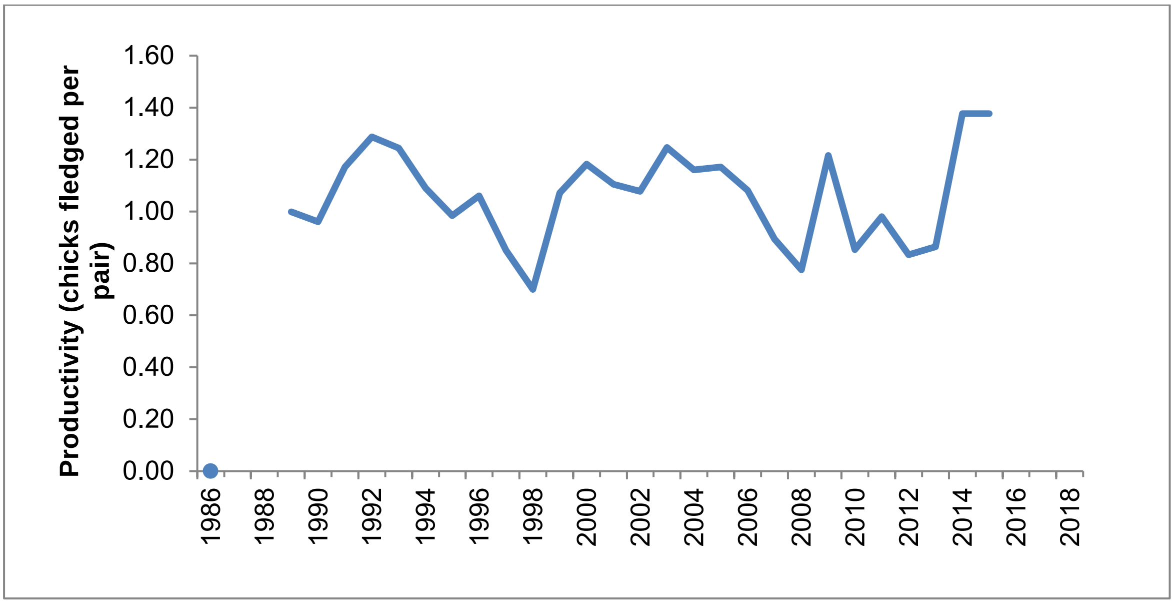

Figure 10. Trend in productivity (no. of chicks fledged per pair) of roseate tern throughout Ireland, 1986-2015. Based on SMP data; view the methods of analysis.

Unsurprisingly, the trend shown above for All-Ireland closely matches that shown for the Republic of Ireland, where the majority of data have been collected over the years, albeit with slightly lower average annual values. Losses of eggs and chicks due to poor weather were responsible for at least some of relatively low values recorded e.g. in 1998 and 2008. No data from the Republic of Ireland have been submitted to the SMP since 2015.

Isle of Man

Roseate tern does not breed on the Isle of Man.

Channel Islands

Roseate tern does not breed on the Channel Islands.

UK phenology, diet, survival rates

No data have been collected as part of the Seabird Monitoring Programme.

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3 Daly, D., Murphy, B., O'Connor, B. and Murray, T. 2018. Lady's Island Lake Tern Report 2018. Unpublished report.
5 Acampora, H., Ní Dhonnabháin, L., Miley, D. and Newton, S. 2018. Rockabill Tern Report 2018. BirdWatch Ireland Seabird Conservation Report.

Arctic Tern Sterna paradisaea

Description

The following has been adapted from original text by Norman Ratcliffe in Seabird Populations of Britain and Ireland (with permission from A&C Black, London).

Arctic terns are the commonest tern breeding in the UK, but their northerly distribution means they are less familiar to most observers. The population is concentrated in the Northern Isles, with 73% occurring there. In common with other tern species, Arctic terns were probably reduced to low levels by hunting for the millinery trade and egging, but have probably increased since the 1930s owing to legal protection. Increasing sandeel stocks in waters around Shetland through the 1970s and early 1980s, improving food availability, may have also contributed to population growth. However, a collapse of the sandeel stock around Shetland between 1984 and 1990 resulted in a reversal of fortunes.

In western Scotland and the Western Isles, declines and redistribution of the population have resulted from predation by introduced American mink, *Neovison vison*. Future population trends depend on the success of mink eradication and control projects being implemented in these areas. Many Arctic tern colonies at the southern range of the UK population are increasing, probably in response to site management for breeding terns.

Conservation status

Arctic tern is currently identified as a conservation priority in the following:

Amber listed in Birds of Conservation Concern 4 (2015 update)
(further information on Conservation Designations for UK Taxa
Amber listed in Birds of Conservation Concern in Ireland 2014-2019 (2014 update)
EC Birds Directive - listed in Annex 1 and as a migratory species

International importance

UK Population	% Biogeographic Population	% World Population
53,400 AON*	4.7 (Europe and N Atlantic)	3.1

*AON = Apparently Occupied Nests

The UK population figure (rounded to the nearest hundred) was derived from data in Mitchell, P.I., Newton, S.F., Ratcliffe, N. and Dunn, T.E. (eds.) 2004. *Seabird Populations of Britain and Ireland.* Poyser, London. This was also the source of figures for the Biogeographic and World populations.

UK population estimates and change 1969-2002 (census data)

All terns show a low degree of site faithfulness from one year to the next. In response to predation or habitat change, especially in areas where islands and other suitable habitat are plentiful, terns often move *en masse* between different sites. This is such a problem that in order to gain an accurate national estimate of tern numbers, a simultaneous census was planned to cover all colonies in Britain within a single year. Hence in 2000, the majority of British tern colonies were surveyed including extensive surveys of Orkney and Shetland. The main exception was in the Western Isles, where most tern colonies in Lewis and Harris were surveyed in 1999, while those in the south of the Sound of Harris to Barra Head were surveyed in 2002. For Northern Ireland, it was decided to make the most of limited resources and utilise results from the All-Ireland tern survey conducted in 1995. More recent counts (with those from 2000 given priority) were included for some colonies. Movements among these regions are unlikely to have caused severe bias in trend estimation. Thus, Seabird 2000 is likely to have included counts from the vast majority of Arctic tern colonies, with comprehensive coverage within their UK range. During the SCR, coverage of the Northern Isles was poor, but this was overcome by inclusion of data from the 1980 survey of terns in Orkney and Shetland. There is also debate concerning the degree to which survey coverage, changes in methods and survey timing have contributed to changes in status since Operation Seafarer, and so long-term changes should be treated with caution.

	Operation Seafarer (1969-70)	**Seabird Colony Register (1985-88)**	**Seabird 2000 (1998-2002)**
UK Population estimate (AON*)	51,411	76,886	53,380
% change since previous census	n/a	+50	-31

*AON = Apparently Occupied Nests

For census results for individual countries and Ireland, the Channel Islands and the Isle of Man see under relevant sections below.

Distribution/abundance

The Seabird 2000 census provides the most comprehensive recent assessment of the distribution and abundance of breeding seabirds. Numbers are found in different regions, and a map showing the location and size of colonies, is provided in the Seabird 2000 Arctic tern results page.

The locations sampled during the annual Seabird Monitoring Programme provide some information on distribution and are accessible via the Seabird Monitoring Programme online database.

Annual abundance and productivity by geographical area

With reference to the regional accounts below please note the following.

Breeding abundance: graphs of abundance index with 95% confidence limits are only shown for a region where the trend produced has been deemed accurate (see methods of analysis). Where a trend was thought to be inaccurate, graphs of abundance at major colonies in a region may be shown instead, particularly if such colonies hold greater than 10% of the regional population, are monitored frequently and may thus help illustrate regional population fluctuations outwith national censuses. Occasionally, too few data have been collected regionally to produce either of these.

Productivity: graphs of productivity are only shown if analysis of productivity data produced a significant result for regional and/or year effects (again see methods of analysis). If results were not significant, then a regional mean productivity value is given. However, on some occasions too few data are available from which to provide a meaningful average. Furthermore, for 11 species where the quality of monitoring data available was considered high, population viability analysis was undertaken at the UK level and the results of this are also reported.

United Kingdom

Breeding abundance

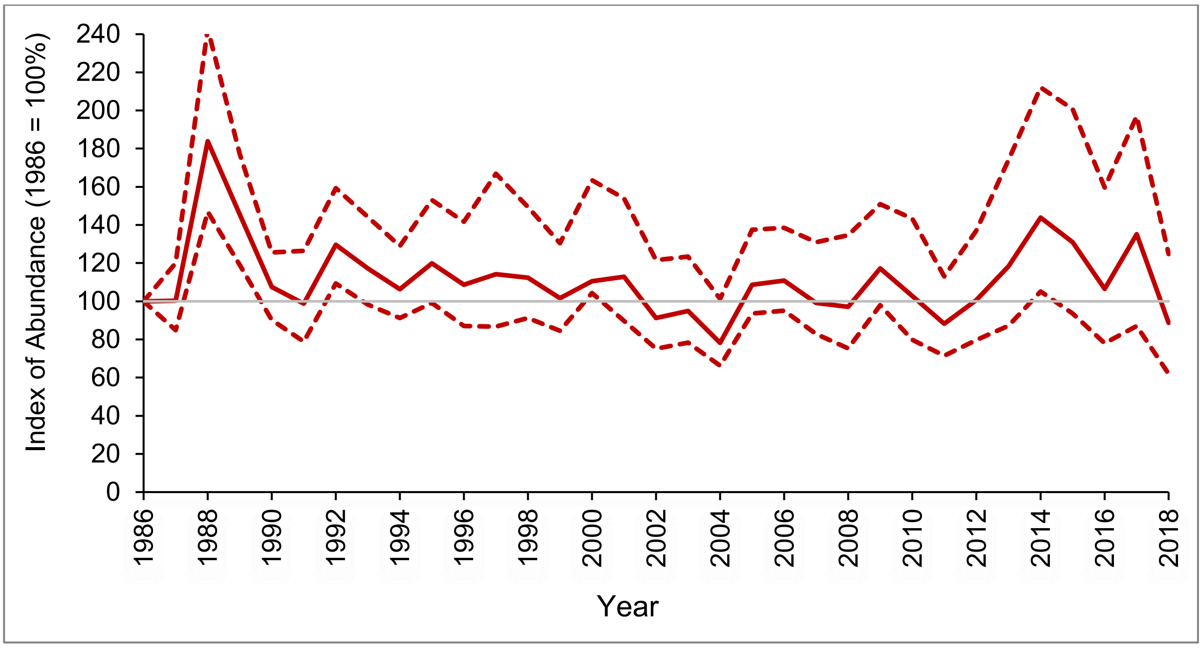

Figure 1. Trend in UK abundance index (solid line) of Arctic tern 1986-2018 with 95% confidence limits (dotted lines). Based on SMP data; view the methods of analysis.

There is uncertainty, due to questions of compatibility of methods between censuses, of the magnitude of changes in Arctic tern population size between 1969-70 and 1985-88, though numbers probably increased over this period. The Arctic tern abundance index, based on the SMP sample, showed a rapid increase, followed by a decrease, during 1986 to 1990 (influenced by changes at a few large colonies in the Northern Isles of Scotland during those years). Between 1990 and 2009, the index fluctuated between 100 and 130, excluding 2002-2004 when a dip was noticeable. Abundance fell steeply between 2009 and 2011 but rose again to 2014, when it was higher than in any year (excluding 1988 and 1989) probably due to increased numbers at colonies in England and Wales. In 2015 and 2016, the index fell again but was still above the 1986 baseline. After a rise in the abundance index in 2017, it decreased to 11% below the 1986 baseline in 2018. Declining abundance up to and including 2004 was in part caused by poor breeding seasons in the Northern Isles, which were attributed to sandeel *Ammodytes spp.* shortages linked to oceanographic changes (see below). Declines in the Arctic tern population have also been caused (in western Scotland) by American mink predation, a non-native invasive species. A successful mink eradication programme on the Western Isles and other control measures[1] are contributing towards conservation initiatives aimed at increasing the population.

Productivity

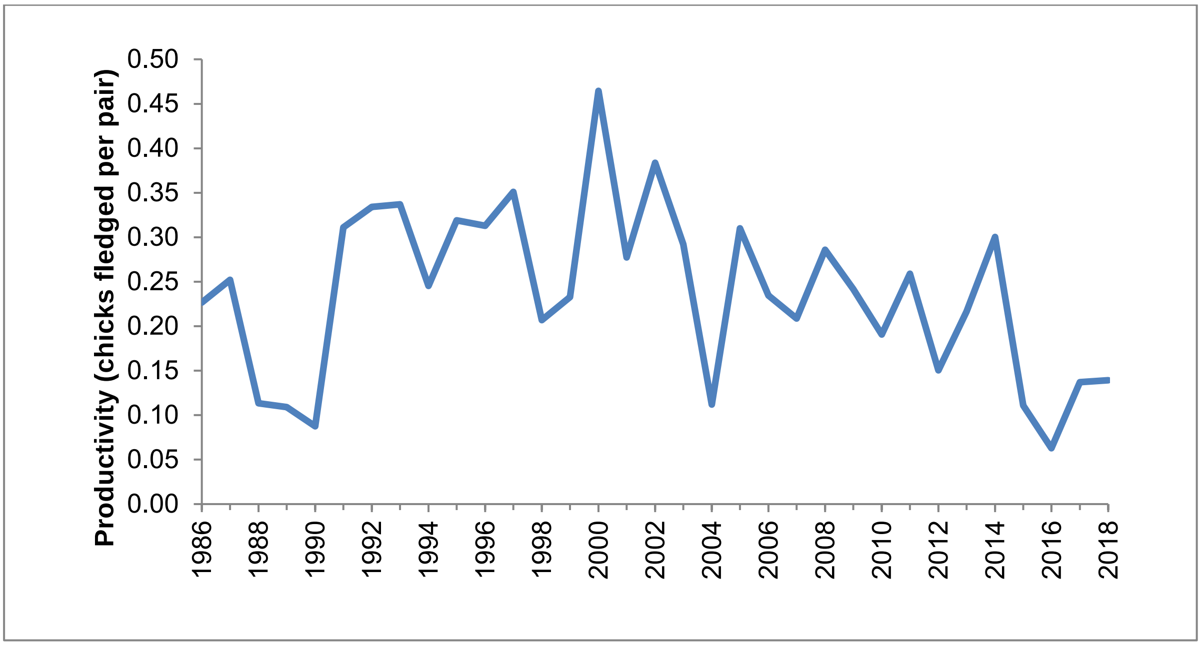

Figure 2. Trend in UK productivity (no. of chicks fledged per pair) of Arctic tern 1986-2018. Based on SMP data; view the methods of analysis.

The productivity of Arctic terns is consistently the lowest of any of the seabirds breeding in the UK. Since 1986, the annual average productivity has only risen above 0.40 chicks per pair once, in 2000, and in most years lies below 0.30. Especially unproductive years occurred from 1988 to 1990, in 2004 and in two of the last four breeding seasons, associated with marked shortages in prey (especially sandeels around the Northern Isles, where most Arctic terns breed). The effects of this may have been exacerbated by poor weather hampering foraging and chilling eggs and chicks, together with increased predation by gulls seeking alternative food sources. Sandeel shortages in Shetland have probably been caused by oceanographic changes that affected larval sandeel transport and recruitment from spawning stock in Orkney[2,3]. From 2015 to 2017, sandeel prey appeared to be plentiful and unseasonable weather conditions, strong tides and predation were the more likely causes of fewer chicks fledging than in 2014[4,5,6].

Scotland

Population estimates and change 1969-2002 (census data)

	Operation Seafarer (1969-70)	**Seabird Colony Register (1985-88)**	**Seabird 2000 (1998-2002)**
Population estimate (AON*)	46,385	71,178	47,306
% change since previous census	n/a	+53	-34

* AON = Apparently Occupied Nests

Breeding abundance

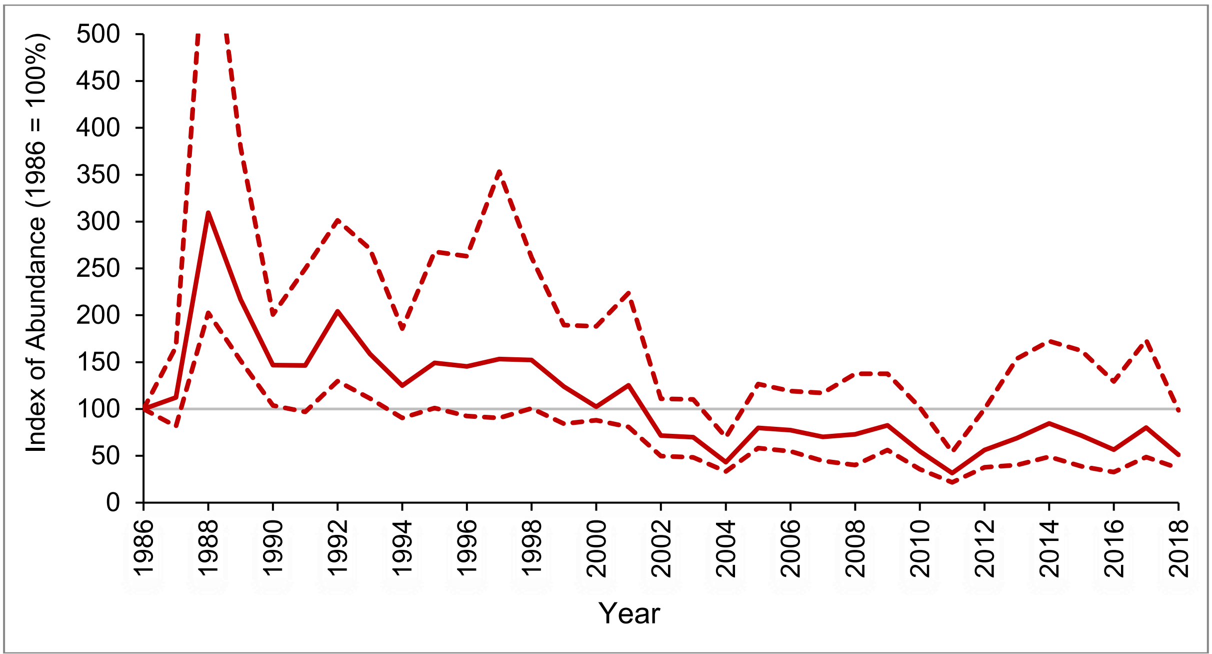

Figure 3. Trend in abundance index (solid line) of Arctic tern in Scotland, 1986-2018 with 95% confidence limits (dotted lines; drawing of upper limit restricted to preserve detail in the abundance index). Based on SMP data; view the methods of analysis.

The rapid increase and subsequent fall in the abundance of Arctic terns in Scotland between 1986 and 1990 is probably influenced by changes at a few large colonies in the Northern Isles during those years. Thereafter, the index declined to a low point in 2004, with a short period of recovery before further declines from 2009 to 2011. The index has risen slightly in recent years and, in 2014, was just 15% below the 1986 baseline, although by 2018 had declined to almost 50% below. Declines are likely to have been caused by a combination of factors. In the Northern Isles, very low productivity (below 0.30) is evident in 29 years between 1986 and 2018, driven by sandeel shortages linked to oceanographic changes[3]. In western Scotland, declines have been caused by American mink taking adults, eggs and chicks from near-shore nesting islands[1,7], although successful mink eradication programmes on the west coast have led to increases at many sites[8]. Scotland's Arctic tern population appears not have changed significantly since Operation Seafarer, although there is some uncertainty over this due to questions concerning the compatibility of methods between the national censuses.

Productivity

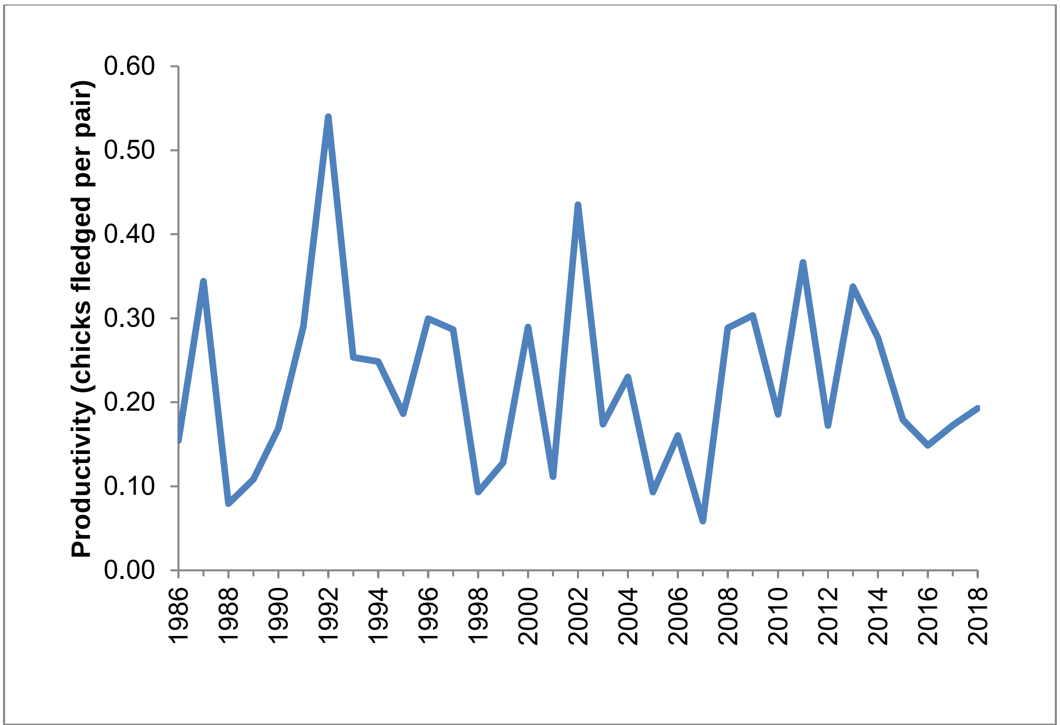

Figure 4. Trend in productivity (no. of chicks fledged per pair) of Arctic tern in Scotland, 1986-2018. Based on SMP data; view the methods of analysis.

Productivity of Arctic terns is consistently lower than common terns, and indeed the lowest of any seabird species breeding in Scotland. Annual average productivity has risen above 0.40 chicks per pair only twice in 30 years. Very low productivity (below 0.20) is evident in 17 years, including six years in the last decade, associated with food shortages (especially sandeels around the Northern Isles, where most Arctic terns breed), exacerbated by poor weather and increased predation by gulls seeking alternative food sources. Sandeel shortages in Shetland have probably been caused by oceanographic changes that affected larval sandeel transport and recruitment from spawning stock in Orkney[2,3]. At colonies in Lochaber, and in Argyll and Bute, detailed studies into the effects of predation by American mink revealed that colonies where mink were controlled fledged an average of 0.65 chicks per nesting pair compared to 0.50 at colonies with no, or unsuccessful, mink control[8].

England

Population estimates and change 1969-2002 (census data)

	Operation Seafarer (1969-70)	Seabird Colony Register (1985-88)	Seabird 2000 (1998-2002)
Population estimate (AON*)	4,469	4,544	3,602
% change since previous census	n/a	+2	-21

* AON = Apparently Occupied Nests

Breeding abundance

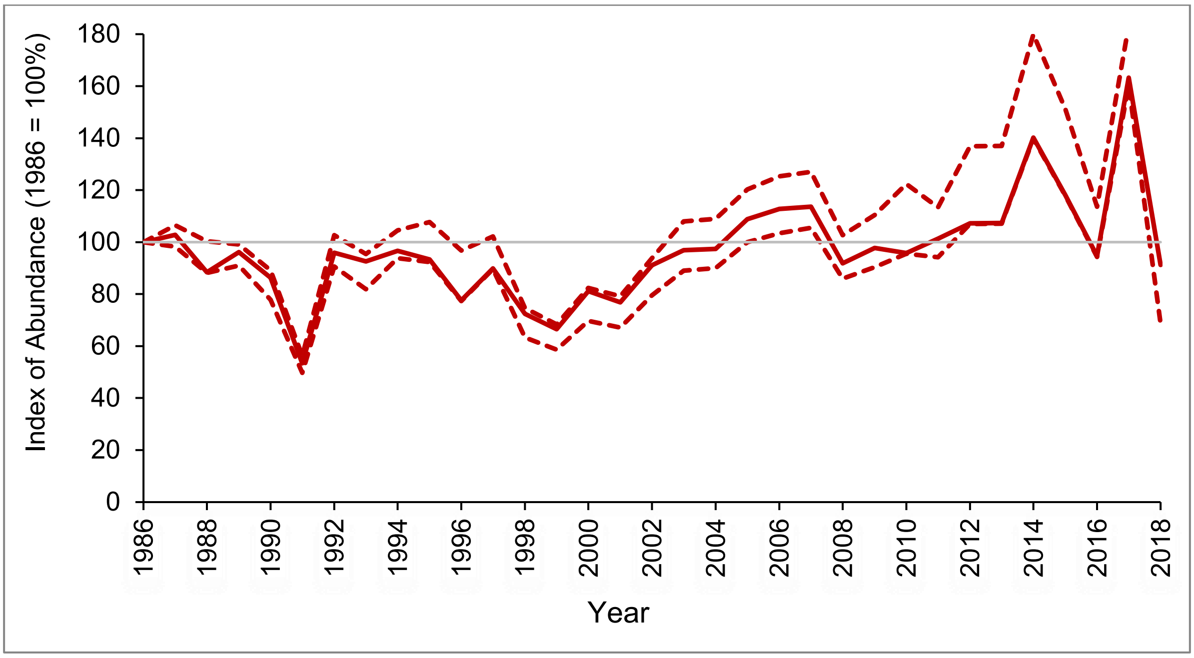

Figure 5. Trend in abundance index (solid line) of Arctic tern in England, 1986-2018 with 95% confidence limits (dotted lines). Based on SMP data; view the methods of analysis.

Arctic tern numbers in England appear to have been stable between the first two censuses (1969-70 and 1985-88), however, this should be viewed with caution as there is uncertainty regarding how compatible the different methods used in each census were. Between the SCR census and Seabird 2000, numbers declined by one-fifth. However, since 2000 (when all Arctic tern colonies were surveyed for Seabird 2000), numbers appear to have increased. With the addition of missing data from Long Nanny, Figure 5 now shows the abundance trend since 1986 (previous reports only showed numbers at five main colonies). Abundance declined from 1986 to 1991 before recovering in 1992 then falling again until 1999. Since then, numbers have increased and the baseline has been crossed in recent years, reaching a new high point in 2014. Three colonies monitored in 2018 (Farne Islands, Coquet, Long Nanny) which contained over 95% of Arctic terns nesting in England, held 6,370 AON. This is more than has been recorded during any of the national censuses and is a 77% increase to what was recorded from all colonies (*c.*16 are known) during Seabird 2000.

Productivity

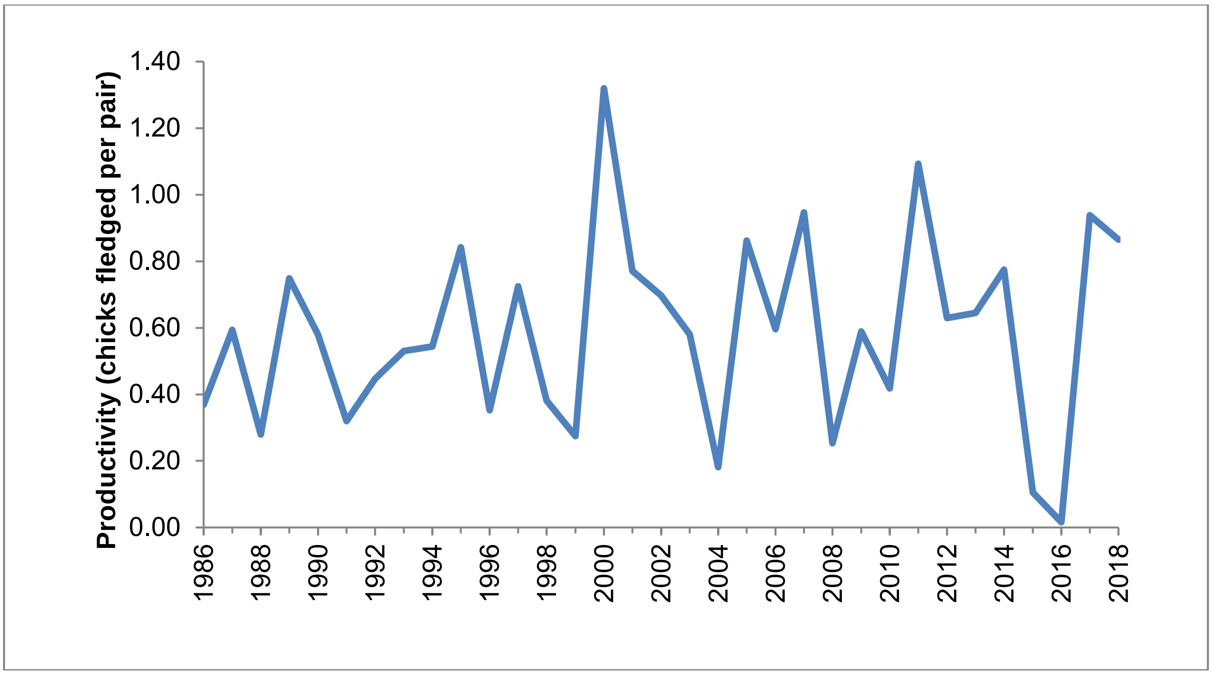

Figure 6. Trend in productivity (no. of chicks fledged per pair) of Arctic tern in England, 1986-2018. Based on SMP data; view the methods of analysis.

Productivity of Arctic terns in England has fluctuated widely over the 32 years it has been monitored. However, it has not been as consistently low as that recorded at Scottish colonies. Until recently, the lowest recorded productivity was in 2004 (0.18), however, in 2016 it reached 0.02, the lowest year since records began. During 2015 and 2016, Arctic terns at Long Nanny nested in large numbers but, out of 3,000 AON, only 40 chicks fledged. While productivity has remained low at most reported colonies, Coquet Island achieved reasonably high productivity in 2017 and 2018, with 1.13 and 1.39 chicks fledged per pair respectively.

Wales

Population estimates and change 1969-2002 (census data)

	Operation Seafarer (1969-70)	Seabird Colony Register (1985-88)	Seabird 2000 (1998-2002)
Population estimate (AON*)	436	732	1,705
% change since previous census	n/a	+68	+133

* AON = Apparently Occupied Nests

Breeding abundance

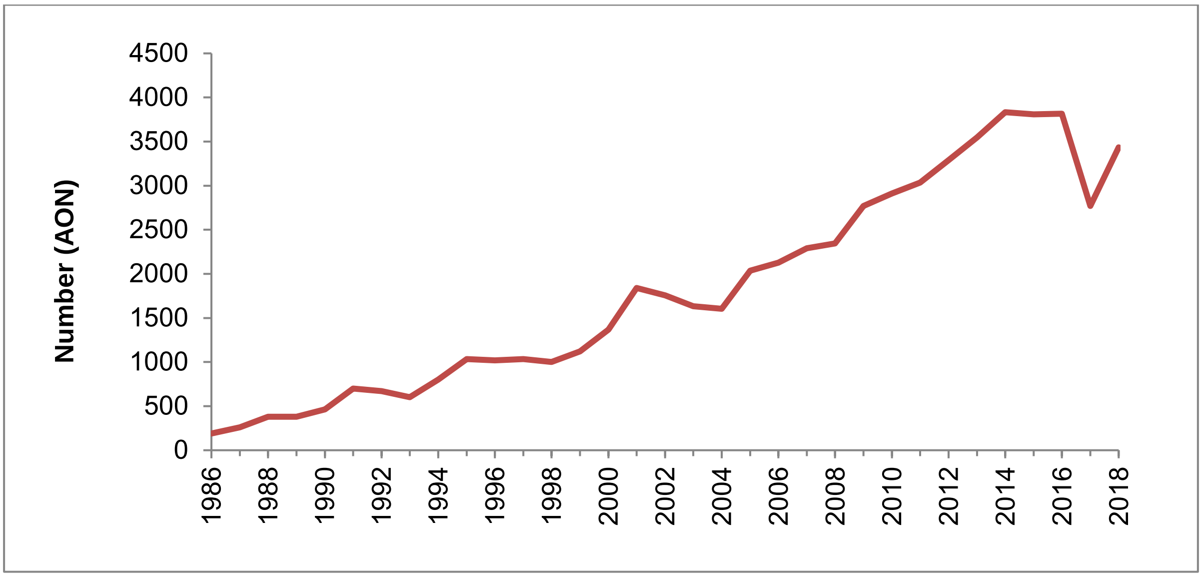

Figure 7. Abundance of Arctic tern on The Skerries, Isle of Anglesey, 1986-2018.

There are only a few Arctic terns colonies in Wales, all situated on the island of Anglesey. National census data show numbers increased from 436 AON in 1969-70 to 1,705 AON in 1998-2002. This increase has continued; for example, in 2008, over 2,800 AON were found at four colonies and in 2018 there were 3,017 in three colonies, so the Welsh population has almost doubled over the last 18 years. By far the largest colony, holding at least 95% of the Welsh population, is on The Skerries which held 3,500 AON each year between 2013 and 2015. Numbers dropped to 2,770 AON briefly in 2017 but were at 3,435 AON in 2018 (Figure 7).

Productivity

In Wales, productivity of Arctic terns increased during the 1990s, after which there were a few years of relatively consistent high productivity. However, since 2003, productivity has fluctuated widely, possibly due to food shortage in some years. Insufficient data in recent years does not allow a trend to be generated. The Cemyln breeding seasons in 2016 and 2017 were particularly poor, with no chicks fledging from 60 and 20 AON respectively, due to some predation, but mostly repeated disturbance, by otters *Lutra lutra* (Chris Wynne pers. comm.). In 2018 productivity at Cemlyn was 0.71 chicks per pair, much higher than the 1986 to 2018 average of 0.33 chicks fledged per pair.

Northern Ireland

Population estimates and change 1969-2002 (census data)

	Operation Seafarer (1969-70)	Seabird Colony Register (1985-88)	Seabird 2000 (1998-2002)
Population estimate (AON*)	121	432	767

	Operation Seafarer (1969-70)	Seabird Colony Register (1985-88)	Seabird 2000 (1998-2002)
% change since previous census	n/a	+257	+78

* AON = Apparently Occupied Nests

Breeding abundance

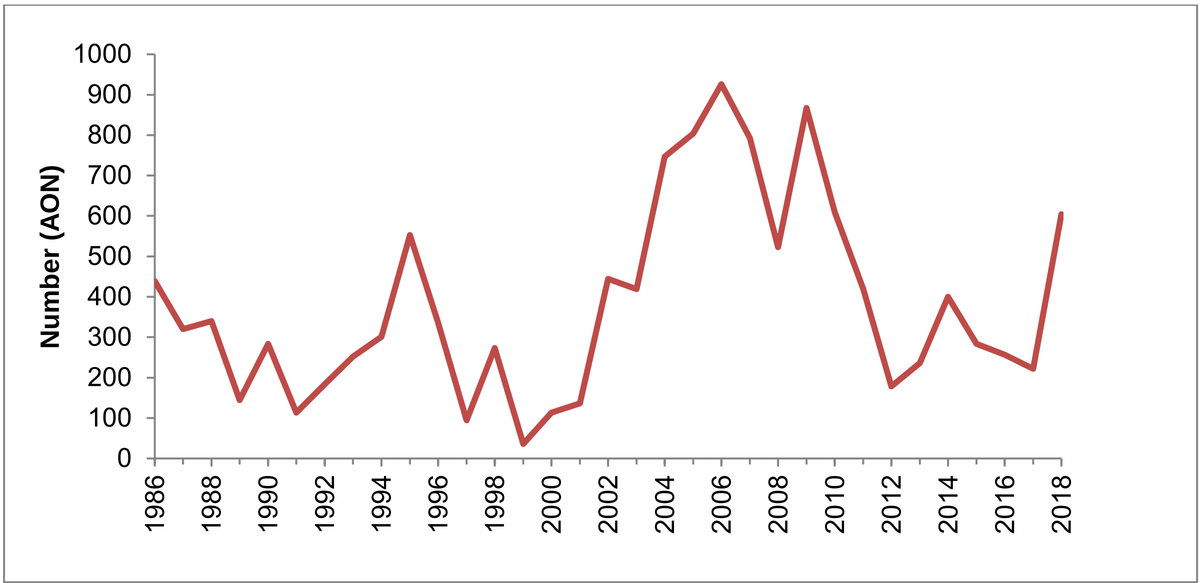

Figure 9. Abundance of Arctic tern at Strangford and Carlingford Loughs, and Cockle Island, 1986-2018.

In Northern Ireland, Arctic terns breed in just a few colonies, including the Copeland Islands, Strangford Lough, Belfast Harbour, Bird Island, Green Island, and Cockle Island. During Operation Seafarer, 121 Arctic tern AON were recorded in Northern Ireland. Numbers then increased in each subsequent census, with Seabird 2000 recording 767 AON. Counts from three regularly monitored colonies, Strangford and Carlingford Loughs, and Cockle Island, show how numbers there have changed over time, reaching a peak in 2006 (926 AON) but declining steeply afterward with just 178 pairs present at the three sites in 2012 (Figure 9). Since then, numbers have fluctuated but are currently increasing again, with 604 AON recorded in 2018. The Copeland Islands, the largest colony of Arctic terns in Northern Ireland, held between 800 and 1,000 AON each year from 2003 to 2012, with a new peak of 1,250 AON being recorded in 2013. No full survey has taken place on all three islands of the Copeland Islands in the past five years, however, Arctic terns were counted on Lighthouse Island in 2018, when 150 AON were recorded. In 2018, numbers still compared favourably against the total figure from the last census with 769 AON recorded at five of eight colonies, especially as the largest, Big Copeland Island, is not included in this total.

Productivity

Arctic terns in Northern Ireland fledged an average of 0.31 chicks per pair per year between 1991 and 2018; there was no statistically significant variation over time. Productivity has been extremely low in some years, especially between 2007 and 2011, when the main colonies on the Copeland Islands failed due to a combination of adverse weather and predation by gulls and otters *Lutra lutra.* Productivity was again very low in 2018, due to the effects of Storm Hector and significant predation by large gulls and otters at Carlingford and Strangford Lough (five chicks fledged from 263 AON).

Republic of Ireland

Population estimates and change 1969-2018 (census data)

	Operation Seafarer (1969-70)	Seabird Colony Register (1984-85)	Seabird 2000 (1998-2002)	Republic of Ireland Census (2015-18)
Population estimate (AON*)	848	1,856	2,735	2,778
% change since previous census	n/a	+119	+47	+2

*AON = Apparently Occupied Nests

Breeding abundance

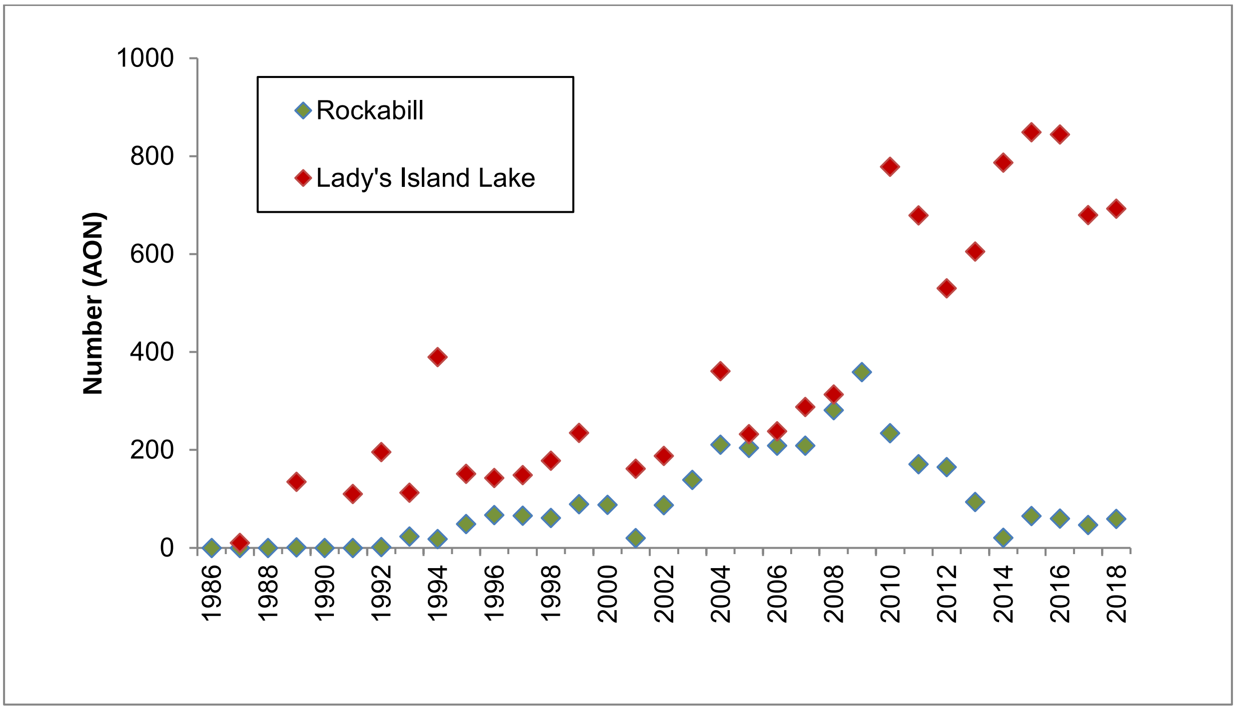

Figure 10. Abundance of Arctic tern at Rockabill and Lady's Island Lake, 1986-2018.

In the Republic of Ireland, Arctic tern numbers increased between every national census, with Seabird 2000 recording a population three times higher than Operation Seafarer. The Rockabill and Lady's Island Lake (Figure 10) colonies increased to combined peak of 1,102 AON in 2010 but, by 2014 numbers had fallen to 808 AON. The majority of these (787 AON) were at Lady's Island Lake with the colony at Rockabill decreasing considerably since 2009.

In 2018, 59 AON were counted at Rockabill and 693 AON at Lady's Island Lake[8,9]. A recent seabird census of the Republic of Ireland recorded 2,778 Arctic tern AON, a slight increase since Seabird 2000[10].

Productivity

Arctic terns in the Republic of Ireland on average fledged approximately 0.28 chicks per pair per year between 1991 and 2013; there was no statistically significant variation over time. No productivity data have been submitted to the SMP since 2014.

All Ireland

Population estimates and change 1969-2002 (census data)

	Operation Seafarer (1969-70)	Seabird Colony Register (1985-88)	Seabird 2000 (1998-2002)
Population estimate (AON*)	969	2,288	3,502
% change since previous census	n/a	+136	+53

* AON = Apparently Occupied Nests

Breeding abundance

Seabird 2000 found Arctic terns numbers throughout Ireland had increased by 261% since Operation Seafarer. Since Seabird 2000, numbers in Northern Ireland had been increasing, and in 2006, numbers at monitored colonies were double that recorded by Seabird 2000. No full survey has taken place on all three islands of the Copeland Islands in the past five years, however, Arctic terns were counted on Lighthouse Island in 2018, when 150 AON were recorded. In 2018, numbers still compared favourably against the total figure from the last census with 769 AON recorded at five of eight colonies, especially as the largest, Big Copeland Island, was not included in the total. A recent seabird census of the Republic of Ireland has counted 2,778 AON, a 2% increase since Seabird 2000[10]. These recent count data suggest that it is very likely that the Irish Arctic tern population is increasing.

Productivity

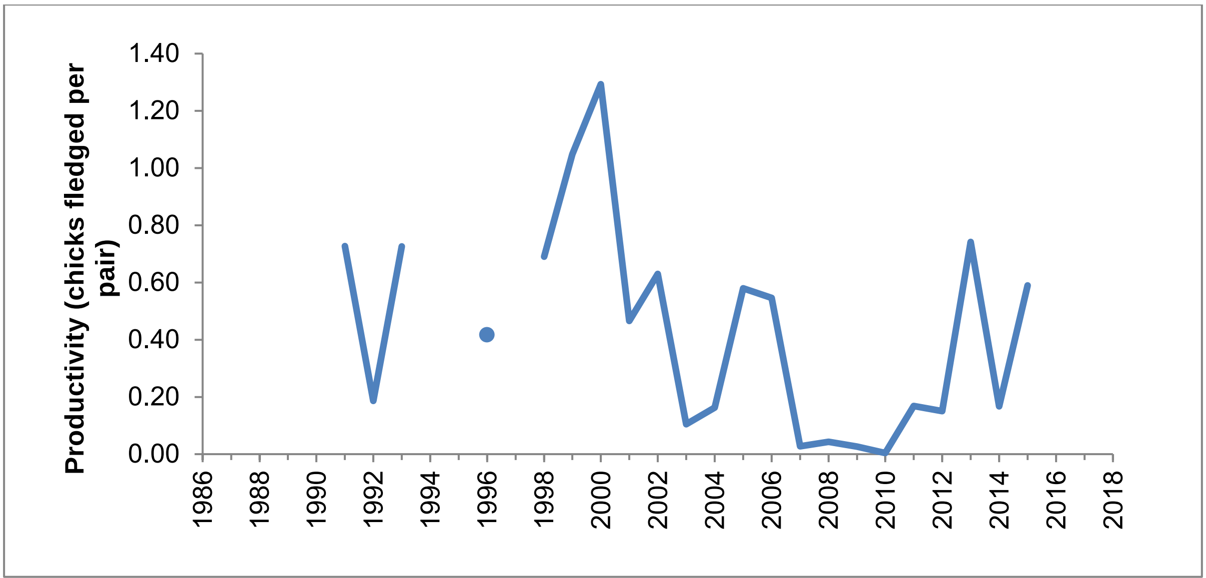

Figure 11. Trend in productivity (no. of chicks fledged per pair) of Arctic tern throughout Ireland, 1986-2015. Based on SMP data; view the methods of analysis.

Productivity of Arctic terns from colonies throughout Ireland appears to have been declining over the last decade, with very few chicks fledged in 2005, 2006, 2013 and 2015. Prior to 1998, data are lacking for several years, so no clear trend is evident over the whole period. No Arctic tern productivity data have been submitted to the SMP from the Republic of Ireland since 2014.

Isle of Man

Population estimates and change 1969-2002 (census data)

	Operation Seafarer (1969-70)	Seabird Colony Register (1984-85)	Seabird 2000 (1998-2002)	Isle of Man Census (2017-18)
Population estimate (AON*)	29	22	8	56
% change since previous census	n/a	-24	-64	+600

* AON = Apparently Occupied Nests

Breeding abundance

The small population of Arctic tern breeding on the Isle of Man nest almost entirely near The Ayres or Rue Point. 29 AON were recorded during Operation Seafarer and 22 during the

Seabird Colony Register. This had declined somewhat by Seabird 2000 when only 8 AON were recorded, although numbers had been lower during the early 1990s. Immediately after Seabird 2000, numbers increased slightly, but a decline began in 2005 and continued until 2012 when only AON were recorded. In contrast, the Isle of Man Seabird Census in 2017 recorded 56 AON, the highest number since monitoring began[11].

Productivity

Data submitted to the SMP on the productivity of Arctic terns on the Isle of Man are sparse; thus, no meaningful average productivity value can be given.

Channel Islands

Arctic tern does not breed on the Channel Islands.

UK phenology, diet, survival rates

No data have been systematically collected as part of the Seabird Monitoring Programme.

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Guillemot *Uria aalge*

Description

The following has been adapted from original text by Mike P. Harris and Sarah Wanless in [Seabird Populations of Britain and Ireland] (with permission from A&C Black, London).

The guillemot is one of the most abundant seabirds in the temperate and colder parts of the northern hemisphere with very large populations in the Atlantic and the Pacific Oceans and the adjacent areas of the Arctic Ocean. In the northeast Atlantic, its range extends from Portugal in the south to Spitzbergen in the north and includes the Baltic Sea. Two subspecies, not easily separable in the field, breed in our area; the dark-mantled nominate race *aalge* occurs in most of Europe including Scotland and possibly northern England; the smaller, much browner mantled *albionis* occurs in England, Wales, Ireland, Helgoland, France and Iberia. A bridled morph, with a striking white eye-ring and spectacle occurs in the Atlantic but not in the Pacific. The frequency of this morph increases with latitude from less than 1% in the south to 20-25% in northern Britain.

Guillemots breed at most places around the coasts where there is suitable cliff habitat. They are extremely gregarious; colonial breeding is the norm and colonies can contain many tens of thousands of individuals. Breeding areas are situated where the birds are safe from mammalian predators. This means that on the mainland, they are confined to sheer cliffs or in among boulders at the bases of cliffs where access is difficult even from the sea. On islands, cliffs and the tops of large stacks are preferred but where such habitat is absent they breed among rocks or even on flat open ground. No nest is built, the single relatively large egg being incubated on the bare rock, guano or soil on a wide variety of breeding sites including large flat, broad ledges where birds are crowded together at average densities of about 20 pairs/m^2, narrow ledges, isolated sites that are little more than toeholds, grassy banks, on top of or under boulders and elsewhere, even under bushes. Productivity is highest where birds breed at high density or where sites are well protected from predators.

Conservation status

Guillemot is currently identified as a conservation priority in the following:

Amber listed in Birds of Conservation Concern 4 (2015 update)
further information on Conservation Designations for UK Taxa
Amber listed in Birds of Conservation Concern in Ireland 2014-2019 (2014 update)

EC Birds Directive - migratory species

International importance

UK Population	% Biogeographic Population	% World Population
1,416,300 Individuals	33.3 (N Atlantic)	12.9

The UK population figure (rounded to the nearest hundred) was derived from data in Mitchell, P.I., Newton, S.F., Ratcliffe, N. and Dunn, T.E. (eds.) 2004. *Seabird Populations of Britain and Ireland.* Poyser, London. This was also the source of figures for the Biogeographic and World populations.

UK population estimates and change 1969-2002 (census data)

Census coverage for this species is likely to have been extremely high during Seabird 2000.

Due to subtle methodological differences within and between the SCR and Seabird 2000 (largely to do with timing of counts and how this affects colony attendance of adults), there is a degree of uncertainty in the calculation of rates of change between the two censuses. However, the general findings are backed up by systematic standardised counts made annually at 15-20 colonies dispersed around Britain.

All counts relating to Seabird 2000 refer to individuals at colonies. Counts of birds can, if required, be converted into an approximate estimate of the number of pairs by multiplying by a correction factor 0.67 to allow for the presence of mates and non-breeders. While this factor has been shown to be generally representative in Britain, more recent debate challenges whether it is still universally applicable[1].

	Operation Seafarer (1969-70)	Seabird Colony Register (1985-88)	Seabird 2000 (1998-2002)
UK Population estimate (Individuals)	611,281	1,081,341	1,416,334
% change since previous census	n/a	+77	+31

For census results for individual countries and Ireland, the Channel Islands and the Isle of Man see under relevant sections below.

Distribution/abundance

The Seabird 2000 census provides the most comprehensive recent assessment of the distribution and abundance of breeding seabirds. Numbers found in different regions, and a map showing the location and size of colonies, is provided in the Seabird 2000 guillemot results page.

The locations sampled during the annual Seabird Monitoring Programme provide some information on distribution and are accessible via the Seabird Monitoring Programme online database.

Annual abundance and productivity by geographical area

With reference to the regional accounts below please note the following.

Breeding abundance: graphs of abundance index with 95% confidence limits are only shown for a region where the trend produced has been deemed accurate (see methods of analysis). Where a trend was thought to be inaccurate, graphs of abundance at major colonies in a region may be shown instead, particularly if such colonies hold greater than 10% of the regional population, are monitored frequently and may thus help illustrate regional population fluctuations outwith national censuses. Occasionally, too few data have been collected regionally to produce either of these.

Productivity: graphs of productivity are only shown if analysis of productivity data produced a significant result for regional and/or year effects (again see methods of analysis). If results were not significant, then a regional mean productivity value is given. However, on some occasions too few data are available from which to provide a meaningful average. Furthermore, for 11 species where the quality of monitoring data available was considered high, population viability analysis was undertaken at the UK level and the results of this are also reported.

United Kingdom

Breeding abundance

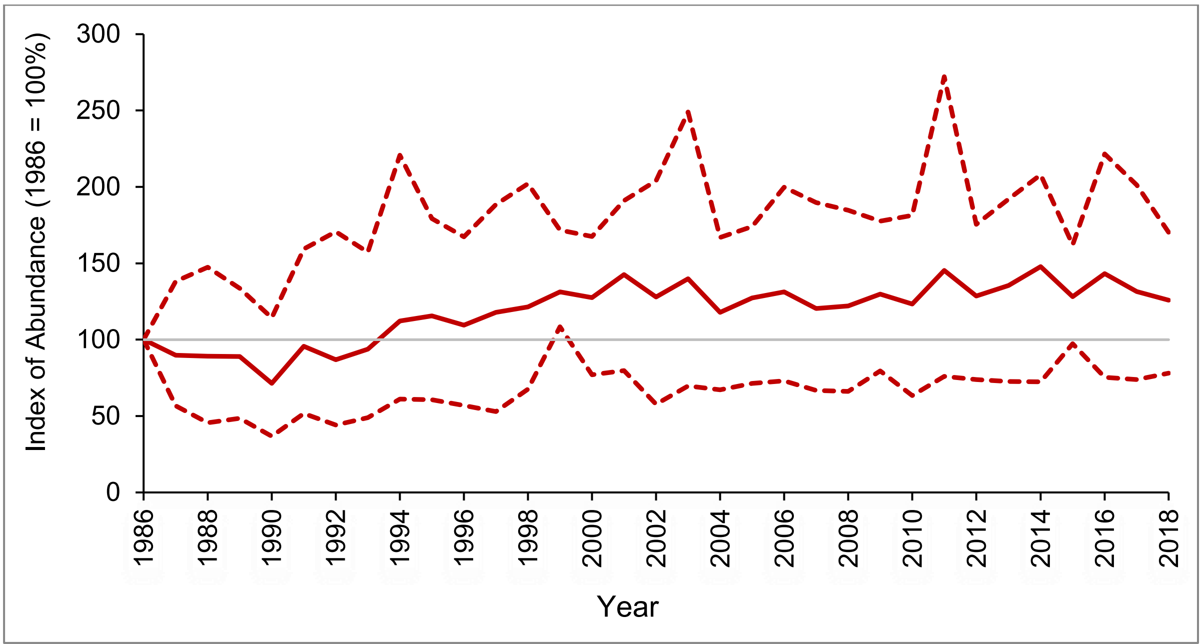

Figure 1. Trend in UK abundance index (solid line) of guillemot 1986-2018 with 95% confidence limits (dotted lines). Based on SMP data; view the methods of analysis .

The UK population index for guillemot (Figure 1) was fairly stable in the years immediately following 1986. Between 1990 and 2001, the index increased by 83% and, the trend fluctuated and perhaps even declined thereafter. Since 2007, the trend climbed steadily and in 2014 reached its highest value at 42% above the 1986 baseline. However, trends in each country are markedly different (e.g. see accounts for Scotland and Wales). Over the longer term, national census results show that guillemots increased from 611,000 individuals in 1969-70 to over one million in 1985-88. There is no clear evidence as to why they have increased. While predictions of future population trends are uncertain, observed low productivity in recent years, combined with lowered return rates (see below), may lead to future declines.

Table 1 (below) shows how guillemot numbers have changed at important colonies (those in the SPA network) since they were surveyed for the Seabird 2000 census. The largest declines recorded since Seabird 2000, have been at colonies in Scotland, while important colonies in England, Wales and Northern Ireland have all increased. Fowlsheugh in Scotland is the only colony where numbers have increased since Seabird 2000, however, numbers need to be treated with caution as some SPAs have not been surveyed since 2007, e.g. Foula, Hoy, and Buchan Ness to Collieston Coast.

Area	**SPA Name**	**Seabird 2000**	**Count** (Year)	**Change (%)**	**% *per annum***
Shetland	Hermaness NNR	10,439 [2000]	5,808 [2016]	-44	-3.6
Shetland	Noss	45,777 [2001]	24,456 [2015]	-47	-4.4
Shetland	Foula	41,500 [2000]	24,799 [2007]	-40	-7.1

Area	SPA Name	Seabird 2000	Count (Year)	Change (%)	% *per annum*
Shetland	Sumburgh Head	16,572 [1999]	7,749 [2017]	-53	-4.1
Shetland	Fair Isle	39,257 [1999]	20,924 [2015]	-47	-3.9
Orkney	West Westray Cliffs	54,718 [1999]	22,930 [2017]	-58	-4.7
Orkney	Copinsay	18,675 [1999]	18,461 [2015]	-1	-0.1
Orkney	Marwick Head	34,679 [1999]	11,985 [2018]	-65	-5.4
Orkney	Hoy	21,777 [1999]	9,020 [2007]	-59	-10.4
East Coast	Troup, Pennan and Lion's Heads	45,254 [2001]	23,626 [2017]	-48	-4.0
East Coast	Buchan Ness to Collieston Coast	29,389 [2001]	19,296 [2007]	-34	-6.8
East Coast	Fowlsheugh	62,330 [1999]	69,828 [2018]	12	0.6
East Coast	Firth of Forth Islands	37,795 [2001]	26,099 [2018]	-31	-2.2
East Coast	St Abb's Head NNR	40,720 [1998]	42,905 [2018]	5	0.3
East Coast	Farne Islands	31,497 [2000]	49,037 [2016]	56	3.0
East Coast	Flamborough Head and Bempton Cliffs	46,685 [2000]	84,647 [2017]	81	7.7
The Minch	Handa	112,676 [1998]	54,664 [2016]	-51	-3.9
The Minch	Shiant Isles	16,456 [1999]	9,054 [2015]	-45	-3.7
The Minch	Mingulay and Berneray	32,590 [1998]	22,265 [2014]	-32	-2.4
Irish Sea	Ailsa Craig	9,415 [2001]	7,040 [2018]	-25	-1.7
Irish Sea	Rathlin Island	95,117 [1999]	3,454 [2018]	-96	-16.0
Irish Sea	Skomer and Skokholm	15,171 [2000]	29,136 [2017]	92	3.9
Irish Sea	Lambay Island	60,754 [1999]	59,983[2017]	-1	-0.1

Table 1: Recent counts of the number of guillemot (individuals) recorded in SPAs in Britain and Ireland compared to the number recorded during Seabird 2000. The percentage that each colony has changed in size and the *per annum* change are also provided. (Note: data at Hermaness and St Abb's Head relate to only part of the SPA)

Productivity

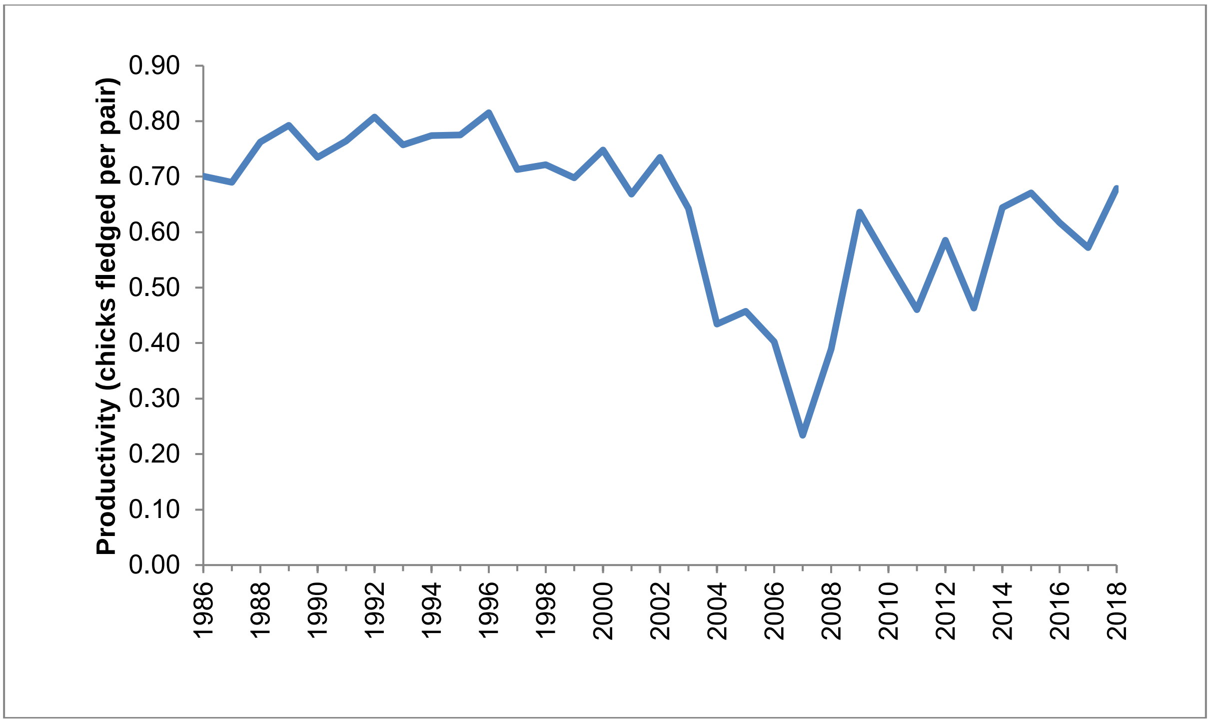

Figure 2. Trend in UK productivity (no. of chicks fledged per pair) of guillemot 1986-2018. Based on SMP data; view the methods of analysis .

After remaining stable from 1986 to 2002, guillemot productivity (Figure 2) declined dramatically until 2007, by which time a mean of just 0.23 chicks per pair were fledged. Productivity has improved since then, although values recorded between 2009 and 2018 are still lower than those recorded prior to 2002. Since 2009 fluctuations have been more pronounced compared to 1986-2002. In 2018, productivity was at 0.68 chicks fledged per pair. The reasons behind these changes in productivity are not fully known. Declines in productivity coincided with food shortages and primarily affected colonies in the north and east of the UK, where sandeels (rather than sprats and their relatives) are the main prey. Detailed studies at the Isle of May found reduced energy content in fish brought to chicks at this time[2] and that the proportion of sandeels in the diet has decreased at east coast colonies over the last 15-30 years, with sprat mainly fed to chicks since 2000[3]. This would appear to be related to declines in abundance of their sandeel prey which in certain regions is negatively correlated with sea surface temperatures that have risen due to climate change [4,5]. However, in recent years, sandeels have apparently been abundant at some colonies and this has coincided with increased in productivity, although productivity at colonies where the predominant prey species is sprat has also been high.

Analysis of the SMP dataset found that mean productivity of guillemots between 1986 and 2008 was 0.66 and it declined at a rate of 0.02 chicks per nest per year[4]. This equated to a decline of 31% over the study period. The quality of the dataset meant such a change (in excess of 10%) would be detected with confidence. Using available life history information (population size, clutch size, age at first breeding and survival rates of different age classes) to parameterise population viability analysis, predicted that were this level of productivity maintained, populations of the guillemot would increase by 75% over 25 years. However, this does not take into account density dependent processes which are known to operate in this species. For the population to decline by 25% over a 25-year period, productivity would have to fall to 0.25 chicks per nest per year.

Scotland

Population estimates and change 1969-2002 (census data)

	Operation Seafarer (1969-70)	Seabird Colony Register (1985-88)	Seabird 2000 (1998-2002)
Population estimate (Individuals)	519,461	943,098	1,167,841
% change since previous census	n/a	+82	+24

Breeding abundance

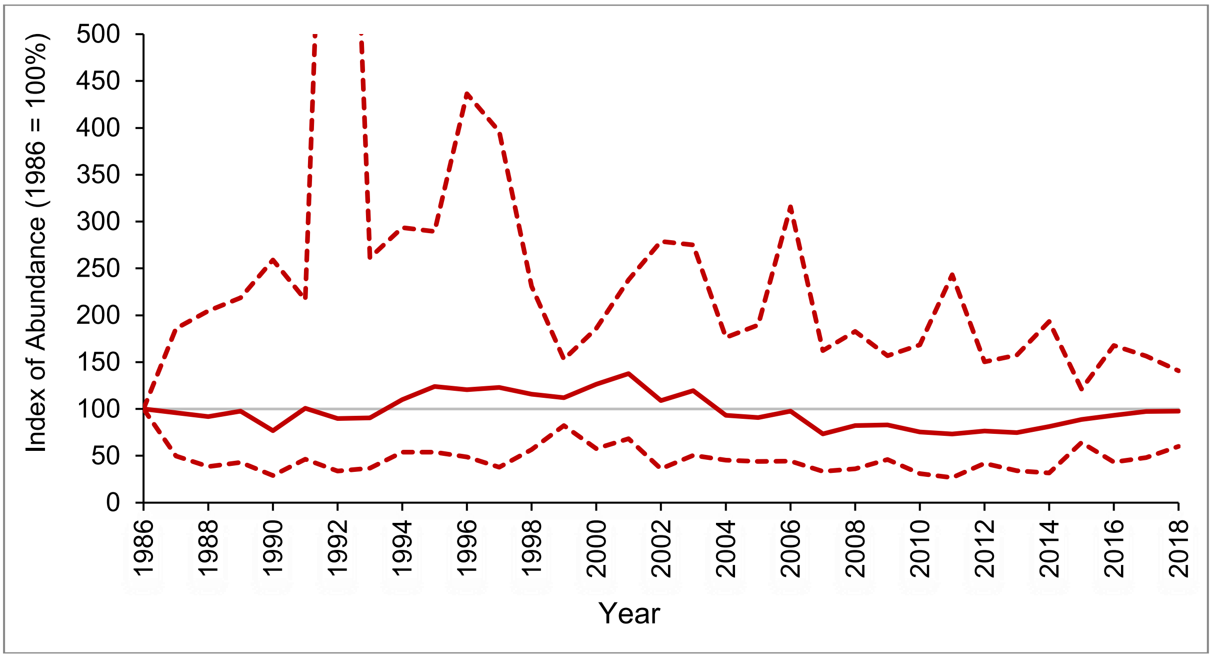

Figure 3. Trend in abundance index (solid line) of guillemot in Scotland, 1986-2018 with 95% confidence limits (dotted lines; drawing of upper limit restricted to preserve detail in the abundance index). Based on SMP data; view the methods of analysis .

National census data show an increase an 82% in the Scottish guillemot breeding population between 1969-70 and 1985-88, with a further increase of 24% up to the time of Seabird 2000. The population trend for guillemot in Scotland (Figure 3) was stable up to the early 1990s, after which it climbed slightly over a few years before levelling off. However, since Seabird 2000 (1998-2002), the index has fallen and has been lower than the 1986 baseline since 2004 (maximum 27% below in 2007), although in 2018 it was just 2% below. However, such a broad scale picture masks regional differences. For instance, numbers of guillemots in study plots on mainland Shetland have been falling at a considerable rate since peak figures (as measured post-1986) were recorded in 2000; plots held 85% fewer guillemots in 2018, although numbers have been slowly increasing since 2009[5]. Data from study plots between 2000 and 2018 indicate declines of 41% on Handa and 24% at St. Abb's Head but an increase of 22% at Fowlsheugh. Recent increases in productivity across Scotland, coupled with increased return rates (assuming measurements of this at the Isle of May (Figure 4, below) are typical of what is happening elsewhere), may lead to future increases throughout Scotland. At Sumburgh Head, large gull predation was likely to have been a contributing factor to chick losses in 2017[7] and 2018[6].

Productivity

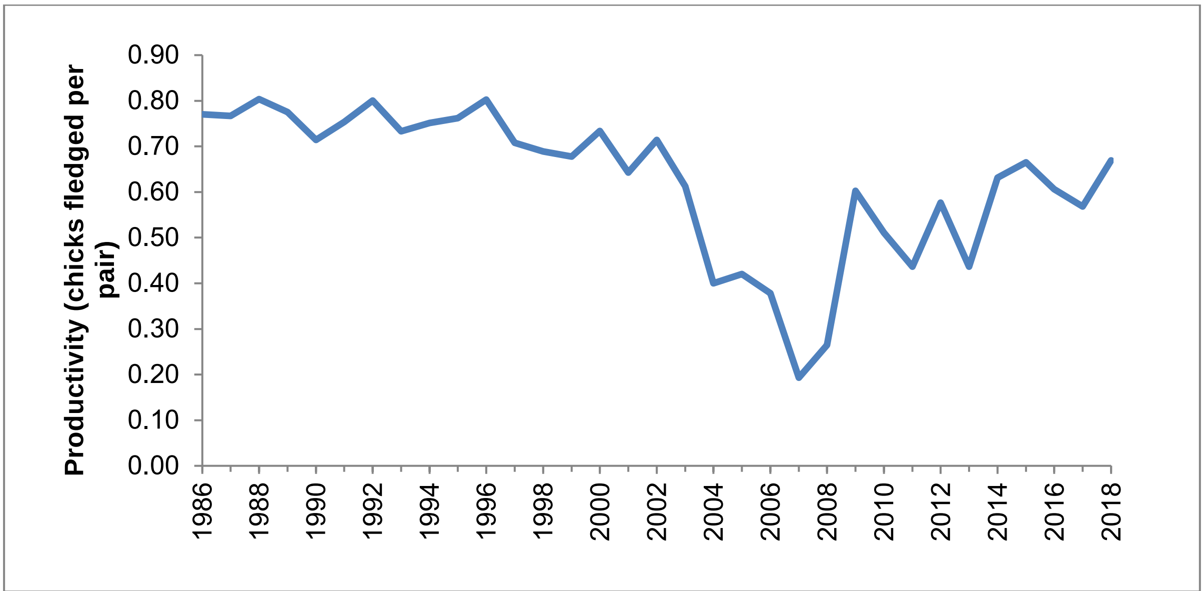

Figure 4. Trend in productivity (no. of chicks fledged per pair) of guillemot in Scotland, 1986-2018. Based on SMP data; view the methods of analysis .

Most SMP data on guillemot productivity in the UK have been collected at Scottish colonies so the trend in Figure 4 closely matches that for the UK, although for most years productivity is lower than the national average, except for 1986 to 1988. Productivity was relatively stable until 1996, falling slightly thereafter with a steep decline from 2003 to 2007 when productivity reached its lowest value of 0.19 chicks fledged per pair. Declines in productivity primarily affected colonies in the north and east (e.g. Shetland, Isle of May), coinciding with shortages in sandeels, the main prey for guillemots breeding in those areas. Overall, productivity has improved in the last few years across Scotland, when sandeels were apparently more abundant near some colonies. However, some regions have still recorded very low levels of productivity during the last few years. For example, from 2011 to 2013, the mean productivity in Shetland was 0.14 and in Orkney 0.19, compared to 0.62 in north-west Scotland and 0.72 in south-east Scotland. In 2017 and 2018, guillemots had a relatively successful season, although values recorded were still lower than the years prior to 2000. In 2018, guillemots fledged an average of 0.80 chicks per pair in Shetland; 0.34 in Orkney; 0.83 in north-west Scotland; and 0.71 in south-east Scotland.

At Sumburgh Head, the median laying date in 2018 was two to three days later than in 2017 (Figure 9) and hatching success of first eggs was the lowest since 2011 (63%) when only 11% hatched. However, productivity of 0.54 fledged per laying pair was equal to the long-term mean of 0.54 (1989–2017)[5].

England

Population estimates and change 1969-2002 (census data)

	Operation Seafarer (1969-70)	Seabird Colony Register (1985-88)	Seabird 2000 (1998-2002)
Population estimate (Individuals)	29,910	61,070	91,986
% change since previous census	n/a	+104	+51

Breeding abundance

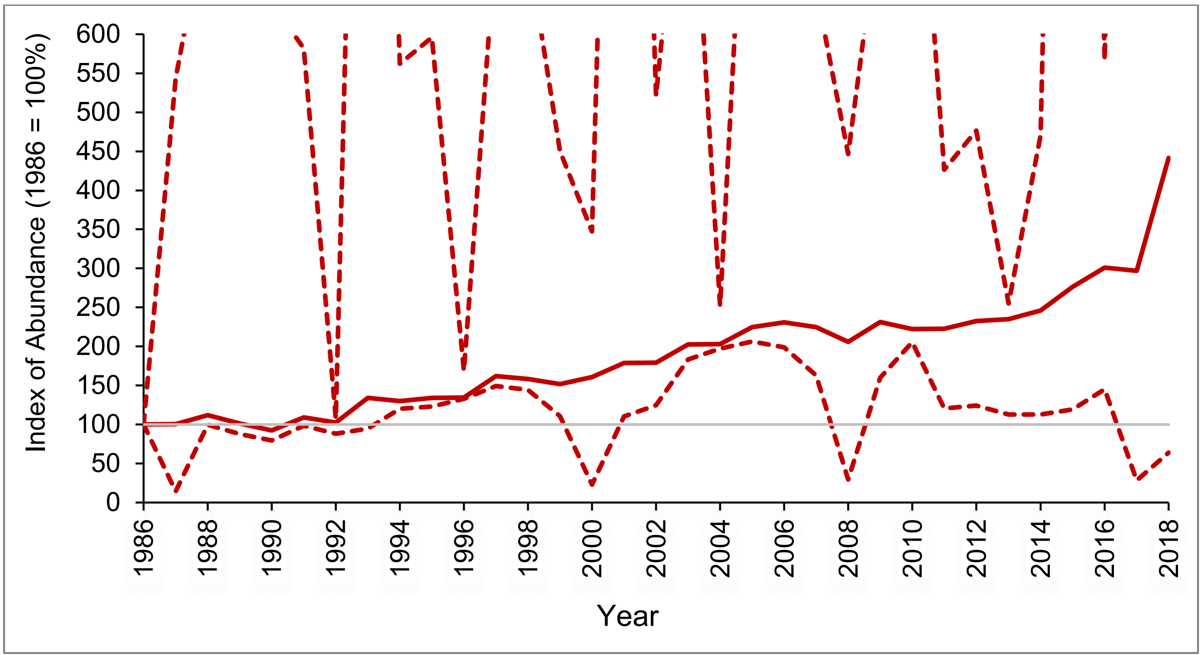

Figure 5. Trend in abundance index (solid line) of guillemot in England, 1986-2018 with 95% confidence limits (dotted lines; drawing of upper limit restricted to preserve detail in the abundance index). Based on SMP data; view the methods of analysis .

The abundance trend for guillemots in England has generally been upward since the early 1990s. Census results show increases since Operation Seafarer, with numbers doubling by the time of the Seabird Colony Register and increasing by half again by Seabird 2000. It appears from the trend shown above that this increase has continued post Seabird 2000, in contrast to the trend in Scotland. However, the wide confidence intervals associated with the index and the steep increase of the index from 2017 to 2018 (probably due to few colonies being monitored frequently) suggest the results should be treated with some caution.

Productivity

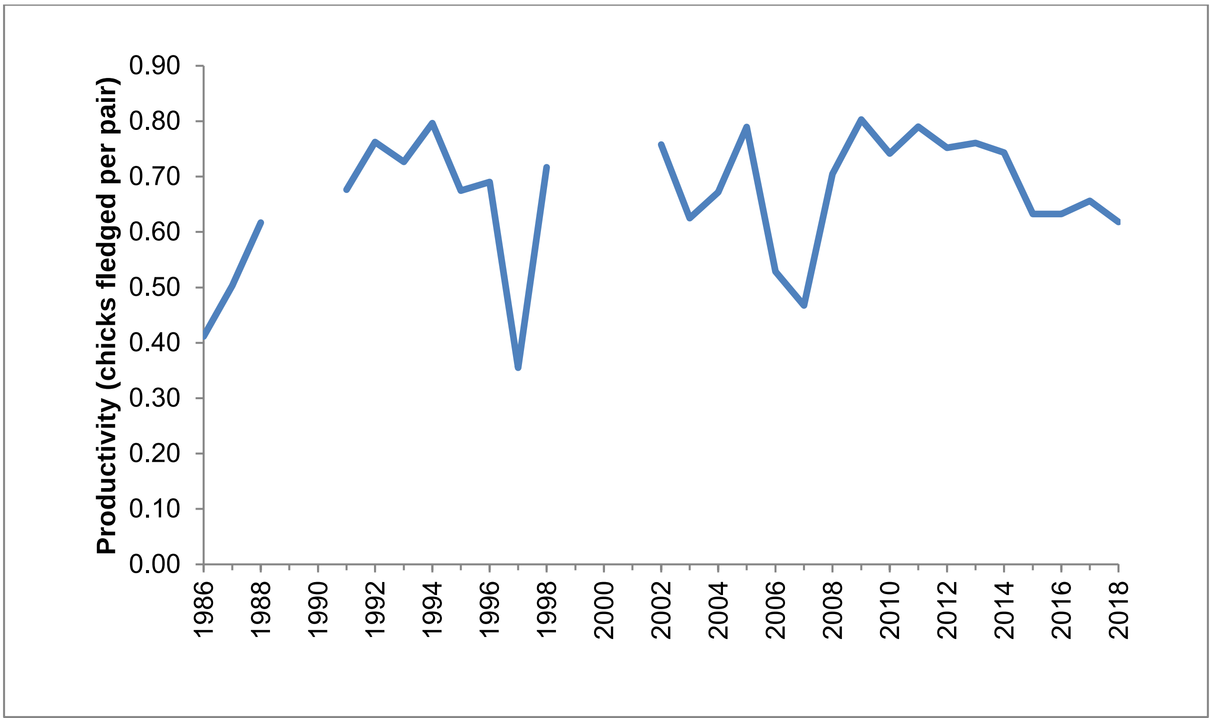

Figure 6. Trend in productivity (no. of chicks fledged per pair) of guillemot in England, 1986-2018. Based on SMP data; view the methods of analysis .

Productivity at the few English colonies studied (Bempton Cliffs, Berry Head, Lundy, Farne Islands and St. Aldhelm's Head) has been relatively high compared to Scotland. This difference may be due to the food taken at these colonies or be partially due to the intensity of monitoring at the Isle of May, Fair Isle and Sumburgh Head; more northern colonies may be more reliant on sandeels which have been scarce in some recent years (see 'Diet' section). However, low levels of productivity are apparent in several years i.e. 1986, 1997, 2006 and 2007. The reasons for this are not always reported but, in 1997, severe gales at the end of June caused major losses of guillemot eggs and chicks at colonies on the east coast of England.

In 2018, an average of 0.62 and 0.65 chicks per pair fledged at Flamborough Head and Bempton Cliffs, and Lundy Island NNR respectively.

Wales

Population estimates and change 1969-2002 (census data)

	Operation Seafarer (1969-70)	Seabird Colony Register (1985-88)	Seabird 2000 (1998-2002)
Population estimate (Individuals)	17,238	32,126	57,961

	Operation Seafarer (1969-70)	Seabird Colony Register (1985-88)	Seabird 2000 (1998-2002)
% change since previous census	n/a	+86	+45

Breeding abundance

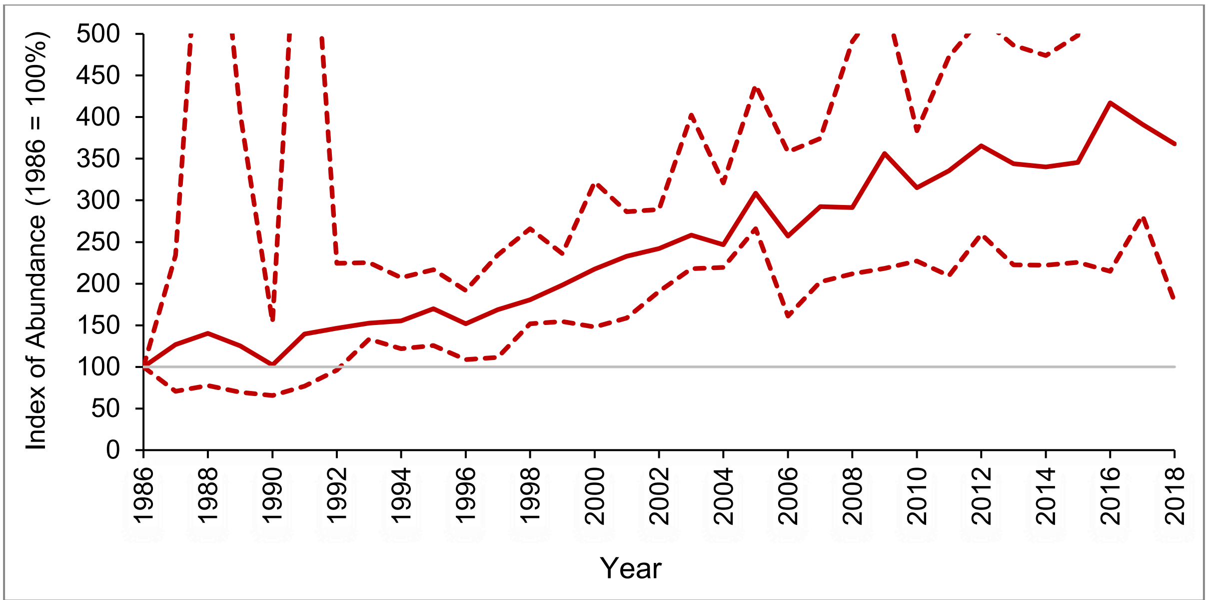

Figure 7. Trend in abundance index (solid line) of guillemot in Wales, 1986-2018 with 95% confidence limits (dotted lines; drawing of upper limit restricted to preserve detail in the abundance index). Based on SMP data; view the methods of analysis .

The abundance index for guillemots in Wales shows a steady increase since the 1990, similar to that for England. The increasing trends for both Wales and England contrast markedly with that of Scotland where abundance has been declining during the past decade. The rate of increase in Wales is greater than England, with an index value in 2018 over two times (267%) that of the 1986 baseline (*cf.* 4.4% for England and almost equal for Scotland). Over the longer term, national census data for Wales show that guillemots have been increasing since Operation Seafarer. A large proportion of the Welsh population is found on Skomer (24% during Seabird 2000), where previously it was thought that immigration was possibly driving this increase. However, a recent study using 30 years of detailed field observations to estimate key population parameters (productivity, adult survival and juvenile survival) in order to model the population size, showed that the observed rate of increase could be explained by these intrinsic parameters alone without immigration[6].

Productivity

There was no statistically significant difference in the productivity of guillemots over the SMP sampling time at colonies in Wales, where an average of 0.73 chicks were fledged per site per year between 1989 and 2018. Average productivity in Wales is slightly higher than recorded in England (0.71 chicks fledged per pair) and far higher than in Scotland (0.59 chicks fledged per pair) in recent years. This is probably due to differences in food taken by guillemots in southern/western colonies compared to eastern/northern colonies. Lower productivity in colonies in north and east Scotland, where sandeels are the main prey, coincided with food shortages. However, guillemots in Welsh colonies are less reliant on sandeels, feeding instead mostly on sprats and gadoids, although more recently there has been an increase in relatively low-quality prey (Gadids), suggesting a shift in prey availability[7].

Northern Ireland

Population estimates and change 1969-2002 (census data)

	Operation Seafarer (1969-70)	Seabird Colony Register (1985-88)	Seabird 2000 (1998-2002)
Population estimate (Individuals)	44,672	45,047	98,546
% change since previous census	n/a	<+1	+119

Breeding abundance

In Northern Ireland, the largest guillemot colony is on Rathlin Island with smaller colonies at The Gobbins, Muck Island and at scattered cliff faces between Ballycastle and Portrush. Guillemot numbers were stable between Operation Seafarer and the Seabird Colony Register (SCR) censuses, but more than doubled between the SCR and Seabird 2000 to 98,546 individuals. Rathlin Island held 95,117 individuals (96% of the national population) during the last census. In 2007, numbers on Rathlin Island were found to have declined by 14% to 81,303 individuals, but in 2011, a repeat survey recorded 130,445 individuals - an incredible rise of 60% in four years - making it again the largest colony in the UK[8]. However, numbers of guillemots on Rathlin Island in 2007 were probably low for a number of reasons. Observations at other UK colonies found return rates of birds were amongst the lowest on record that year (see below). Many colonies recorded declines (compared to 2006) and the abundance index for the UK shows a pronounced dip. A detailed study on Canna (Argyll and Bute, Scotland), approximately 120 miles north of Rathlin Island, suggested many returning guillemots had not attempted to breed at some sub-colonies; many adults were occasionally present but very few were incubating eggs or brooding young. Observations of guillemot chicks in early July also found they were less than half-grown, pointing to a late breeding season.

Non-breeding and late-breeding may contribute to lower counts if surveys coincide with periods when birds are absent from, or yet to take up occupancy of, nesting ledges. Only two small colonies, The Gobbins and Muck, have been surveyed in recent years; 2,284 individuals were recorded at The Gobbins and 2,478 individuals at Muck Island in 2018. Both increasing since Seabird 2000 when they held 2,805 individuals combined. Numbers at the other two colonies in Co. Antrim, Carrick-a-rede (185 individuals) and Sheep Island (439 individuals), have not been assessed since 2000. Overall, recent figures suggest the Northern Ireland guillemot population has increased.

Productivity

Data submitted to the SMP on the productivity of guillemots in Northern Ireland are sparse; thus, no meaningful average productivity value can be given. The only information in 2018 was from The Gobbins where many guillemot eggs were predated by hooded crows *Corvus cornix*, carrion crows *Corvus corone* and herring gulls *Larus argentatus* (Kerry Leonard pers. comm.).

Republic of Ireland

Population estimates and change 1969-2018 (census data)

	Operation Seafarer (1969-70)	Seabird Colony Register (1984-85)	Seabird 2000 (1998-2002)	Republic of Ireland Census (2015-18)
Population estimate (Individuals)	39,643	98,910	138,108	177,388
% change since previous census	n/a	+149	+40	+28

Breeding abundance

The table above shows that guillemot numbers in the Republic of Ireland increased considerably after Operation Seafarer and had more than tripled by Seabird 2000. Few colonies are monitored frequently, or in any one year; however, a Republic of Ireland Seabird Census (2015-18) counted 177,388 individuals, an increase of 28% compared to Seabird 2000[9]. This population estimate is the highest ever recorded for the Republic of Ireland, however, it should be treated with caution because different levels of survey effort and methods were applies. Two major colonies, the Cliffs of Moher (+75%) and Great Saltee (+21%), have recorded substantial increases since the Seabird 2000 census, while Lambay Island, the largest colony in Ireland, has remained relatively stable (-1%). This regional variation in colony growth may well be driven by local food availability. Studies have shown that annual variation in guillemot population growth rate can be explained by variation in abundance of their preferred prey species[10].

Productivity

Data submitted to the SMP on the productivity of guillemots in the Republic of Ireland are sparse; thus, no meaningful average productivity value can be given.

All Ireland

Population estimates and change 1969-2002 (census data)

	Operation Seafarer (1969-70)	Seabird Colony Register (1985-88)	Seabird 2000 (1998-2002)
Population estimate (Individuals)	84,315	143,957	236,654

	Operation Seafarer (1969-70)	Seabird Colony Register (1985-88)	Seabird 2000 (1998-2002)
% change since previous census	n/a	+71	+64

Breeding abundance

National census data show the number of guillemots in the whole of Ireland has increased substantially. The Seabird Colony Register recorded 71% more guillemots than Operation Seafarer and numbers had increased again, by 64%, by Seabird 2000.

In Northern Ireland, Rathlin Island held 130,445 individuals in 2011, and The Gobbins and Muck Island held 2,284 and 2,478 respectively in 2018. A Republic of Ireland Seabird Census (2015-18) counted 177,388 individuals, the highest on record. Overall, these recent figures suggest that the guillemot population in Ireland is likely to have increased since Seabird 2000, although the figure from the Republic of Ireland Census should be treated with caution because different levels of survey effort and methods were applied.

Productivity

Very few systematic data on the productivity of guillemots have been collected throughout Ireland as part of the SMP; thus, no meaningful average productivity value can be given.

Isle of Man

Population estimates and change 1969-2018 (census data)

	Operation Seafarer (1969-70)	Seabird Colony Register (1984-85)	Seabird 2000 (1998-2002)	Isle of Man Census (2017-18)
Population estimate (Individuals)	1,050	2,195	4,566	5,217
% change since previous census	n/a	+109	+108	+14

Breeding abundance

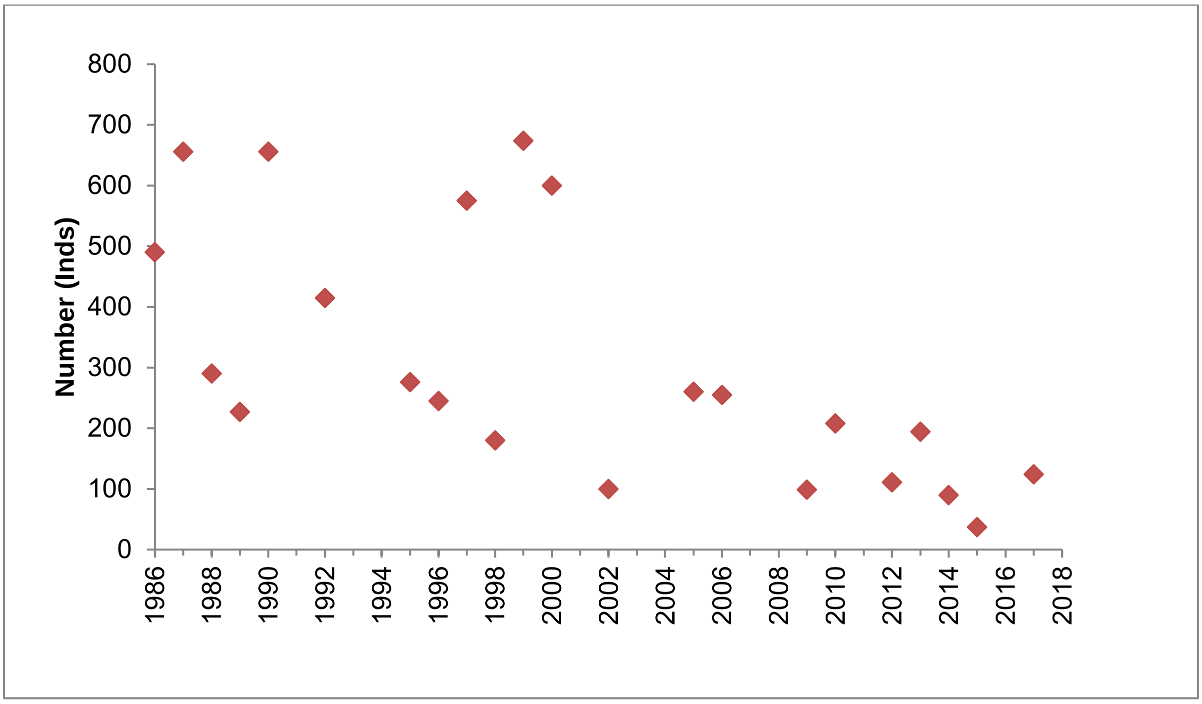

Figure 8. Abundance of guillemot on the Calf of Man, 1986-2017.

The number of guillemots breeding on the Isle of Man increased four-fold between Operation Seafarer and Seabird 2000. Few colonies have been regularly surveyed since Seabird 2000, other than on the Calf of Man, which held *c.*15% of the total Isle of Man guillemot population during the SCR (350 individuals) and *c.*10% during Seabird 2000 (416 individuals) although both figures could be underestimates as counts were done from land only. A decline appears to have occurred at the colony since Seabird 2000, with recent surveys recording between 25% (e.g. 2009, 2012, 2014, 2015 and 2017) and 50% (e.g. in 2010 and 2013) of the census total. In 2017, a seabird census of the Isle of Man recorded a total of 5,217 individual guillemots, an increase of 14% since Seabird 2000. The most significant increase was found to have occurred at the Anvil-Sugarloaf Chasms, which had increased from 707 individuals in 1985-86 to 3,848 individuals (mean count) by 2017[11].

Productivity

No systematic data on the productivity of guillemots on the Isle of Man have been submitted to the SMP.

Channel Islands

Population estimates and change 1969-2015 (census data)

	Operation Seafarer (1969-70)	Seabird Colony Register (1984-85)	Seabird 2000 (1998-2002)	Channel Islands Census (2015)
Population estimate (Individuals)	201	345	476	496
% change since previous census	n/a	+72	+38	+4

Breeding abundance

National census data show that guillemot numbers on the Channel Islands increased between Operation Seafarer and Seabird 2000. In 2015, a seabird census of the Channel Islands was carried out recording a total of 492 individual guillemots, this represents a very slight increase (5%) since Seabird 2000[12].

Productivity

No systematic data on the productivity of guillemots on the Channel Islands have been submitted to the SMP.

UK phenology, diet, survival rates

Phenology

Phenology (seasonal timing of life cycle events) is not currently monitored within the SMP, but data collected by Professors Tim Birkhead and Ben Hatchwell from the University of Sheffield (Figure 9) show that the median laying date of guillemots on Skomer became almost two weeks earlier over the period 1991-2013.Laying dates in 2009-2012 were the earliest in the time series, being between 9-15 days earlier than the 1991-2008 long-term mean. In contrast, data for Sumburgh Head (Shetland) for the period 2001-2018 (also Figure 9) show median laying date became progressively later initially and, by 2005, guillemots were nesting over three weeks later than in 2001. From 2006 onward, the trend reversed but in more recent years laying date is once again retreating.

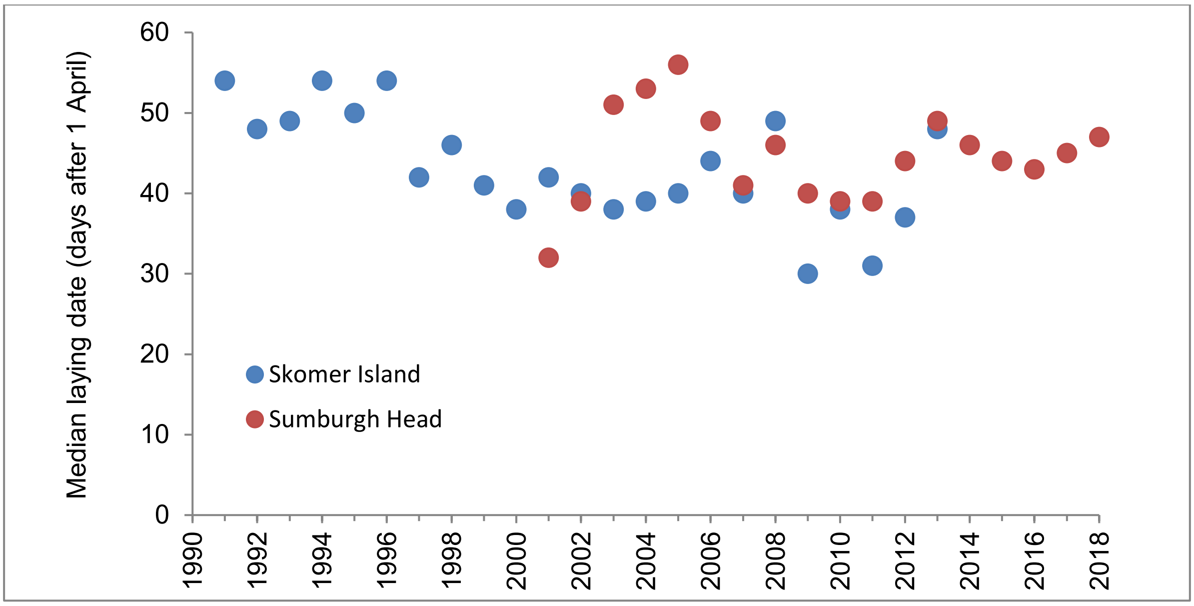

Figure 9. Median laying date of guillemots on Skomer (blue dots) and Sumburgh Head (red dots), 1991-2018. Skomer data from 1991-2013 reproduced with kind permission of Professors Tim Birkhead and Ben Hatchwell (University of Sheffield/ Countryside Council for Wales[13]). Sumburgh data reproduced with kind permission of Will Miles (SOTEAG[5]).

Diet

Although local differences in feeding conditions have been suggested as a cause of regional variation in seabird demography actual multi-colony comparisons of diet are rare. In UK waters, the main fish eaten by seabirds during the breeding season belong to three families: Ammodytidae, Clupeidae and Gadidae. Climate change and fishing are affecting these fish stocks and so probably impact on predators such as seabirds. A recent study used standardised observations of prey brought in for chicks to make the first integrated assessment of the diet of guillemot chicks at a UK scale[14]. Chick diet varied markedly among 23 colonies sampled (spread from Devon to Shetland) between 2006 and 2011. Sandeels (Ammodytidae, probably mostly lesser sandeels *Ammodytes marinus*), were the commonest prey. Their contribution to the diet varied both latitudinally and among marine regions, with the proportion significantly higher for a given latitude on the west coast compared to the east[14]. The non-sandeel component of the diet showed latitudinal changes, with small clupeids, probably sprats *Sprattus sprattus*, predominant at southern colonies whereas juvenile gadids were the main alternative to sandeels in the north. Part of the study period coincided with a brief population explosion of snake pipefish *Entelurus aequoreus* in the Northeast Atlantic and North Sea. Pipefish were recorded in guillemot chick diet at several northern and north-western colonies in 2006 and 2007 but have been absent since 2009. Spatial and temporal variation in chick diet accorded broadly with patterns expected as a result of rising sea temperatures and impacts of fishing[14].

Within the SMP, detailed diet data has been collected annually on the Isle of May. The proportion of sandeels in the diet of young guillemots at the Isle of May fluctuated between 1987 and 2000 before falling steeply and has now been consistently low since 2001 (Figure 10). Those years in which sandeels comprise a low proportion of guillemot's diet on the Isle of May also tend to coincide with low productivity. Alternative energy-rich prey includes clupeids such as sprat, but in 2004 the energy content of these fish (and sandeels) was found to be unusually low, corresponding with very low guillemot productivity[2]. In 2018, of 1,029 food items delivered to chicks, 89.0% were Clupeids (most thought to be sprat), 5.8% were sandeels and 5.0% were gadoids. This did not appear to impact on the productivity of guillemots as they still managed to fledge an average number (0.70) of chicks during the 2018 breeding season[16].

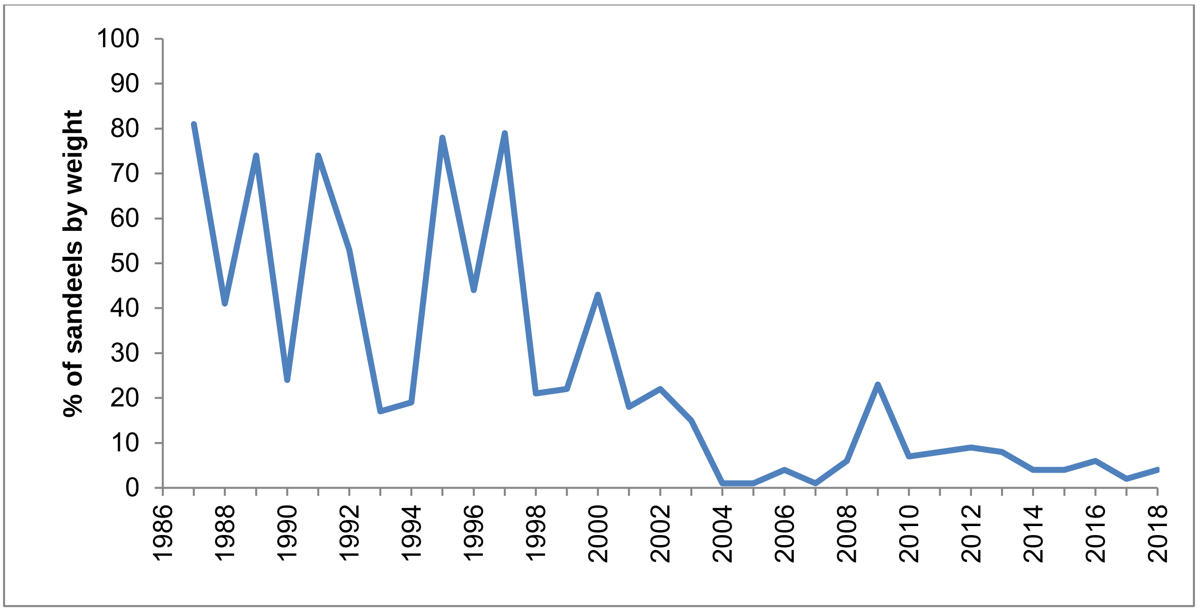

Figure 10. Percentage of sandeels (by weight) in the diet of young guillemots at the Isle of May , 1987-2018.

Feeding watches at Sumburgh Head (Shetland) throughout the main chick-rearing period (mid-June to mid-July) between 2007 and 2018, have identified the main prey delivered to chicks as gadoids (79.7%) and sandeels (10.9%), which combined account for over 90% of identified food items each year[5]. This contrasted with 2017, when gadids comprised 50.7% of chick diet and sandeels 46.4%[17]. As in previous years, the occurrence of clupeids and squid was rare in 2018. Years when few sandeels are delivered to chicks saw an increase in gadids and *vice versa*. Comparison of chick diet data collected at this colony between 2007-2018 indicates the percentage of sandeels delivered has fallen from 60% to 10%[18]. At what point this shift from a diet dominated by sandeels took place is unknown, as data at Sumburgh Head have only been collected from 2007; the last year when sandeels made up more than 50% of the chick's diet. A similar shift in diet at Fair Isle (40km south-west of Sumburgh Head) seems to have occurred at some time between 2000 and 2002[12]. Since 2003, weights of chicks near fledging at Compass Head (1.3km north of Sumburgh Head) have been lower than during the 1990s and average productivity at Sumburgh Head has also reduced[5].

Return rate and survival rate

Important notes on interpretation: Estimation of guillemot adult return rate is currently only undertaken at one site within the Seabird Monitoring Programme - the Isle of May (North-east Fife). Also presented are data from Skomer from a long-term study undertaken by Professors Tim Birkhead and Ben Hatchwell from the University of Sheffield. Return rates are based on sightings of individually colour-ringed birds and are calculated as the proportion of marked birds present in year one that is seen in the following year. Because not every adult alive is seen each year, return rates for 2018 presented here for Isle of May and Skomer need to be treated as minimum estimates of survival of birds seen the previous year. In contrast, survival estimates would take into account birds that are not seen one year but which re-appear in following years.

Guillemot return rate on the Isle of May has declined over time with very low values recorded in 2007 and 2008 (Figure 11). Since then, return rate has improved, with values recorded between 2009, 2014 and 2018 close to average (90%). Figure 12 shows that there is no clear trend in return rate of Skomer guillemots, although a very low value was recorded in 1990. Return rates of guillemots on Skomer were negatively affected by the occurrence of major oil spills on their wintering grounds and by climate (high values of the North Atlantic Oscillation)[19].

The winter of 2013/14 saw a succession of severe storms from late January to the beginning of March result in a large 'wreck' of seabirds along Atlantic coasts from England and Ireland to Spain. A minimum of 54,000 seabirds, mostly auks, were washed ashore dead or dying. Examination of many corpses revealed birds were emaciated with empty stomachs indicating starvation as the main cause of death although a small proportion showed signs of oil contamination[20]. Overall, about 30% of the casualties were guillemots[21].

Biometric data from 30 of these corpses indicated birds were typical of the subspecies *albionis* which breeds from south-west Scotland down to Iberia. Rings recovered from guillemot corpses (from beaches in France) also indicated birds originated from colonies around the UK and Ireland. The majority of birds examined were found to be adults. The total mortality will be much higher than reported because not all beaches were checked, birds were washed ashore over a number of weeks and many birds will be lost unrecorded at sea[14].

On Skomer, following the ‘wreck’ of winter 2013/14 the data from 2014 strongly suggested a very high level of mortality among adult birds between 2013 and 2014 and this was consistent with the very high number of guillemot ringing recoveries in the weeks following the ‘wreck’. The data from 2015 reaffirmed that mortality following the ‘wreck’ had been high[22]. The survival of adult guillemots, based on re-sightings only (not on statistical analyses) suggested that survival was slightly higher in 2016 than in 2015, but lower than in many previous years[23]. In 2018, survival was (as in 2017) slightly lower than in 2016[24].

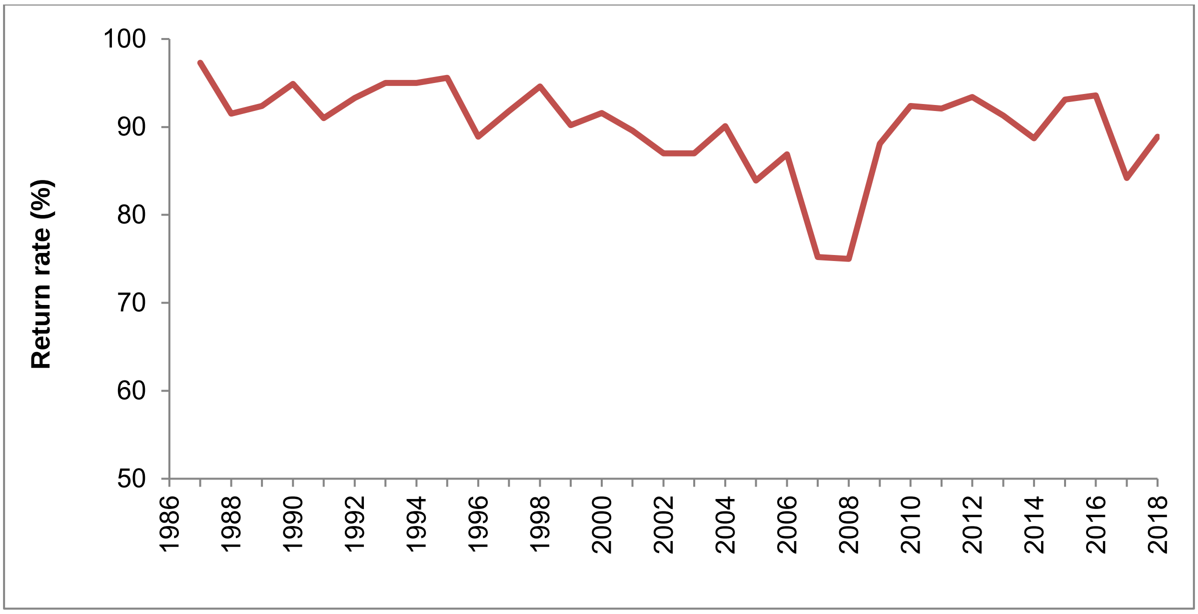

Figure 11. Annual return rate of guillemot breeding on the Isle of May, 1987-2018.

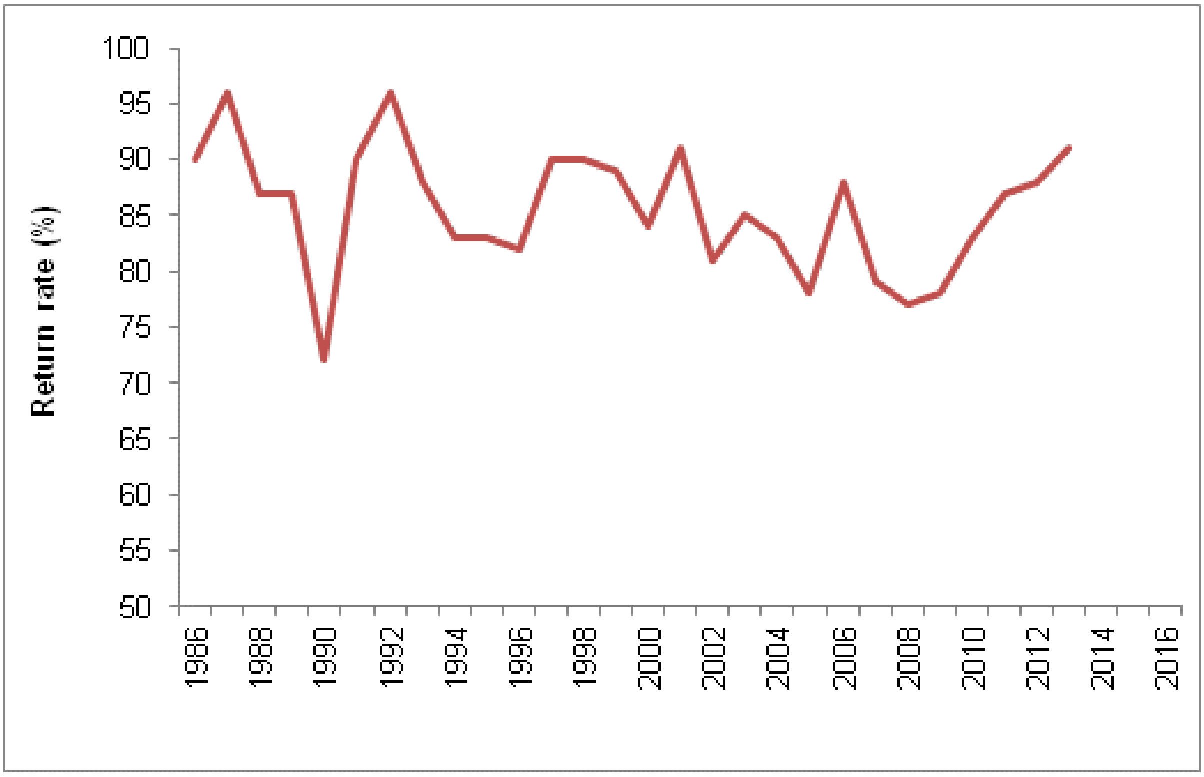

Figure 12. Annual return rate of guillemot breeding on Skomer, 1986-2013. Reproduced with kind permission from Professors Tim Birkhead and Ben Hatchwell (University of Sheffield)/Countryside Council for Wales[13].

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Razorbill *Alca torda*

Description

The following has been adapted from original text by Oscar J. Merne & P. Ian Mitchell in Seabird Populations of Britain and Ireland (with permission from A&C Black, London).

The razorbill is a bird of the temperate North Atlantic and adjacent parts of the Arctic Ocean. They breed on both sides of the Atlantic and in the east they breed as far south as Brittany (France), north to Svalbard (Norway) and east to the White Sea in north-west Russia. Razorbills breeding in the British Isles winter along the Atlantic coast of Europe from southwest Norway to Iberia and North Africa, and into the western Mediterranean. Immature birds move significantly further away from their natal colonies than do adults and generally further south, though occasionally they stray west as far as Greenland and the Azores.

Razorbills breed mainly on small ledges or in cracks of rocky cliffs and in associated scree, and on boulder-fields. Rarely, colonies have been found up to 300m inland. Razorbills are usually associated with colonies of other seabirds, and small numbers scattered among large concentrations of guillemots and black-legged kittiwakes can easily be overlooked. Razorbill 'nest' sites are usually hidden from view, but the presence of a colony is clearly indicated by the attendance of off-duty birds standing close by. Since it is not usually possible to count occupied sites, the species is difficult to census. Hence, prior to Operation Seafarer (1969-70), very little was known about its numbers and population trends in the UK. Furthermore, interpreting differences between Operation Seafarer (1969-70) and the SCR Census (1985-88) is difficult, since most counts during Operation Seafarer were expressed as pairs, while the SCR Census counted the number of individuals. Despite methodological differences between the two censuses, during 1969-1988, there appeared to be an increase in the total number of razorbills breeding.

Conservation status

Razorbill is currently identified as a conservation priority in the following:

Amber listed in Birds of Conservation Concern 4 (2015 update)
further information on Conservation Designations for UK Taxa
Amber listed in Birds of Conservation Concern in Ireland 2014-2019 (2014 update)
EC Birds Directive - migratory species

International importance

UK Population	% Biogeographic Population	% World Population
187,100 Individuals	23.6 (ssp. *islandica*)	20.2

The UK population figure (rounded to the nearest hundred) was derived from data in Mitchell, P.I., Newton, S.F., Ratcliffe, N. and Dunn, T.E. (eds.) 2004. *Seabird Populations of Britain and Ireland.* Poyser, London. This was also the source of figures for the Biogeographic and World populations.

UK population estimates and change 1969-2002 (census data)

The count unit for razorbills is individuals (on suitable breeding ledges), which may include off-duty adults, non-breeders and immature birds, as well as - where nests are visible - brooding and incubating birds. At a few sites it is possible to count apparently occupied sites or nests (AOS or AON). However, in order to compare counts between years, all counts of AOS and AON were divided by 0.67 to estimate the equivalent count of individuals. In Seabird 2000, only 3% of the population estimate (in terms of birds) was converted from counts of AOS and AON, comparable to the SCR Census when converted counts comprised 5% of the total estimate. In contrast, 78% of the total population estimate of razorbills in Operation Seafarer was expressed as pairs (i.e. AOS or AON). However, it is unclear how surveyors determined 'pairs' present in each colony. Therefore, comparisons of Operation Seafarer data with subsequent counts of individuals should be treated with caution.

During Seabird 2000 and the SCR Census survey, methods prescribed counting razorbills between 1 and 21 June, to coincide with the late incubation and main nestling period, and during 08:00 to 16:00 hrs (BST) to coincide with the periods of most consistent attendance by birds at the colony. This may not necessarily coincide with the maximum numbers of birds attending the cliffs during a season, but instead provides the most comparable measure of attendance when using one-off counts. In Seabird 2000, 43% of counts were conducted during this period and time, with a further 21% in the prescribed period, but either outwith the correct time or the time was not noted. During the SCR Census, only 37% of counts were conducted on the correct dates but actual time was never recorded.
These count windows were not prescribed during Operation Seafarer and so some counts were carried out later in July or even in early August when many successful adults would have left with their chicks and when failed breeders would have deserted, resulting in an underestimate.

	Operation Seafarer (1969-70)	Seabird Colony Register (1985-88)	Seabird 2000 (1998-2002)
UK Population estimate (Individuals)	132,734	154,219	187,052
% change since previous census	n/a	+16	+21

For census results for individual countries and Ireland, the Channel Islands and the Isle of Man see under relevant sections below.

Distribution/abundance

The Seabird 2000 census provides the most comprehensive recent assessment of the distribution and abundance of breeding seabirds. Numbers found in different regions, and a map showing the location and size of colonies, is provided in the Seabird 2000 razorbill results page.

The locations sampled during the annual Seabird Monitoring Programme provide some information on distribution and are accessible via the Seabird Monitoring Programme online database.

Annual abundance and productivity by geographical area

With reference to the regional accounts below please note the following.

Breeding abundance: graphs of abundance index with 95% confidence limits are only shown for a region where the trend produced has been deemed accurate (see methods of analysis). Where a trend was thought to be inaccurate, graphs of abundance at major colonies in a region may be shown instead, particularly if such colonies hold greater than 10% of the regional population, are monitored frequently and may thus help illustrate regional population fluctuations outwith national censuses. Occasionally, too few data have been collected regionally to produce either of these.

Productivity: graphs of productivity are only shown if analysis of productivity data produced a significant result for regional and/or year effects (again see methods of analysis). If results were not significant, then a regional mean productivity value is given. However, on some occasions too few data are available from which to provide a meaningful average. Furthermore, for 11 species where the quality of monitoring data available was considered high, population viability analysis was undertaken at the UK level and the results of this are also reported.

United Kingdom

Breeding abundance

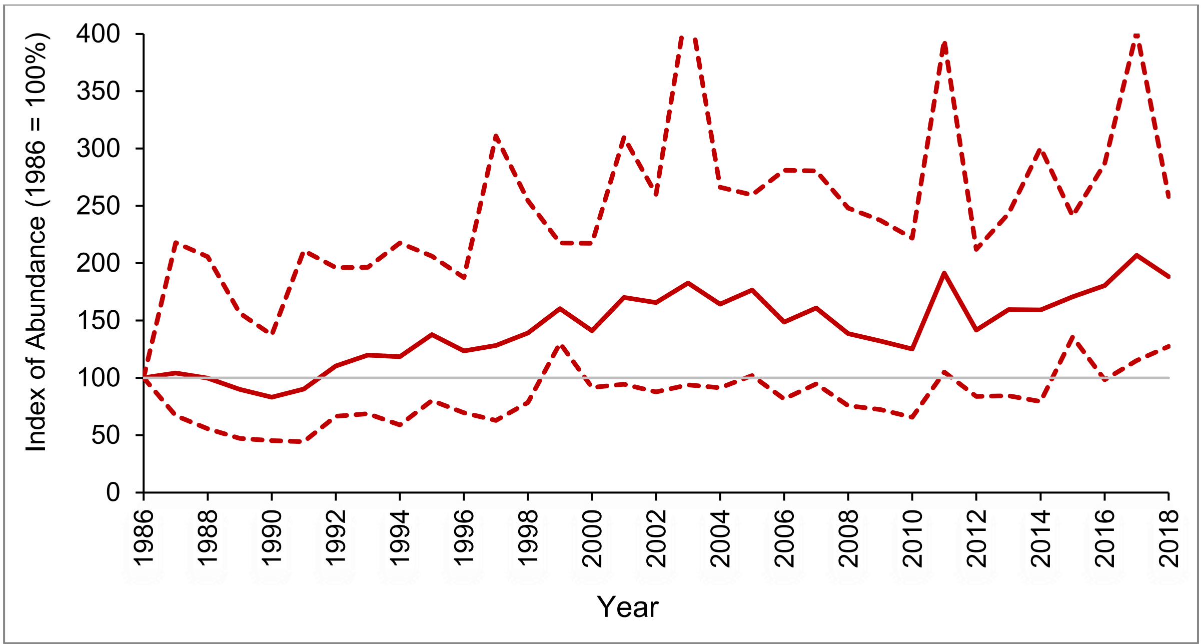

Figure 1. Trend in UK abundance index (solid line) of razorbill 1986-2018 with 95% confidence limits (dotted lines; drawing of upper limit restricted to preserve detail in the abundance index). Based on SMP data; view the methods of analysis .

Over the longer term, census results show that the UK razorbill population increased by 16% between 1969-70 and 1985-88. Since then, like the guillemot, the UK population index for razorbill has increased compared to the 1986 baseline. After a period of stability between 1986 and 1991, the SMP sample index increased fairly steadily until 2003, peaking at 78% above the 1986 value. The reasons for the increase are unknown. Between 2005 and 2010, the index declined, possibly as a result of so-called 'density-dependent' effects, where growth at the densest colonies slowed or reversed when competition for space and food reached critically high levels. However, in autumn 2007, a ‘wreck’ of adult razorbills in the Skagerrak (the strait between Denmark, Norway and Sweden) and North Sea, most of which originated from Scottish colonies (see Scotland section), may also have contributed to the declining trend. The index has risen since 2010, with 2017 having the highest index value since the baseline began in 1986, although wide confidence intervals suggest this apparent increase should be treated with caution.

Table 1 below shows how numbers have changed at some of the most important UK colonies (those in the SPA network) in the period since they were surveyed for Seabird 2000. The largest declines recorded since Seabird 2000 have been in colonies in northern and western Scotland, while the largest colonies in England and Wales have all increased.

Area	**SPA Name**	**Seabird 2000**	**Count (Year)**	**Change (%)**	**% *per annum***
Shetland	Foula	4,200 (2000)	559 (2007)	-87	-25.0
Shetland	Fair Isle	3,599 (2000)	1,930 (2015)	-46	-4.1
Orkney	West Westray Cliffs	2,412 (1999)	982 (2017)	-59	-4.9

Area	SPA Name	Seabird 2000	Count (Year)	Change (%)	*% per annum*
East Coast	Troup, Pennan and Lion's Heads	4,831 2001	4,422 2017	-8	-0.6
East Coast	Fowlsheugh	6,362 1999	14,063 2018	121	4.3
East Coast	Forth Islands	4,830 2001	5,466 2018	13	0.7
East Coast	St Abb's Head NNR	2,214 1998	2,683 2018	21	1.0
East Coast	Flamborough Head and Bempton Cliffs	8,539 2000	27,967 2017	228	7.2
The Minch	Handa	16,991 2001	5,047 2014	-70	-8.9
The Minch	Shiant Isles	8,046 1999	8,029 2015	0	0.0
The Minch	Mingulay and Berneray	22,900 1998	17,400 2014	-24	-1.7
Irish Sea	Rathlin Island	20,860 1999	22,975 2011	10	0.8
Irish Sea	Skomer and Skokholm	5,306 2000	10,120 2018	91	3.7
Irish Sea	Lambay Island	4,337 1999	7,353 2017	70	3.0

Table 1: Recent counts of the number of razorbill (IND) recorded in SPAs in Britain and Ireland compared to the number recorded during Seabird 2000. The percentage that each colony has changed between counts, and the *per annum* change, is also provided. (Note: data for St Abb's Head relate to only part of the SPA).

Productivity

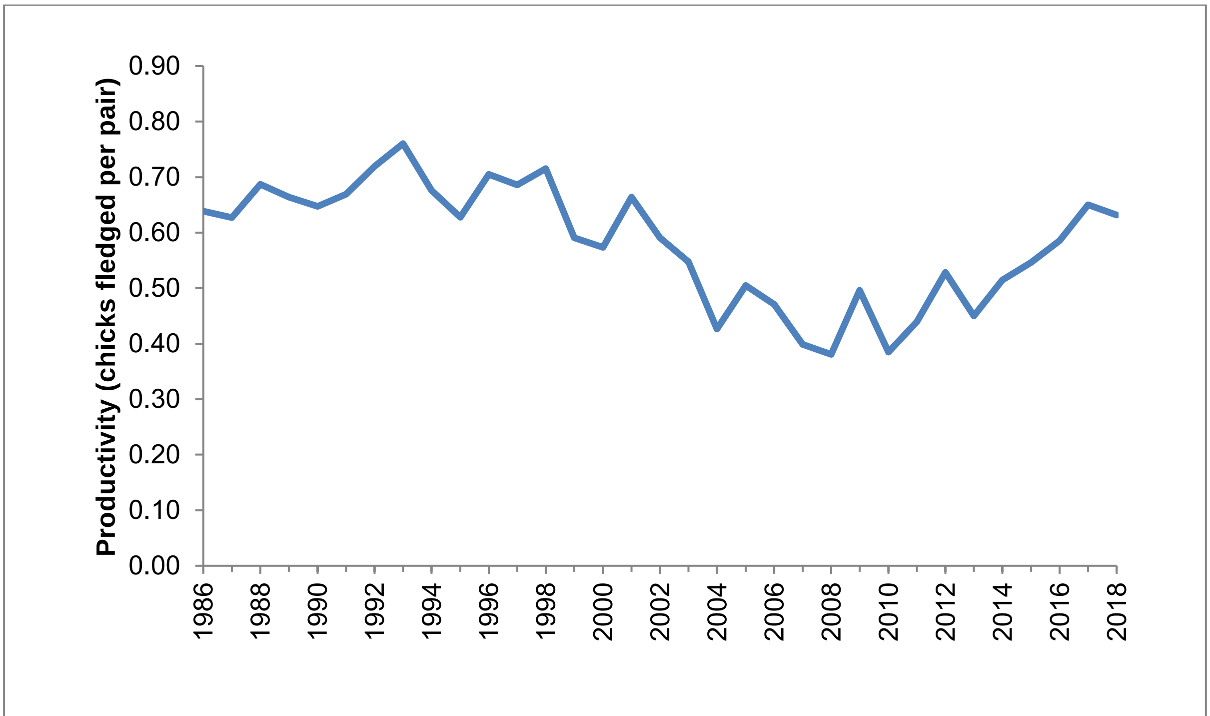

Figure 2. Trend in UK productivity (no. of chicks fledged per pair) of razorbill, 1986-2018. Based on SMP data; view the methods of analysis .

Razorbill productivity was fairly stable from 1986 to 1993 but then declined to a low point in 2008 of 0.38 chicks fledged per pair. Between 2010 and 2017, however, there has been a steep upward trend from 0.38 to 0.65 chicks fledged per pair. In 2018, the trend declined slightly to 0.63 razorbill chicks being fledged per pair.

Success at several monitored colonies in Scotland and Wales has been particularly poor in recent years compared to that recorded in England. The decline in productivity coincides with food shortages, especially notable at colonies in the north and east of the UK and, at the Isle of May, a decrease in the energy content of fish brought to chicks[1]. The association of years of low razorbill productivity with rising sea surface temperatures (SST) due to climate change is uncertain, though there are indications that a decline in sandeel stocks may be linked to warming sea temperatures[2].

Analysis of the SMP dataset found mean productivity of razorbill between 1986 and 2008 to be 0.55 and that it was declining at a rate of 0.01 chicks per nest per year[3]. This equates to a decline in productivity of 26% over the study period. The quality of the dataset meant a change in productivity greater than 25% would be detected with confidence. However, the data do not have sufficient power to detect a change in productivity of 10% or less. Population viability analysis (using available life history information on population size, clutch size, age at first breeding and survival rates of different age classes) predicted that were this rate of productivity to be sustained, razorbill abundance would decline by only 4% over 25 years. Were productivity to drop below 0.50, populations would decline by 25% over 25 years. Success would have to half again for a 50% decline over 25 years to be observed.

Scotland

Population estimates and change 1969-2002 (census data)

	Operation Seafarer (1969-70)	**Seabird Colony Register (1985-88)**	**Seabird 2000 (1998-2002)**
Population estimate (Individuals)	111,038	123,586	139,186
% change since previous census	n/a	+11	+13

Breeding abundance

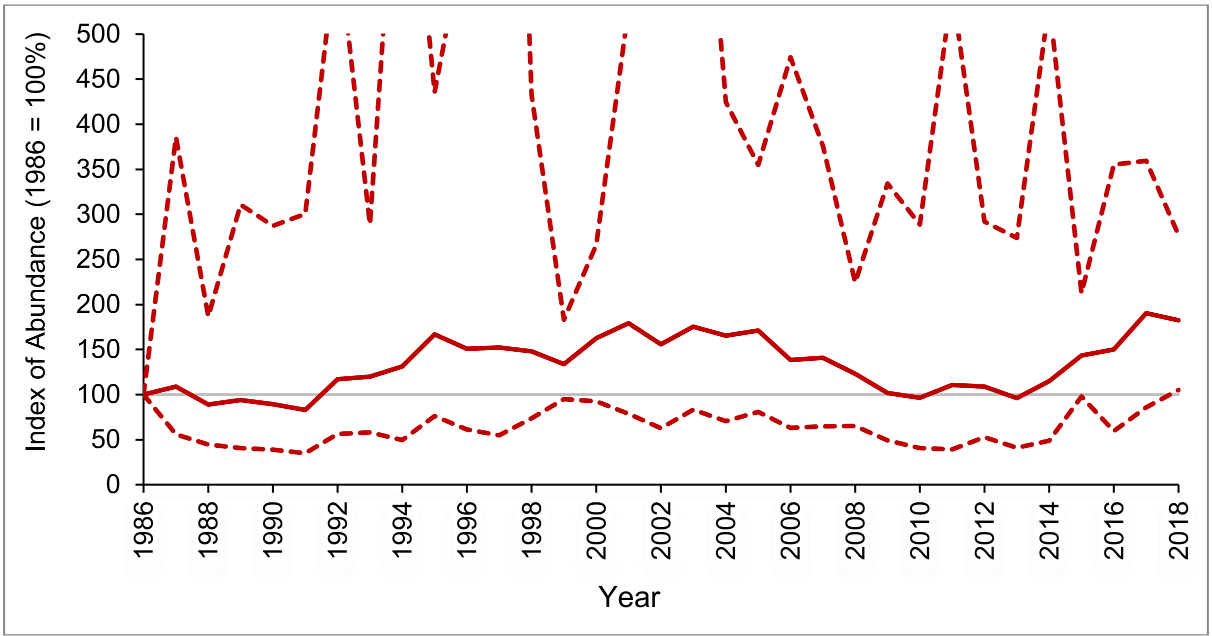

Figure 3. Trend in abundance index (solid line) of razorbill in Scotland, 1986-2018 with 95% confidence limits (dotted lines; drawing of upper limit restricted to preserve detail in the abundance index). Based on SMP data; view the methods of analysis .

In Scotland, census data indicate the number of razorbills increased between Operation Seafarer and Seabird 2000. Numbers during the Seabird Colony Register were 11% higher than in 1969-70 and had increased again, by 13%, during Seabird 2000. The abundance trend extrapolated from colonies sampled for the SMP shows an increasing trend until 2001 but declined until the 2009 to 2013 period, when the index lay close to the 1986 baseline. Since then, the index has increased and in 2018 was 82% above the baseline. In autumn 2007, a 'wreck' of adult razorbills in the Skagerrak and North Sea, most of which originated from Scottish colonies, may have contributed to the dip in the trend between 2007 and 2009[4]. Whole-colony counts submitted to the SMP from 52 sites indicate that these sites held 28,493 razorbill individuals in 2018, an increase of 28% compared to the total from the same sites counted during Seabird 2000.

Productivity

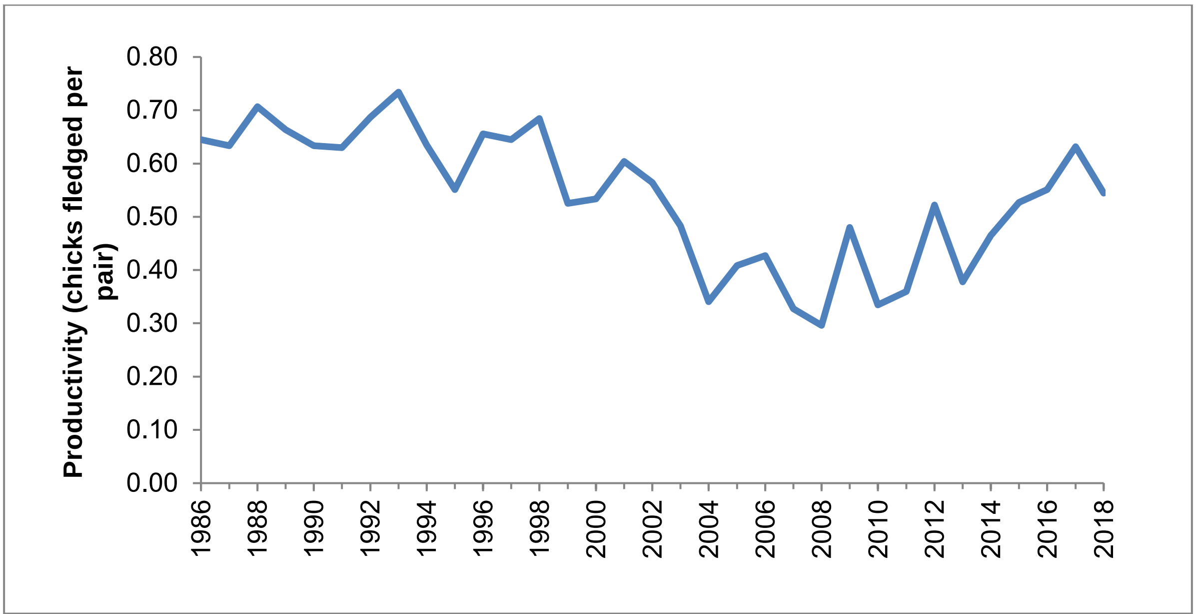

Figure 4. Trend in productivity (no. of chicks fledged per pair) of razorbill at Scottish colonies, 1986-2018. Based on SMP data; view the methods of analysis .

The trend in Figure 4 closely matches that for the UK. Data collected at colonies in Scotland indicate declining productivity since the early 1990s, although the decline has not been constant. Some colonies recorded consistently low levels of productivity between 2009 and 2018. At these colonies, in the years when chicks fledged, success was only been above 0.25 on Papa Westray five times (mainly from 2014 onwards); and on Fair Isle has only been above 0.50 five times (again from 2014 onwards but not during 2017). The few data available from Sumburgh Head suggest low productivity has been widespread in the Northern Isles in recent years[5]. Mingulay (Western Isles), where productivity monitoring began in 2013, had poor breeding seasons in 2013 (0.23), 2014 (0.28) and 2015 (0.30). In contrast, the frequently monitored colonies at North Sutor and on the Isle of May (both east coast of Scotland) were relatively successful between 2009 and 2018, fledging an average of 0.51 and 0.56 chicks per site respectively, with neither colony recording complete failure.

England

Population estimates and change 1969-2002 (census data)

	Operation Seafarer (1969-70)	**Seabird Colony Register (1985-88)**	**Seabird 2000 (1998-2002)**
Population estimate (Individuals)	5,405	10,101	11,144
% change since previous census	n/a	+87	+10

Breeding abundance

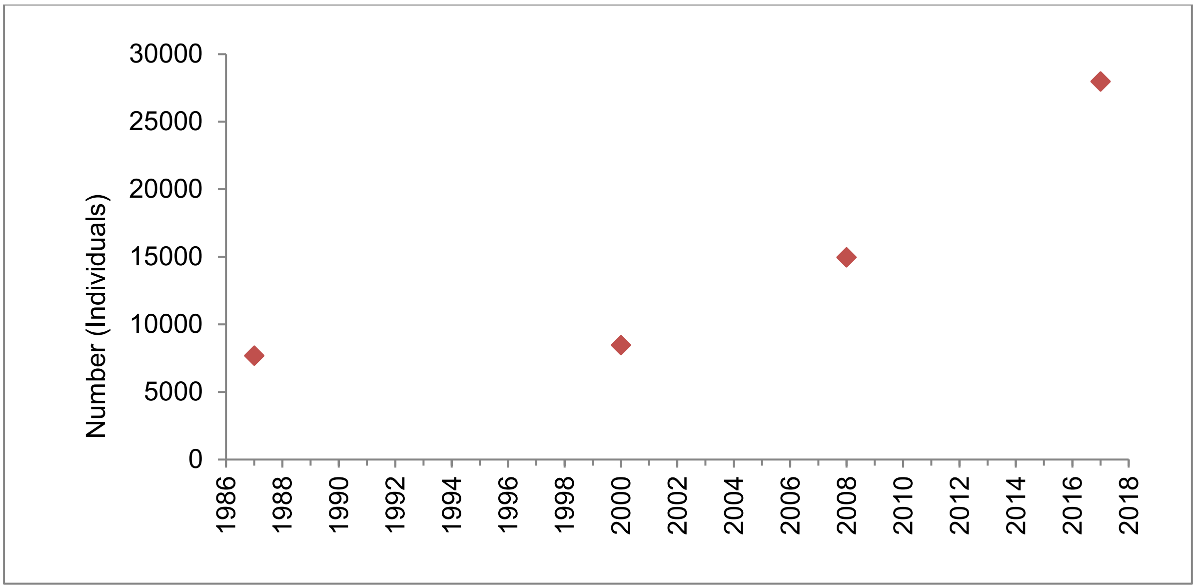

Figure 5. Abundance of razorbill at Flamborough Head and Bempton Cliffs, 1986-2017.

Razorbill numbers in England almost doubled between Operation Seafarer and the Seabird Colony Register to 10,101 individuals. By the time of Seabird 2000, a further increase of 10% had occurred. Few colonies of any great size are monitored regularly from which to draw firm conclusions about trends since Seabird 2000. However, available data suggest an increase may have occurred. For example, in 2017 and 2018, 24 monitored colonies held 33,000 individuals compared to 10,000 during Seabird 2000. Data from the largest English colony, at Flamborough Head and Bempton Cliffs (Figure 5), found a substantial increase with 27,967 individuals being recorded in 2017, an increase of 231% since the Seabird 2000 census (8,463 individuals), and double the total English population recorded during that census.

Productivity

Productivity data have been collected in England since 1996, initially from the Farne Islands and then at Bempton Cliffs since 2009. Analysis showed no statistically significant variation over time. On average, razorbills fledged 0.64 chicks per site per year.

Wales

Population estimates and change 1969-2002 (census data)

	Operation Seafarer (1969-70)	Seabird Colony Register (1985-88)	Seabird 2000 (1998-2002)
Population estimate (Individuals)	9,316	9,501	12,638
% change since previous census	n/a	+2	+33

Breeding abundance

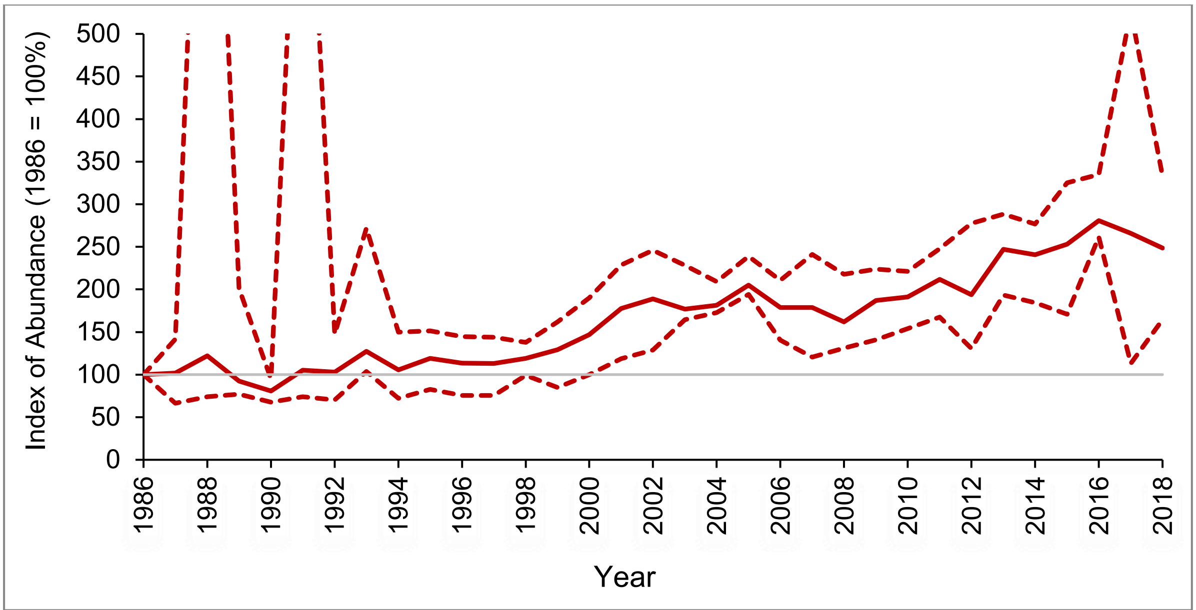

Figure 6. Trend in abundance index (solid line) of razorbill in Wales, 1986-2018 with 95% confidence limits (dotted lines; drawing of upper limit restricted to preserve detail in the abundance index). Based on SMP data; view the methods of analysis .

The trend in abundance for razorbills at Welsh colonies has generally been upward since 1986, with a new peak reached in 2016 (180% above baseline). National census data show numbers were stable between Operation Seafarer and the Seabird Colony Register but had increased by 33% by Seabird 2000 - a trend which has continued to the present. Almost 75% of Welsh razorbill colonies were surveyed in 2018 (51), with numbers totalling 15,992 individuals, 26% more than were recorded in the whole country during Seabird 2000.

Productivity

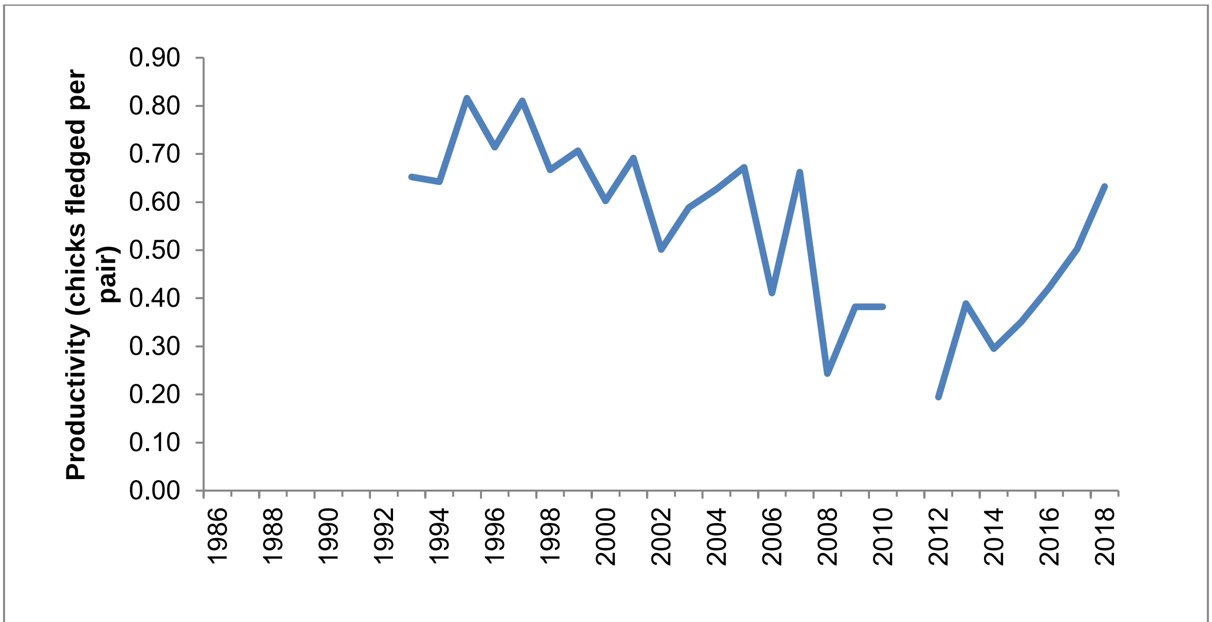

Figure 7. Trend in productivity (no. of chicks fledged per pair) of razorbill in Wales, 1986-2018. Based on SMP data; view the methods of analysis .

Razorbill productivity data were not collected at Welsh colonies prior to 1993. Although productivity has varied between years, there was a sharp decline until 2012 after which it rose to 2013 and then declined again before rising to 0.63 chicks fledged per pair in 2018. In recent years (2003 onwards) almost all data have been collected on Skomer (note: no data were collected in 2011) where productivity in 2018 (0.62) rose above 0.56 for the first time since 2009. With productivity decreasing between 1998 and 2008 and low rates of survival also recorded at Skomer in recent years (see Figure 10 below), it is of no surprise that abundance also began to fall from 2016 onwards (Skomer holds about 30% of the Welsh razorbill population).

Northern Ireland

Population estimates and change 1969-2002 (census data)

	Operation Seafarer (1969-70)	**Seabird Colony Register (1985-88)**	**Seabird 2000 (1998-2002)**
Population estimate (Individuals)	6,975	11,031	24,084
% change since previous census	n/a	+58	+118

Breeding abundance

Razorbill numbers in Northern Ireland have been on the increase since Operation Seafarer according to national census data. The Seabird Colony Register recorded 58% more individuals than during the first census, which was followed by a further large increase by Seabird 2000.

Only eight or nine colonies exist and few of these are monitored frequently. Most of the national population (87% during Seabird 2000) is found on Rathlin Island where a count in 2007 recorded 10,684 individuals - a severe decline of 49% since Seabird 2000. A repeat survey in 2011 recorded 22,975 individuals - more than double that in 2007 - making it the second largest colony in the UK. Obviously, given the increase that occurred afterward, the numbers of razorbills on Rathlin Island in 2007 must have been unusually low. However, there is a lack of detail from Rathlin Island and other colonies in the vicinity from which to form any conclusions as to why such an increase occurred. However, it should be noted that numbers of razorbills in attendance at the colony can be subject to large fluctuations, particularly as many birds may not breed each year. Only two small colonies have been surveyed recently; The Gobbins and Muck held 1,722 individuals in 2013 compared to 901 individuals during Seabird 2000. However, in 2014, numbers at these colonies were very low totalling a mere 642 individuals. In 2015, numbers increased to 1,177 individuals which may mean the sudden drop observed in 2014 was due to many birds failing to breed. In 2018, 1,618 individuals were recorded at both colonies. Numbers at the other colonies have not been assessed since 2000 when they held a total of 1,926 individuals. However, without a whole-colony count of Rathlin Island, it is not possible to draw any meaningful assumptions on the current status of the razorbill population in Northern Ireland.

Productivity

Data submitted to the SMP on the productivity of razorbills in Northern Ireland are sparse; thus, no meaningful average productivity value can be given.

Republic of Ireland

Population estimates and change 1969-2018 (census data)

	Operation Seafarer (1969-70)	Seabird Colony Register (1984-85)	Seabird 2000 (1998-2002)	Republic of Ireland Census (2015-18)
Population estimate (Individuals**)**	33,989	20,987	27,446	33,689
% change since previous census	n/a	-38	+31	+23

Breeding abundance

In contrast to Northern Ireland, razorbill numbers in the Republic of Ireland were found to have declined by 38% between Operation Seafarer and the Seabird Colony Register. Although a subsequent increase had occurred by Seabird 2000, the population was still slightly below that recorded during the first census, again in contrast to changes in Northern Ireland where razorbill numbers doubled over the same period. A recent seabird census in the Republic of Ireland counted 33,689, an increase of 23% compared to Seabird 2000[6]. Although the national trend was positive, there was much variation in numbers since the Seabird 2000 census. Most notable of these was the change in breeding population estimates at the Cliffs of Moher which had decreased by 48% (from 7,700 to 4,046 individuals). In contrast, Great Saltee and Lambay Island experiencing substantial increases of at least 70% from 3,239 and 4,337 individuals respectively. Horn Head recorded 6,812 individuals, remaining largely stable. The abundance of razorbills at colonies can be closely associated with prey abundance e.g. sprat, therefore, it is possible that local changes in food availability are driving the apparent regional differences in population trends[7].

Productivity

Data submitted to the SMP on the productivity of razorbills in the Republic of Ireland are sparse; thus, no meaningful average productivity value can be given.

All Ireland

Population estimates and change 1969-2002 (census data)

	Operation Seafarer (1969-70)	Seabird Colony Register (1985-88)	Seabird 2000 (1998-2002)
Population estimate (Individuals)	40,964	32,018	51,530
% change since previous census	n/a	-28	+61

Breeding abundance

The razorbill population for the whole of Ireland was 51,530 individuals during Seabird 2000, 61% higher than during the Seabird Colony Register when numbers were found to have declined by 28% since Operation Seafarer. Most of the Northern Irish population (87% during Seabird 2000) is found on Rathlin Island where a count in 2011 recorded 22,975 individuals - making it the second largest colony in the UK and the largest in Ireland. A recent seabird census in the Republic of Ireland recorded 33,689, an increase of 23% compared to Seabird 2000[6]. Without a more recent whole-colony count from Rathlin Island, it is not possible to draw any meaningful assumptions on the current status of the razorbill population in the whole of Ireland.

Productivity

Data submitted to the SMP on the productivity of razorbills throughout Ireland are sparse; thus, no meaningful average productivity value can be given.

Isle of Man

Population estimates and change 1969-2018 (census data)

	Operation Seafarer (1969-70)	Seabird Colony Register (1984-85)	Seabird 2000 (1998-2002)	Isle of Man Census (2017-18)
Population estimate (Individual)	897	848	1,524	682
% change since previous census	n/a	-5	+80	-55

Breeding abundance

Figure 8. Abundance of razorbill on the Calf of Man, 1986-2017.

Between Operation Seafarer and the Seabird Colony Register the number of razorbills on the Isle of Man was relatively stable. By Seabird 2000, the population had increased by 80% to 1,524 birds. A seabird census was carried on the Isle of Man in 2017, recording a total of 682 individual razorbills, a 54% decrease since Seabird 2000[8]. On the Calf of Man, which held between 20-25% of the razorbill population during the SCR and Seabird 2000 censuses, numbers have shown considerable variation over time (Figure 8). However, differences in the method used to collect data makes it difficult to draw any conclusion to the trend. For instance, in 2010 (331 individuals) were close to the peak count recorded in 1999 (362 individuals). However, counts in 1999 were from land only while those in 2010 were from land and sea. In 2013, 226 individuals were recorded but counts were done from sea only.

Productivity

Data submitted to the SMP on the productivity of razorbills on the Isle of Man are sparse; thus, no meaningful average productivity value can be given.

Channel Islands

Population estimates and change 1969-2015 (census data)

	Operation Seafarer (1969-70)	Seabird Colony Register (1984-85)	Seabird 2000 (1998-2002)	Channel Islands Census (2015)
Population estimate (Individual)	63	81	65	112
% change since previous census	n/a	+29	-20	+72

Breeding abundance

The small population of razorbills nesting on the Channel Islands numbered just 65 individuals during Seabird 2000, almost the same as that recorded by Operation Seafarer. Razorbills were slightly more numerous during the Seabird Colony Register, when 81 individuals were recorded. In 2015 a seabird census of the Channel Islands recorded 112 razorbills, an increase of 72% since Seabird 2000[9].

Productivity

No systematic data on the productivity of razorbills on the Channel Islands have been submitted to the SMP.

UK phenology, diet, survival rates

Phenology

No systematic data on phenology (timing of life-cycle events) have been collected as part of the SMP.

Diet

No systematic data on razorbill diet have been collected as part of the SMP.

Return rate and survival rate

Important notes on interpretation: Estimation of razorbill adult return and survival rates are currently undertaken at two sites within the Seabird Monitoring Programme - the Isle of May (North-east Fife) and Skomer (Dyfed). Return rates are based on sightings of individually colour-ringed birds and are calculated as the proportion of marked birds present in year one that is seen in the following year. Because not every adult alive is seen each year, return rates for 2018 presented here for Isle of May need to be treated as minimum estimates of survival of birds seen in 2017. In contrast, survival estimates do take into account birds that are not seen one year but which re-appear in following years.

The annual return rate of razorbills from the Isle of May (Figure 9) shows fluctuation over time with a recent increase. Return rates between 2009 and 2012 and in 2017 were among the highest recorded there. After a steep decline in 2008, return rate increased up to 2018 when it was equivalent to 1986 (92.1) when monitoring began. In contrast the survival rate from Skomer (Figure 10) doesn't show any clear trend over the period monitored, though fluctuation has become more pronounced in recent years with much lower rates in recorded in 2007 and 2014[10]. On Skomer, recent years show survival rates returning to the high levels recorded at the beginning of this long-term study. Survival across the Skomer study (1970-2017) averages 0.90, and in 2016-17 was 0.85[11].

There appears to be no relationship between the UK population trend (nor the trends in Scotland and Wales) and survival/return rates at the two colonies where this is measured. The low return rate at the Isle of May in 2008 followed a post-breeding 'wreck' of adult birds in the Skagerrak (the strait between Norway, Denmark and Sweden) during autumn 2007. Ringing recoveries indicated birds had mainly originated from northern or eastern Scotland[4]. A further 'wreck' off the east coasts of Scotland and northern England during winter 2012/13, when many adult and juvenile guillemots and razorbills died, may have been the cause of low return rates on the Isle of May during the 2013 breeding season.

In addition, the winter of 2013/14 saw a succession of severe storms from late January to the beginning of March result in a large 'wreck' of seabirds along Atlantic coasts from England and Ireland to Spain. A minimum of 54,000 seabirds, mostly auks, were washed ashore dead or dying. Examination of many corpses revealed birds were emaciated with empty stomachs indicating starvation as the main cause of death although a small proportion showed signs of oil contamination[12]. Overall, about 10% of the casualties were razorbills[12]. However, in Cumbria, 70% of 850 seabirds washed ashore dead or dying during this 'wreck' were razorbills[13]. Biometric data from 43 corpses recovered from Cumbrian beaches indicated birds were of the subspecies *islandica* which breeds in Britain and Ireland, France and Iceland. Rings recovered from razorbill corpses (from beaches in England and in France) also indicated birds originated from colonies around the UK and Ireland[13]. The majority of birds examined were found to be adults. The total mortality will be much higher than reported because not all beaches were checked, birds were washed ashore over a number of weeks and many birds will be lost unrecorded at sea[12].

On Skomer, after collecting sufficient data to observe the effect of this event on long-term population parameters (scientists require two years' data following a winter to be confident of survival estimates), a considerable drop in the survival of adult breeding razorbills is clear (Figure 10), after a period of steady increase over the last 30 years. The survival of breeding adult razorbills after the seabird wreck in the winter of 2013-14 was just 0.59, more than 30% below the study average of 0.90 (1970-2014)[14].

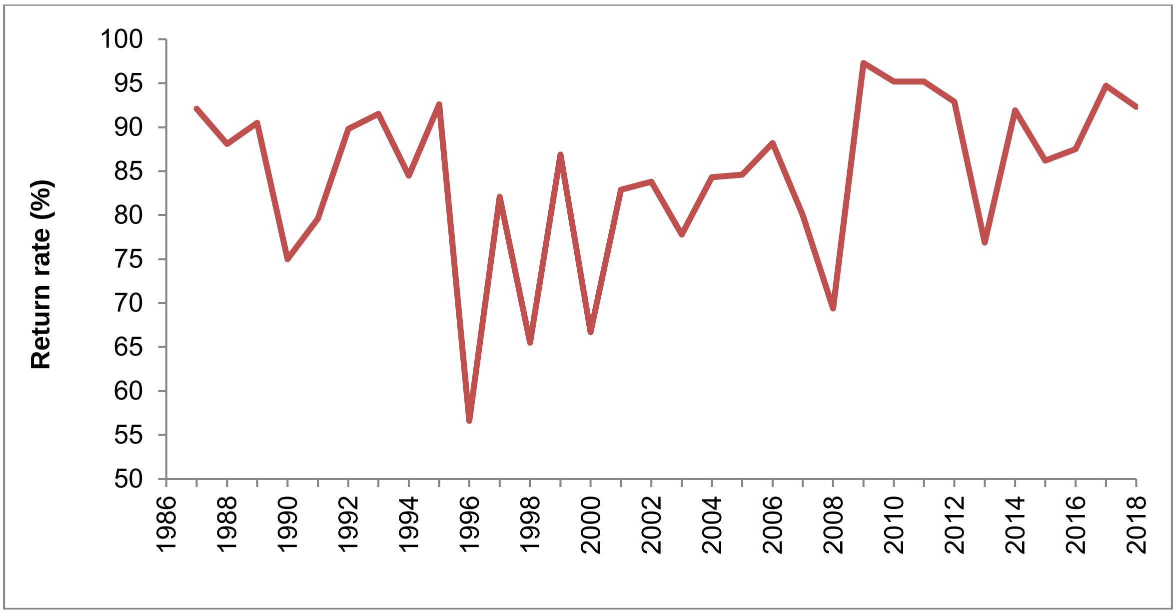

Figure 9. Annual return rate of razorbills breeding on the Isle of May, 1987-2018.

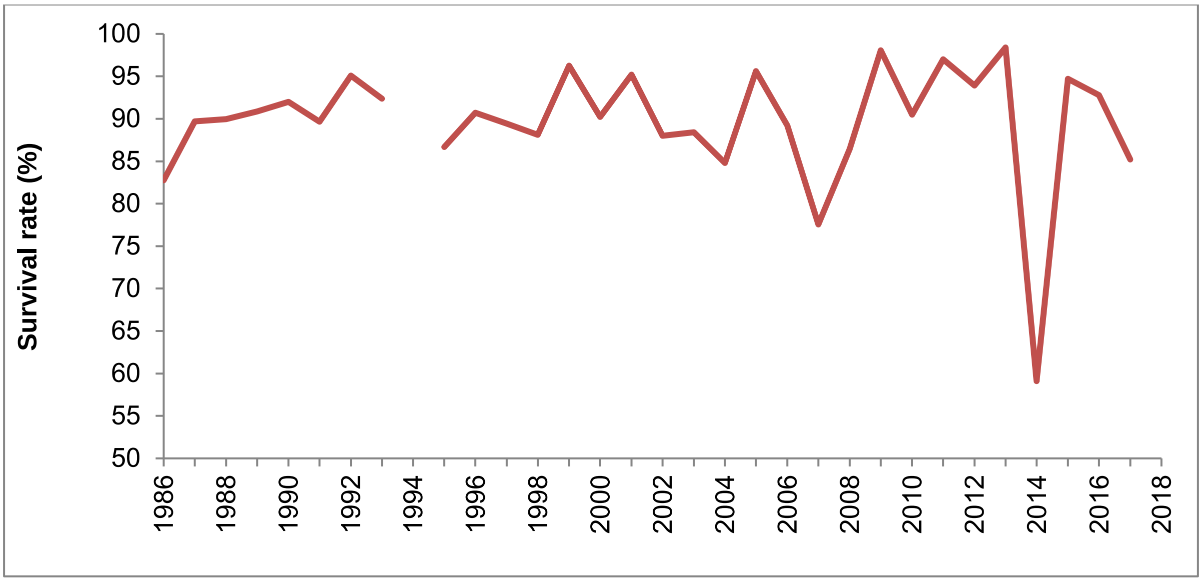

Figure 10. Annual survival rate of razorbills breeding on Skomer, 1986-2018.

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Black Guillemot *Cepphus grylle*

Description

The following has been adapted from original text by P. Ian Mitchell in [Seabird Populations of Britain and Ireland] (with permission from A&C Black, London).

The black guillemot or 'tystie' is a circumpolar species, concentrated around the North Atlantic, Barents Sea, Baltic and smaller numbers around the Chukchi Sea in northern Alaska and north-eastern Siberia. Approximately half of the UK's population breeds around the Northern Isles, with the remainder confined mainly to the coasts and islands of north and west Scotland. Their distribution within the core range is determined by the availability of suitable nest cavities that are safe from land predators such as rats *Rattus* sp., American mink *Neovison vison*, stoats *Mustela erminea* and otters *Lutra lutra*. Between censuses in 1969-70 and 1985-91, there was an expansion in the range of black guillemots, in particular the colonisation of new sites around the Irish Sea, including man-made structures (e.g. harbour walls, jetties, piers), and into north-east Scotland.

The species is one of the more problematic seabirds to survey. It tends to breed away from the large seabird cliff colonies and prefers small rocky islands and low-lying, indented stretches of rocky coast. Nests are hidden in rock crevices and under boulders, which makes them extremely difficult to census during the breeding season (see below).

Conservation status

Black guillemot is currently identified as a conservation priority in the following:

Amber listed in Birds of Conservation Concern 4 (2015 update)
further information on Conservation Designations for UK Taxa
Amber listed in Birds of Conservation Concern in Ireland 2014-2019 (2014 update)

International importance

UK Population	% Biogeographic Population	% World Population
38,700 Individuals	n/a	5.8

The UK population figure (rounded to the nearest hundred) was derived from data in Mitchell, P.I., Newton, S.F., Ratcliffe, N. and Dunn, T.E. (eds.) 2004. *Seabird Populations of Britain and Ireland.* Poyser, London. This was also the source of figures for the Biogeographic and World populations.

UK population estimates and change 1969-2002 (census data)

During Operation Seafarer (1969-70), counts were conducted along with other cliff-nesting seabirds during June. At this time of year, black guillemots are often inconspicuous. Operation Seafarer therefore underestimated the population by an unknown number. Between 1982 and 1991, as part of the SCR Census, a survey of the number of adult black guillemots was conducted between late March and early May prior to the breeding season. Surveys were carried out between 06.00 – 09.00 BST when adults congregate close inshore for courtship and mating. Such counts have been found to be the most repeatable and accurate way of assessing population size. A pre-breeding survey was repeated during Seabird 2000 throughout Britain and Northern Ireland, and thus, provided the first opportunity to examine changes in the population of black guillemots in many areas since 1982-91. The main reason for this is that the spatial scales at which counts were conducted during the SCR Census and Seabird 2000 were highly compatible.

	Operation Seafarer (1969-70)	Seabird Colony Register (1982-91)	Seabird 2000 (1998-2002)
UK Population estimate (Individuals)	n/a	37,745	38,714
% change since previous census	n/a	n/a	+3

For census results for individual countries and Ireland, the Channel Islands and the Isle of Man see under relevant sections below.

Distribution/abundance

The Seabird 2000 census provides the most comprehensive recent assessment of the distribution and abundance of breeding seabirds. Numbers found in different regions, and a map showing the location and size of colonies, is provided in the Seabird 2000 black guillemot results page.

The locations sampled during the annual Seabird Monitoring Programme provide some information on distribution and are accessible via the Seabird Monitoring Programme online database.

Annual abundance and productivity by geographical area

With reference to the regional accounts below please note the following.

Breeding abundance: graphs of abundance index with 95% confidence limits are only shown for a region where the trend produced has been deemed accurate (see methods of analysis). Where a trend was thought to be inaccurate, graphs of abundance at major colonies in a region may be shown instead, particularly if such colonies hold greater than 10% of the regional population, are monitored frequently and may thus help illustrate regional population fluctuations outwith national censuses. Occasionally, too few data have been collected regionally to produce either of these.

Productivity: graphs of productivity are only shown if analysis of productivity data produced a significant result for regional and/or year effects (again see methods of analysis). If results were not significant, then a regional mean productivity value is given. However, on some occasions too few data are available from which to provide a meaningful average. Furthermore, for 11 species where the quality of monitoring data available was considered high, population viability analysis was undertaken at the UK level and the results of this are also reported.

United Kingdom

Breeding abundance

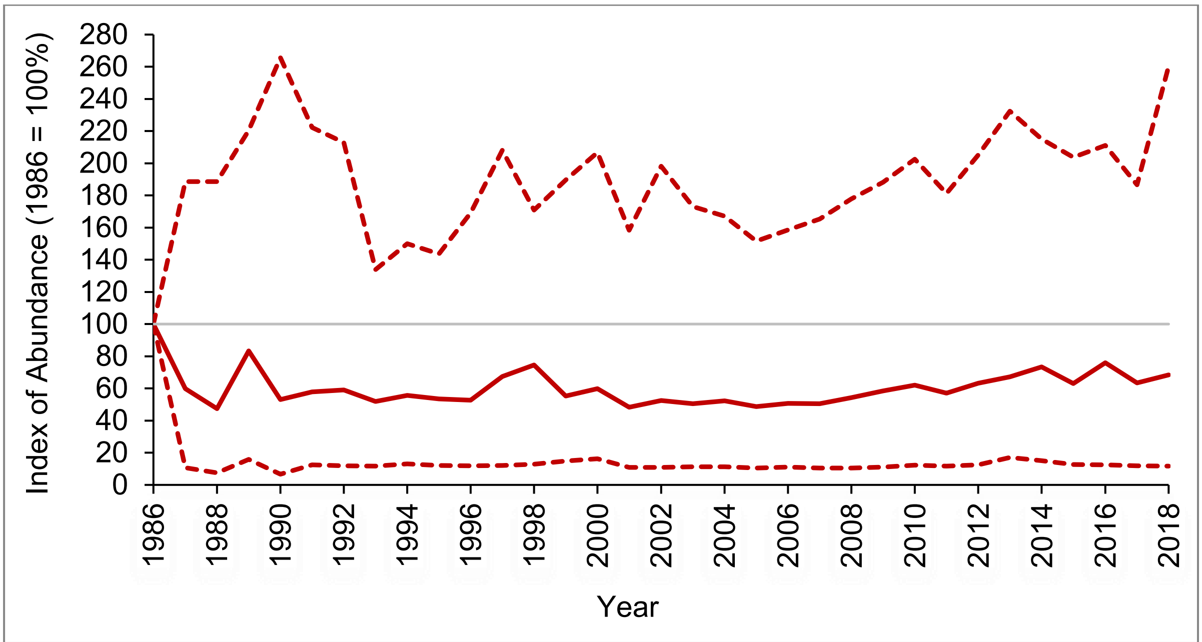

Figure 1. Trend in UK abundance index (solid line) of black guillemot, 1986-2018 with 95% confidence limits (dotted lines). Based on SMP data; view the methods of analysis.

The UK annual sample of black guillemots is small though appears to be representative of the population as a whole. Abundance derived from the sample of colonies monitored as part of the SMP has been generally stable since 1987, normally fluctuating between 50-75% of the 1986 index, although has appeared to be increasing in recent years. Census results also indicate that the UK population changed little (+3%) between the SCR and Seabird 2000 (no comparable data are available from Operation Seafarer).

Productivity

The productivity of black guillemots derived from regularly monitored colonies in the UK (mostly located in Orkney and in Co. Down) showed no statistically significant variation over time. On average, productivity was approximately 1.05 chicks fledged per pair per year between 1986 and 2018. No productivity data for 2018 were submitted to the SMP.

Scotland

Population estimates and change 1969-2002 (census data)

	Operation Seafarer (1969-70)	**Seabird Colony Register (1985-88)**	**Seabird 2000 (1998-2002)**
Population estimate (Individuals)	n/a	37,172	37,505
% change since previous census	n/a	n/a	<+1

Breeding abundance

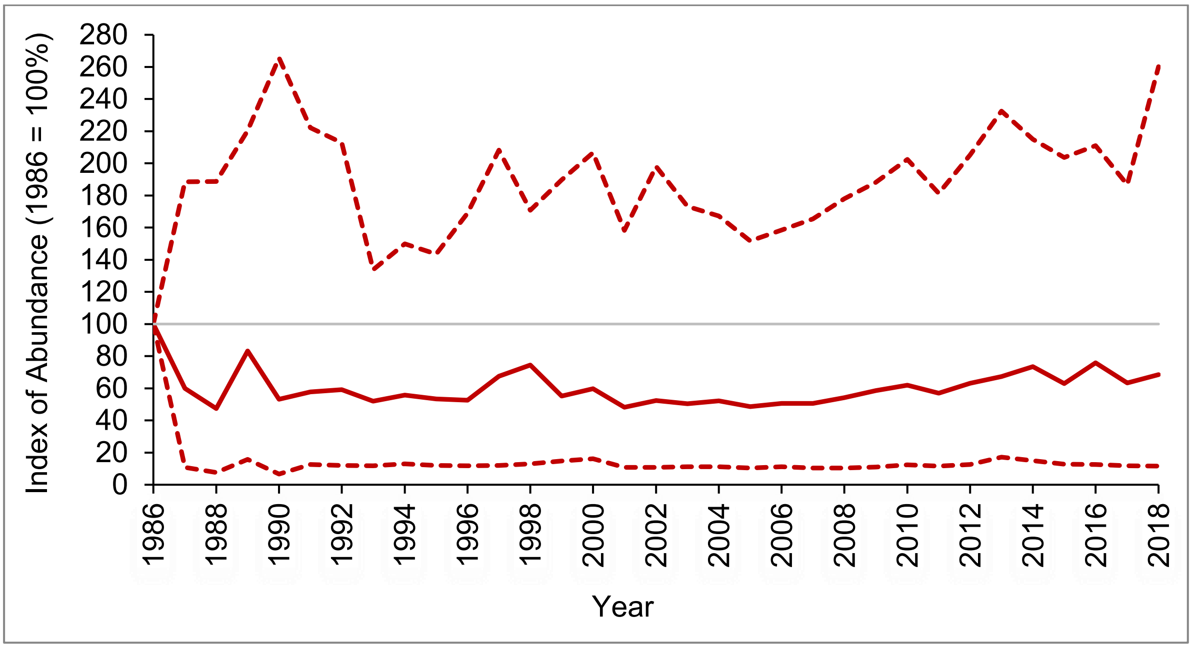

Figure 2. Trend in abundance index (solid line) of black guillemot in Scotland, 1986-2018 with 95% confidence limits (dotted lines). Based on SMP data; view the methods of analysis.

The black guillemot population in Scotland was stable between the Seabird Colony Register and Seabird 2000 censuses - *c.*37,000 individuals were recorded in each census. The abundance index above, based on the SMP sample shows an increasing trend since Seabird 2000. However, most data collected annually are from colonies in Shetland with few data from sites along other parts of the Scottish coastline and the number of sampled colonies in any year is never large. In 2018, data from 47 colonies were submitted to the SMP and showed a 33% increase in individuals since Seabird 2000. This may give an indication of the current status of the black guillemot population in Scotland.

Productivity

Productivity of black guillemots, which is derived from regularly monitored colonies mostly located in Orkney and Shetland, showed no statistically significant variation over time. On average, productivity was approximately 1.01 chicks fledged per pair per year between 1986 and 2012. No data was submitted to the SMP since 2012.

England

Population estimates and change 1969-2002 (census data)

	Operation Seafarer (1969-70)	**Seabird Colony Register (1985-88)**	**Seabird 2000 (1998-2002)**
Population estimate (Individuals)	n/a	14	7
% change since previous census	n/a	n/a	-50

Breeding abundance

England holds only a few breeding black guillemots, all located at St. Bee's Head. Fourteen individuals were counted during the Seabird Colony Register, but numbers had halved by Seabird 2000. Ten individuals were recorded in 2011 and 2012, since then numbers have been decreasing with only two individuals recorded in 2017 and four in 2018.

Productivity

No systematic data on the productivity of black guillemots in the small population in England have been submitted to the SMP.

Wales

Population estimates and change 1969-2002 (census data)

	Operation Seafarer (1969-70)	**Seabird Colony Register (1985-88)**	**Seabird 2000 (1998-2002)**
Population estimate (Individuals)	n/a	26	28

	Operation Seafarer (1969-70)	Seabird Colony Register (1985-88)	Seabird 2000 (1998-2002)
% change since previous census	n/a	n/a	+8

Breeding abundance

Only 28 black guillemot individuals were recorded in Wales during Seabird 2000, mostly around Anglesey, a similar number to that found during the Seabird Colony Register. No sites of any size are monitored frequently so the current status of the population is unknown.

Productivity

No systematic data on the productivity of black guillemots in Wales have been submitted to the SMP.

Northern Ireland

Population estimates and change 1969-2002 (census data)

	Operation Seafarer (1969-70)	Seabird Colony Register (1985-88)	Seabird 2000 (1998-2002)
Population estimate (Individuals)	n/a	533	1,174
% change since previous census	n/a	n/a	120

Breeding abundance

In Northern Ireland, black guillemots increased by 120% between the Seabird Colony Register and Seabird 2000 to 1,174 individuals, probably as a result of increased use of man-made structures for nest sites. Habitat such as harbour walls and piers provided important nesting sites, and it was estimated such habitat held over twice as many nesting black guillemots during Seabird 2000 than it did during the SCR; this equated to an estimated 22% of the national population[1]. Extensive survey work was carried out at 23 colonies in April 2017 and 2018 which held an estimated 80% of the country's population during Seabird 2000[2]. A total of 879 individuals were recorded, 11% less than during Seabird 2000 when 989 individuals were recorded, indicating that the breeding population of black guillemot in Northern Ireland may be in decline.

Productivity

The productivity of black guillemots in Northern Ireland shows no statistically significant variation over time. On average 0.98 chicks were fledged per pair per year at monitored colonies between 1986 and 2015. No data productivity data has been submitted to the SMP since 2014.

A study of a colony at Bangor Marina, where most pairs nest in specially provided holes and nest boxes, has revealed losses of eggs to children and predation of eggs and chicks by brown rats *Rattus norvegicus,* herring gulls *Larus argentatus* and domestic/feral cats *Felis catus*. Gulls have also been seen removing sitting adults, although this has been mitigated against by reducing the size of entrance holes[3]. Thus, losses of young due to predators are now quite low and very few nests are deserted. Overall, productivity at this colony was 1.08 chicks per nest in 2018, slightly above the long-term average of 0.98 (1986-2018).

Republic of Ireland

Population estimates and change 1969-2018 (census data)

	Operation Seafarer (1969-70)	Seabird Colony Register (1984-85)	Seabird 2000 (1998-2002)	Republic of Ireland Census (2015-18)
Population estimate (AON*)	n/a	n/a	3,367	3,917
% change since previous census	n/a	n/a	n/a	+16

Breeding abundance

Seabird 2000 was the first national census to record numbers of pre-breeding adult black guillemots in a systematic way in the Republic of Ireland. Counts carried out in April and early May recorded 3,367 individuals. Few colonies are currently monitored during the recommended month (April), or at the recommended time of day (the first few hours after dawn). The recent Republic of Ireland Seabird Census recorded 3,917 individuals; however, this is an interim assessment. The survey covered the majority of the suitable habitat around the Republic of Ireland's coastline however, it is still incomplete. The data gaps will to be addressed through additional surveys during the 2019 and 2020 breeding seasons[4].

Productivity

The productivity of black guillemots in the Republic of Ireland shows no statistically significant variation over time. On average, black guillemots fledged 1.22 chicks per pair per year at the only colony monitored, Rockabill, between 2000 and 2014. No productivity data have been submitted to the SMP since 2014.

All Ireland

Population estimates and change 1969-2002 (census data)

	Operation Seafarer (1969-70)	Seabird Colony Register (1985-88)	Seabird 2000 (1998-2002)
Population estimate (Individuals)	n/a	n/a	4,541
% change since previous census	n/a	n/a	n/a

Breeding abundance

With no coverage in the Republic of Ireland during the first two national censuses, the long-term trend in the black guillemot population for the whole of Ireland is currently unknown. However, numbers in Northern Ireland more than doubled between the Seabird Colony Register and Seabird 2000. The population for the whole of Ireland during Seabird 2000 was 4,541 individuals. Since then, very few colonies have been monitored during the recommended month (April), or at the recommended time of day (the first few hours after dawn), so no conclusions can be drawn as to current population trend for the whole of Ireland. In Northern Ireland, extensive survey work was carried out at 23 colonies in April 2017 and 2018 which held an estimated 80% of the country's population during Seabird 2000[2]. A total of 879 individuals were recorded, 11% less than during Seabird 2000 when 989 individuals were recorded. A black guillemot census in the Republic of Ireland is underway but only provisional counts of 3,917 individuals have been provided to the SMP. The data gaps will be addressed through additional surveys during the 2019 and 2020 breeding seasons[4].

Productivity

The productivity of black guillemots throughout Ireland showed no statistically significant variation over time. On average 1.06 chicks were fledged per pair per year at monitored colonies between 1986 and 2014. No productivity data has been submitted to the SMP by either of the two countries since 2014.

Isle of Man

Population estimates and change 1969-2018 (census data)

	Operation Seafarer (1969-70)	Seabird Colony Register (1984-85)	Seabird 2000 (1998-2002)	Isle of Man Census (2017-18)
Population estimate (Individual)	n/a	303	602	211
% change since previous census	n/a	n/a	+99	-65

Breeding abundance

Between the Seabird Colony Register and Seabird 2000, numbers of black guillemots on the Isle of Man almost doubled from 303 to 602 individuals. A black guillemot census was carried out on the Isle of Man during April 2018 and recorded a total of 211 individuals, a decline of 65% since Seabird 2000. Individuals were found at 27 sites, including 11 sites that did not hold any birds during the Seabird Colony Register Census[6].

Productivity

No systematic data on the productivity of black guillemots on the Isle of Man have been submitted to the SMP.

Channel Islands

Black guillemot does not breed on the Channel Islands.

UK phenology, diet, survival rates

Phenology

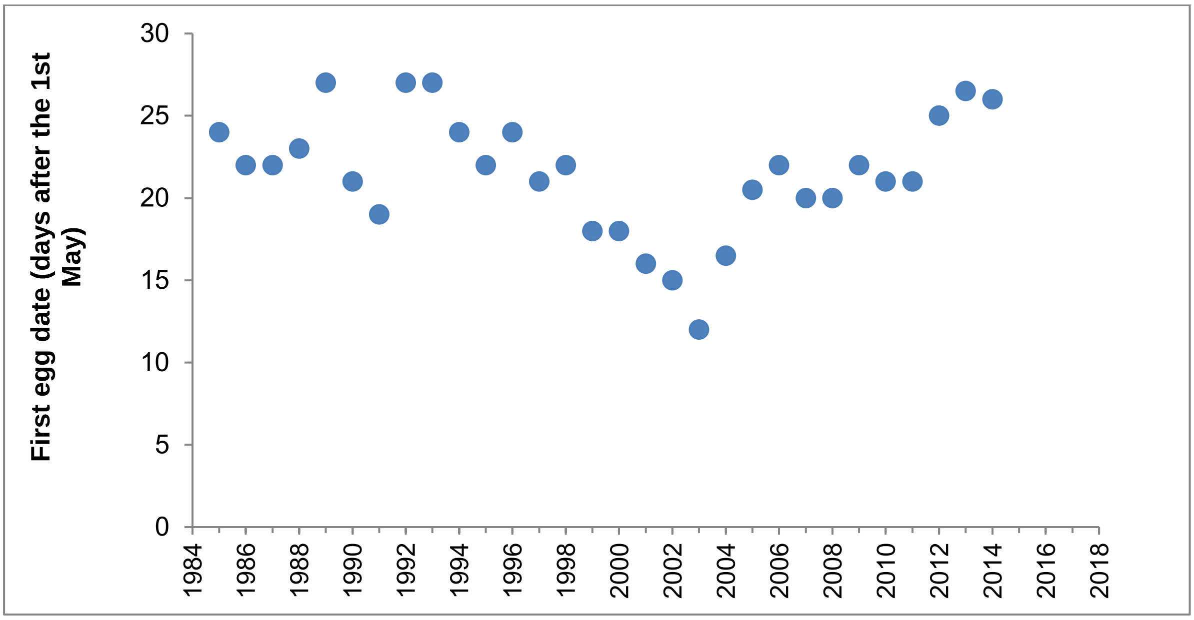

Figure 3: Median date of laying of the first egg of black guillemots nesting at North Pier, Bangor Marina, 1986-2014. Reproduced with kind permission of J. Greenwood.

A detailed study of black guillemots nesting at Bangor Marina has allowed data on the date of laying of the first egg to be collected. In 2014, the median date of laying for the first egg was 26th May. From Figure 3, it can be seen that 2014 was a late year for the onset of egg-laying. There is evidence that the onset of egg-laying is associated with seawater temperature with warmer springs bringing the date forward[5]. On average, it was calculated that the breeding season became earlier by 2.5 days for every 1°C increase in April sea-surface temperature.

Diet

No systematic data on black guillemot diet have been collected as part of the SMP.

Return rate and survival rate

No systematic data have been collected as part of the SMP.

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5 Hill, R.W., Morris, N. G., Bowman, K. A. and Wright, D. 2019. The Isle of Man Seabird Census: Report on the census of breeding seabirds in the Isle of Man 2017-18. Manx BirdLife. Laxey, Isle of Man.
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Atlantic Puffin *Fratercula arctica*

Description

The following has been adapted from original text by Mike P. Harris and Sarah Wanless in Seabird Populations of Britain and Ireland (with permission from A&C Black, London).

The Atlantic puffin is the most instantly recognisable and popular of all North Atlantic seabirds. It breeds in the North Atlantic and the adjacent Arctic Ocean, with strongholds in Iceland and Norway, with around 10% of the population breeding around Britain and Ireland, where it is the second most abundant breeding seabird. Atlantic puffins are pelagic and we are still largely ignorant of where they spend their time away from the colony. Those from north western Britain disperse widely outside the breeding season, as far as Newfoundland in the west and the Canary Islands to the south and even into the Mediterranean as far east as Italy. In contrast, most of those from colonies in eastern Britain remain within the North Sea though in recent decades some have dispersed as far as the Bay of Biscay.

Atlantic puffins typically nest underground in burrows dug in the soil of offshore islands, but where such habitat is sparse, they nest among boulder screes or at low densities in cracks in sheer cliffs. The species is highly colonial and most colonies occur where the nesting birds are safe from mammalian predators. However, during the breeding season a colony can appear deserted during the middle of the day since most birds are either in their burrows or out at sea feeding. At other times awe-inspiring numbers can be seen standing on the slopes, bobbing around on the sea or flying in vast wheels over the colony. Chicks are fed on small fish that the adult carries cross-wise in its beak. In the UK the commonest prey is the lesser sandeel, followed by sprat, herring and a wide range of small juvenile gadoid fish. Fish are caught by underwater pursuit, usually several at a time.

Conservation status

Atlantic puffin is currently identified as a conservation priority in the following:

Red listed in Birds of Conservation Concern 4 (2015 update)
further information on Conservation Designations for UK Taxa
Amber listed in Birds of Conservation Concern in Ireland 2014-2019 (2014 update)
EC Birds Directive - migratory species

International importance

UK Population	% Biogeographic Population	% World Population
580,700 AOB*	9.6 (ssp. *arctica*)	9.6

*AOB = Apparently Occupied Burrows

The UK population figure (rounded to the nearest hundred) was derived from data in Mitchell, P.I., Newton, S.F., Ratcliffe, N. and Dunn, T.E. (eds.) 2004. *Seabird Populations of Britain and Ireland.* Poyser, London. This was also the source of figures for the Biogeographic and World populations.

UK population estimates and change 1969-2002 (census data)

During Seabird 2000 and the SCR Census, surveyors were able to count apparently occupied burrows (AOB) at most colonies. Here the main source of error is the misclassification or overlooking of burrows. However, for logistical reasons complete coverage is impossible to achieve at many colonies. In such situations the density of burrows must be determined through sample plots, the area of the colony estimated, and the measures combined to get an estimated population size. Where birds nest under boulders, in mixed colonies with Manx shearwaters, in completely inaccessible places or at low densities along stretches of cliffs (mainland colonies), counts of burrows are impractical. In these cases, surveyors must count individual birds attending the colony. Such counts can be highly variable, both within and between days, and the lack of any obvious factor influencing attendance means that such counts are of rather limited value in assessing breeding numbers, but they do at least give some idea of colony size. April and May are the prime months for counting individual birds before substantial numbers of immature birds begin to attend colonies.
For the calculation of total populations, some arbitrary decisions had to be made to allow the combination of counts of individuals and AOBs. The practice of assuming that one individual corresponded to one AOB was applied to counts from all three national censuses. This approximation may well result in a serious underestimate of the number of AOBs. However, the overall estimates of the SCR Census and Seabird 2000 should be broadly comparable. In both surveys, 83% of the total population estimates came from counts or estimates of AOBs. Furthermore, in the SCR Census, 65% of the counts of individual birds came from the preferred counting months compared to 73% during Seabird 2000.

	Operation Seafarer (1969-70)	Seabird Colony Register (1985-88)	Seabird 2000 (1998-2002)
UK Population estimate (AOB*)	424,318	488,763	580,714
% change since previous census	n/a	+15	+19

*AOB = Apparently Occupied Burrows

For census results for individual countries and Ireland, the Channel Islands and the Isle of Man see under relevant sections below.

Distribution/abundance

The Seabird 2000 census provides the most comprehensive recent assessment of the distribution and abundance of breeding seabirds. Numbers found in different regions, and a map showing the location and size of colonies, is provided in the Seabird 2000 Atlantic puffin results page.

The locations sampled during the annual Seabird Monitoring Programme provide some information on distribution and are accessible via the Seabird Monitoring Programme online database.

Annual abundance and productivity by geographical area

With reference to the regional accounts below please note the following.

Breeding abundance: graphs of abundance index with 95% confidence limits are only shown for a region where the trend produced has been deemed accurate (see methods of analysis). Where a trend was thought to be inaccurate, graphs of abundance at major colonies in a region may be shown instead, particularly if such colonies hold greater than 10% of the regional population, are monitored frequently and may thus help illustrate regional population fluctuations outwith national censuses. Occasionally, too few data have been collected regionally to produce either of these.

Productivity: graphs of productivity are only shown if analysis of productivity data produced a significant result for regional and/or year effects (again see methods of analysis). If results were not significant, then a regional mean productivity value is given. However, on some occasions too few data are available from which to provide a meaningful average. Furthermore, for 11 species where the quality of monitoring data available was considered high, population viability analysis was undertaken at the UK level and the results of this are also reported.

United Kingdom

Breeding abundance

The logistical difficulties in monitoring Atlantic puffin colonies means that few data are collected annually and that a bias toward smaller colonies exist; these are usually counts of individual adult birds in attendance at breeding sites. For a variety of factors, counts of individuals can vary quite markedly between years compared to counts of apparently occupied burrows (AOB). The UK Atlantic puffin population increased until at least Seabird 2000 (for unknown reasons), and possibly beyond, as counts of AOBs from two of the largest colonies (Farne Islands in Northumberland and Isle of May in North-east Fife) held even greater numbers in 2003 than they did when surveyed for Seabird 2000. However, a substantial decline at these two colonies was recorded between 2003 and 2008/09 (see relevant sections for more detail), with survey work in 2013 suggesting only limited recovery, if any. It is not known whether these decreases are representative of the UK as a whole. The return rate of adult puffins breeding on the Isle of May was very low in 2007 and 2008 (see under ‘Return rates and survival rates’), which explains, at least in part, the population decrease at this colony. The reasons for low return rates in these years are unknown.

Productivity

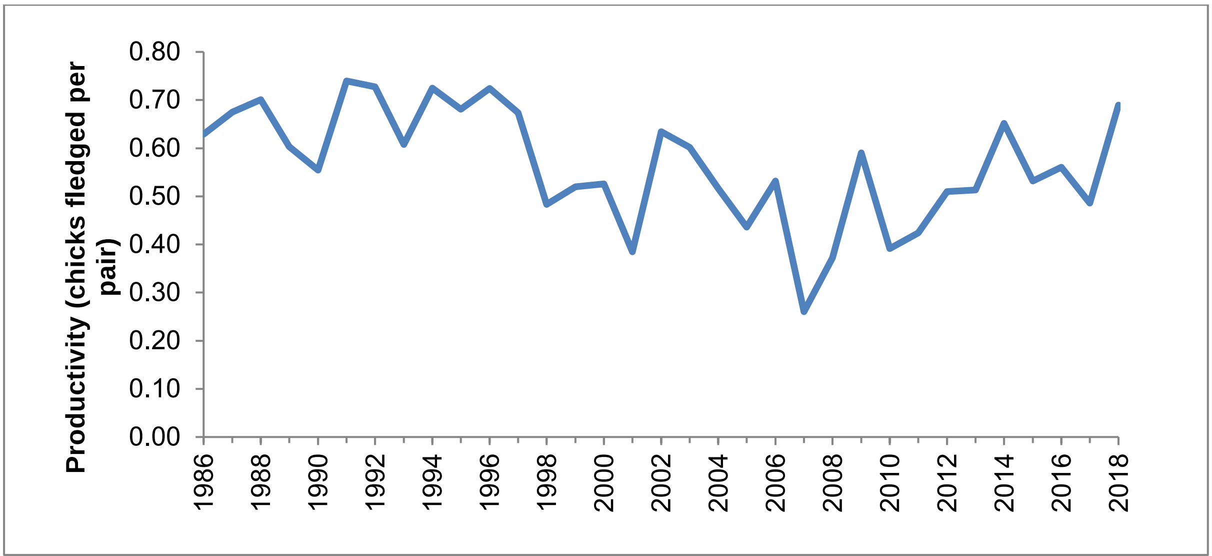

Figure 1. Trend in UK productivity (no. of chicks fledged per pair) of Atlantic puffin 1986-2018. Based on SMP data; view the methods of analysis .

Productivity has fluctuated throughout the recording period (Figure 1) but appears to have been generally lower since the late 1990s, contributing to a declining trend overall. Productivity was at its lowest in 2007 due to food shortage and unprecedented rainfall flooding burrows; these two factors combined also negatively impacted on productivity in 1998 and 2004. In 2012, high rainfall lowered productivity on the Isle of May, but also flooded thousands of burrows on the Farne Islands such that a large proportion of puffins did not even attempt to breed (although those that did had high levels of success). Productivity in 2013 was on a par with 2012, despite a lack of storms and inclement weather during the breeding season, suggesting other factors lowered success e.g. feeding conditions. In 2014, productivity was at its highest for many years due to favourable environmental and feeding conditions throughout the breeding season. Productivity decreased from 2015 to 2017 but increased to just under 0.70 chicks fledged per pair in 2018.

Scotland

Population estimates and change 1969-2002 (census data)

	Operation Seafarer (1969-70)	Seabird Colony Register (1985-88)	Seabird 2000 (1998-2002)
Population estimate (AOB*)	410,011	438,101	493,042
% change since previous census	n/a	+7	+13

*AOB = Apparently Occupied Burrows

Breeding abundance

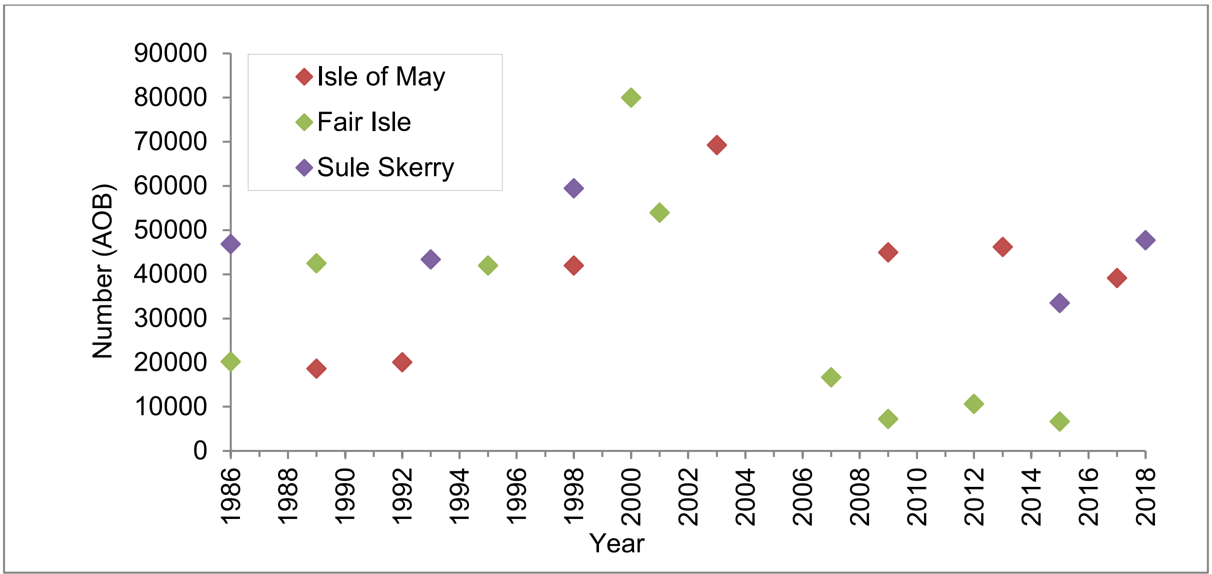

Figure 2. Abundance of Atlantic puffin at three colonies in Scotland, 1986-2018.

The logistical difficulties in monitoring Atlantic puffin colonies means that few data are collected annually. National census data indicate that the number of Atlantic puffins in Scotland increased from Operation Seafarer in 1969-70 by 20% to Seabird 2000. Figure 2 shows changes at the largest colonies (which hold over 40% of the national population). The three colonies shown share mixed fortunes, from when they were first counted before 1990, to the most recent counts between 2015 and 2018. The Isle of May has been surveyed seven times during this period and Apparently Occupied Burrows (AOB) and increased from 18,628 in 1989 to a peak of 69,300 AOB in 2003. By 2009 numbers had decreased to 44,971 AOB and to 39,200 in 2017. The return rate of adult puffins breeding on the Isle of May was very low in 2007 and 2008 (see ‘Return rates and survival rates’ below), which may explain, at least in part, the population decrease at this colony. The reasons for low return rates in these years are unknown. Fair Isle (Shetland) on the other hand, held 20,244 AOB in 1986 and experienced a similar steep increase over 14 years with a count of 80,000 AOB during Seabird 2000. Numbers then decreased and have been below 20,000 AOB since 2007. In 2015, numbers had further decreased to 6,666 AOB, a decrease of 92% since Seabird 2000 and 67% since the Seabird Colony Register. Another large colony of Atlantic puffins is found on Sule Skerry (North-west of Orkney) but it has been surveyed less frequent. It has, however, shown a smaller range of increases and decreases between censuses compared to the other two colonies which are both located to the East of Scotland; in fact, the numbers in 2018 were very similar to what they were in 1986.

Productivity

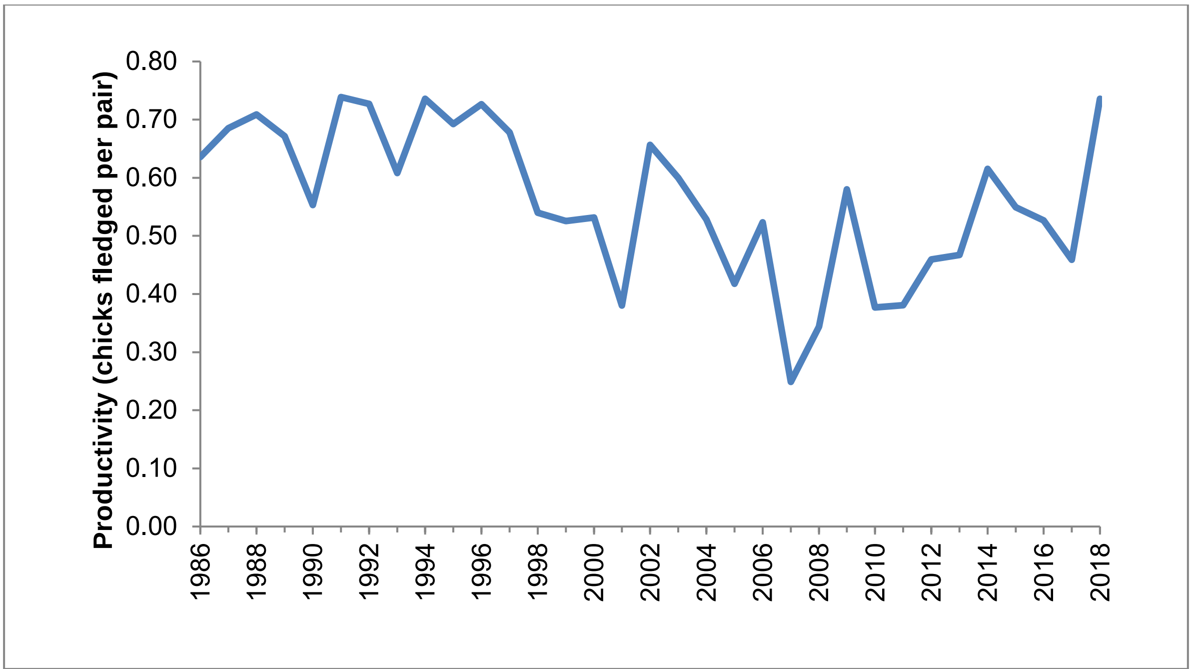

Figure 3. Trend in productivity (no. of chicks fledged per pair) of Atlantic puffin in Scotland, 1986-2018. Based on SMP data; view the methods of analysis .

Productivity has fluctuated throughout the recording period but has generally been lower since the late 1990s, contributing to a declining trend. Productivity was at its lowest in 2007 due to food shortage and unprecedented rainfall flooding burrows; these two factors also impacted productivity in 1998 and 2004. In 2012, productivity on the Isle of May (0.57 chicks fledged per nest) was lower than unusual due to high rainfall throughout the breeding season flooding many burrows. In 2015, productivity on the Isle of May (0.75) was average. On Fair Isle in 2015, Atlantic puffin productivity was 0.76 chicks per fledged pair, 13% lower than in 2014, which was their most successful breeding season since 1987. In 2015, productivity on Dun (St Kilda) was 0.58. Since 2017, average puffin productivity in Scotland has experiencing a steep increase from 0.47 to 0.74 chicks fledged per pair. On the Isle of May in 2018, Atlantic puffins had a below average breeding season with 0.67 chicks fledging per pair, although the return rate for adults (95.2%) was the highest on record.

England

Population estimates and change 1969-2002 (census data)

	Operation Seafarer (1969-70)	**Seabird Colony Register (1985-88)**	**Seabird 2000 (1998-2002)**
Population estimate (AOB*)	8,616	36,868	75,734
% change since previous census	n/a	+328	+105

*AOB = Apparently Occupied Burrows

__Breeding abundance__

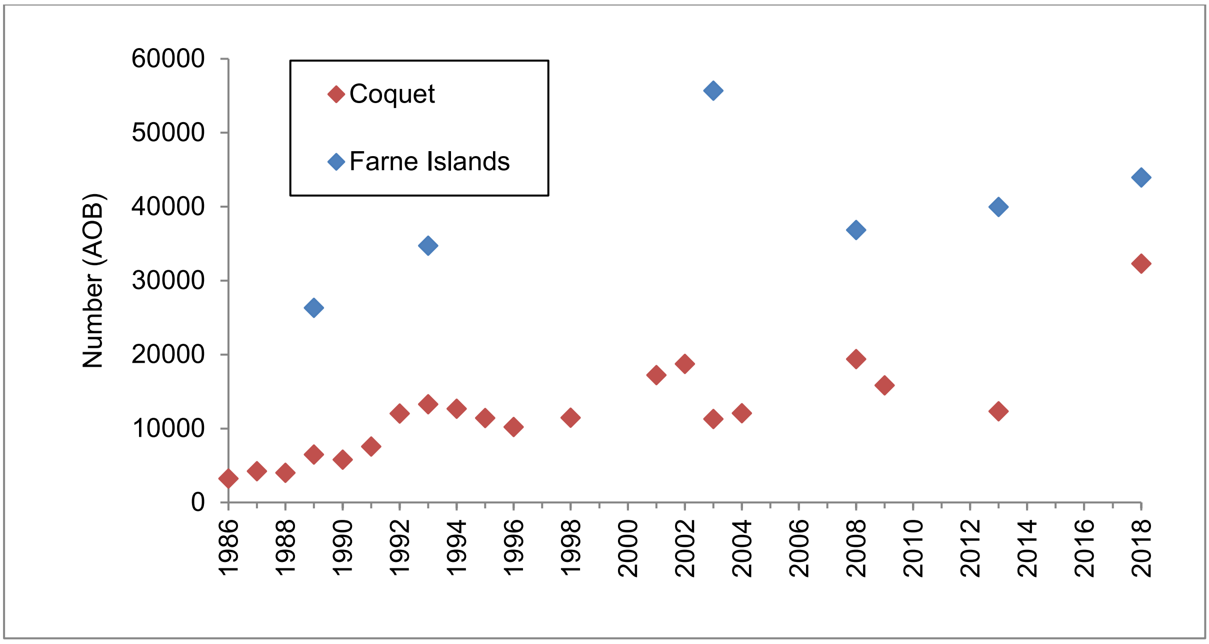

Figure 4. Abundance of Atlantic puffin on Coquet and the Farne Islands, 1986-2018.

Atlantic puffin numbers at colonies in England have increased since Operation Seafarer when 8,616 AOB were counted. The Seabird Colony Register recorded four times that number and, by Seabird 2000, numbers had doubled again. The largest English colonies are both in the north-east on the islands of the Farne Islands and Coquet, which between them held over 95% of England's puffins during the last census. The number of Atlantic puffins nesting on Coquet decreased by 40% immediately after Seabird 2000, had recovered by 2008, but declined over the next five years with a survey in 2013 recording 12,344 AOB, 36% less than in 2008. However, when birds were counted in 2018, 32,309 AOB were recorded, a 73% increase since Seabird 2000. On the Farne Islands, a far larger colony than Coquet (thus monitored less frequently), a 24% decline was recorded between 2003 (55,674 AOB) and 2008 (36,835 AOB). A survey in 2013 recorded 39,962 AOB, suggesting only a limited recovery, if any, since 2008. In 2018, 43,956 AOB were recorded, a decrease of 21% since Seabird 2000.

Productivity

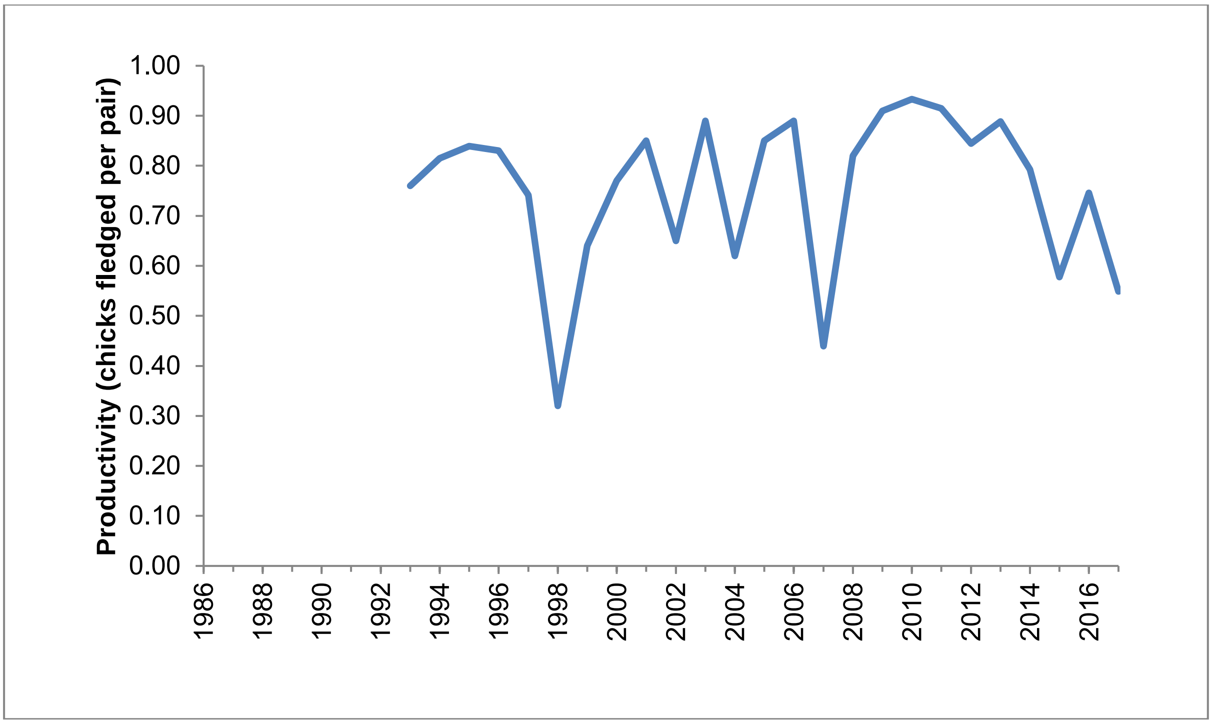

Figure 5. Trend in productivity (no. of chicks fledged per pair) of Atlantic puffin in England, 1986-2017. Based on SMP data; view the methods of analysis .

The productivity of Atlantic puffins at colonies in England (monitored at Coquet, Farne Islands and Lundy) has been variable over time with a decline in recent years. Most of the data have been collected at the Farne Islands where food shortage, and unprecedented rainfall flooding burrows, resulted in lowered productivity in 1998 and 2007. Productivity on the Farne Islands has been particularly high in recent years. For example, in 2012, productivity was estimated at 0.84 chicks fledged from 45 monitored nests partly due to good feeding conditions. However, this may have been an artificially high figure. Normally, over 100 nests are monitored, split roughly equally between Inner Farne and Brownsman, to estimate productivity but the colony on Brownsman suffered severe flooding in April and May of 2012 with an estimated 90% of 12,000 burrows flooded such that many puffins did not attempt to breed[1]. In 2015, productivity was only 0.46 chicks fledged per pair. Excluding 2012, productivity on the Farne Islands never fell below 0.90 chicks fledged per egg laid between 2009 and 2014. 2018, was a good breeding year for Atlantic puffins with low rainfall and calm conditions from mid-June to end of July resulting in high productivity (0.89) on the Farne Islands. Following the eradication of black Rattus *rattus* and brown rats *Rattus norvegicus* on Lundy, plots to study the productivity of Atlantic puffins there have been established; 0.75 and 0.55 chicks were fledged per occupied burrow in 2017 and 2018 respectively.

Wales

Population estimates and change 1969-2002 (census data)

	Operation Seafarer (1969-70)	Seabird Colony Register (1985-88)	Seabird 2000 (1998-2002)
Population estimate (AOB*)	4,255	11,116	10,328
% change since previous census	n/a	+161	-7

*AOB = Apparently Occupied Burrows

Breeding abundance

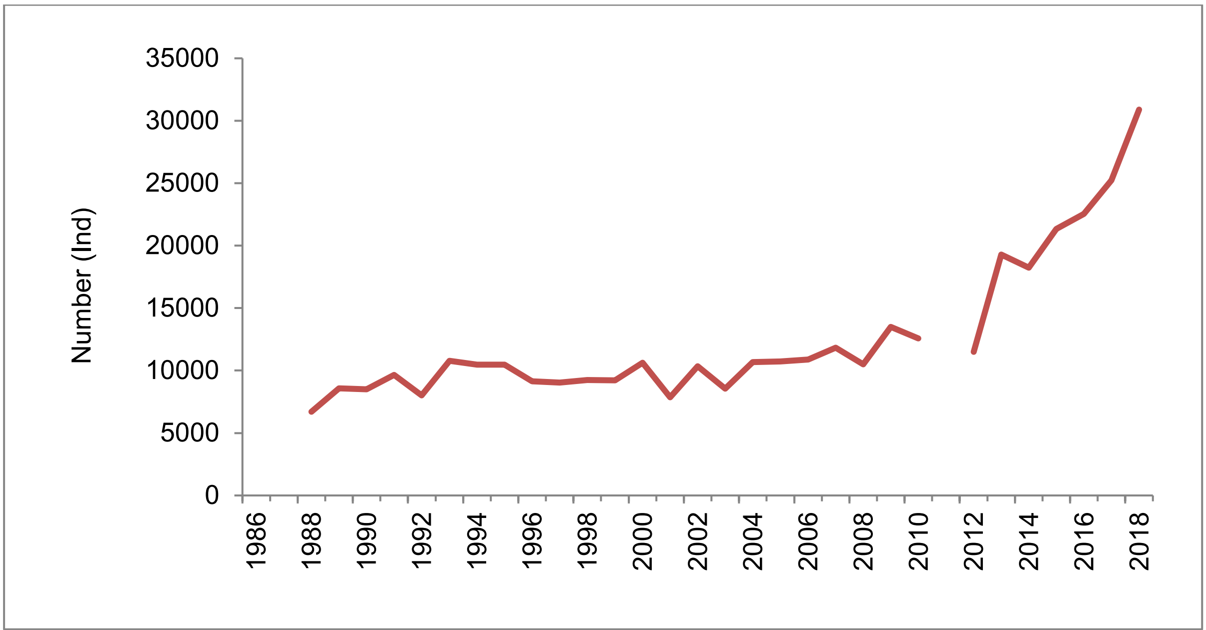

Figure 6. Maximum spring count of Atlantic puffin on Skomer based on counts of individuals attending the colony in spring, 1986-2018.

The number of Atlantic puffins in Wales increased by 161% between Operation Seafarer and the Seabird Colony Register, with little change thereafter up to Seabird 2000. Few Welsh colonies of any size are monitored on an annual basis. However, on Skomer (which held *c.*70% of the national population during Seabird 2000), regular counts are undertaken of adults attending the colony in spring. For a variety of factors these counts can vary markedly between years compared with counts of apparently occupied burrows (AOB). In 2011, no counts of attending adults were completed due to a lack of obvious evening gatherings until much later in the spring; by then, breeding would have commenced resulting in low counts due to birds being out of view in their burrows. In 2012, 11,497 individuals were recorded in spring, slightly fewer than in 2009 and 2010. However, in 2015, over 21,000 individuals were counted attending the colony in early April. In 2018, 30,895 individuals were recorded on Skomer, the highest total since records began in 1988, and an increase of 22% on the previous year (25,277)[2].

Productivity

There has been no statistically significant difference in the productivity of Atlantic puffins at colonies in Wales, where an average of 0.72 chicks were fledged per apparently occupied burrow between 1986 and 2018.

Productivity on Skomer in 2018 was 0.75 chicks fledged per burrow, 1% lower than in 2017.

Northern Ireland

Population estimates and change 1969-2002 (census data)

	Operation Seafarer (1969-70)	**Seabird Colony Register (1985-88)**	**Seabird 2000 (1998-2002)**
Population estimate (AOB*)	1,436	2,678	1,610
% change since previous census	n/a	+86	-40

*AOB = Apparently Occupied Burrows

Breeding abundance

In Northern Ireland, the Atlantic puffin population during Seabird 2000 was estimated at 1,610 AOB. Numbers had increased by 86% between Operation Seafarer and the Seabird Colony Register had fallen by 40% by Seabird 2000. Few data are available from more recent years. The largest colony is on Rathlin Island, which holds approximately 98% of the national population. A large decline appears to have occurred here since Seabird 2000; 1,579 individuals were recorded in 1999, 731 in 2007, and 695 in 2011. The only data received in 2018 was from the small colony at The Gobbins where 55 individuals were recorded compared to 28 individuals during Seabird 2000. A conservation project on the Copeland Islands, using decoys and sound lures to attract birds, has resulted in a new puffin colony being established, with breeding confirmed in 2015[3]. However, without a whole-colony count from Rathlin Island, it is not possible to draw any meaningful conclusions on the current status of the Atlantic puffin population in Northern Ireland.

Productivity

No systematic data on the productivity of Atlantic puffins in Northern Ireland have been submitted to the SMP.

Republic of Ireland

Population estimates and change 1969-2002 (census data)

	Operation Seafarer (1969-70)	Seabird Colony Register (1985-88)	Seabird 2000 (1998-2002)
Population estimate (AOB*)	26,553	17,435	19,641
% change since previous census	n/a	-34	+13

*AOB = Apparently Occupied Burrows

Breeding abundance

The number of Atlantic puffins in the Republic of Ireland declined by 34% between Operation Seafarer and the Seabird Colony Register but then increased by 13% by the time of Seabird 2000. The status of the species in the country since then is largely unknown. On Great Skellig, a count of individuals in early July 2010 recorded 2,170 compared to 4,000 at the same time of year in 1999. Similarly, on Puffin Island, only 1,360 individuals were counted in late April 2011 compared to 5,125 in mid-May 2000. Counts in July may not be indicative of a decline as counts at this time of year can be even more variable than counts in spring due to a wide variety of factors, e.g. adult attendance at the colony and influxes of immature birds. However, the data from Puffin Island do suggest a decline may have occurred there. The recent Republic of Ireland seabird census (2015-2018) did not publish data on Atlantic puffin due to on-going survey work[4].

Productivity

Data submitted to the SMP on the productivity of Atlantic puffins in the Republic of Ireland are sparse; thus, no meaningful average productivity value can be given.

All Ireland

Population estimates and change 1969-2002 (census data)

	Operation Seafarer (1969-70)	Seabird Colony Register (1985-88)	Seabird 2000 (1998-2002)
Population estimate (AOB*)	27,989	20,113	21,251
% change since previous census	n/a	-28	+6

*AOB = Apparently Occupied Burrows

Breeding abundance

Overall, numbers of Atlantic puffins throughout Ireland fell by 28% between Operation Seafarer and the Seabird Colony Register with little further change recorded by Seabird 2000. Due to the logistical difficulty in monitoring this burrow-nesting species, few sizeable colonies have been monitored in either Northern Ireland or the Republic of Ireland, therefore no information exists as to population trend since Seabird 2000. The recent Republic of Ireland seabird census (2015-2018) did not publish data on Atlantic puffin due to on-going survey work[4]. Please refer to the entries for the two individual countries for details of the most recent counts in each.

Productivity

Data submitted to the SMP on the productivity of Atlantic puffins from colonies throughout Ireland are sparse; thus, no meaningful average productivity value can be given.

Isle of Man

Population estimates and change 1969-2018 (census data)

	Operation Seafarer (1969-70)	Seabird Colony Register (1984-85)	Seabird 2000 (1998-2002)	Isle of Man Census (2017-18)
Population estimate (AOB*)	82	93	85	0
% change since previous census	n/a	+13	-9	-100

*AOB = Apparently Occupied Burrows

Breeding abundance

The Isle of Man has had a small but fairly stable population of Atlantic puffins since Operation Seafarer in 1969-70. Numbers have ranged from 82-93 AOB over the three censuses. In 2017/2018, an Isle of Man seabird census found no Atlantic puffin AOB, although there were puffins present in areas which were previously identified as breeding sites (Peel Hill, Spanish Head, Maughold Head)[5].

Productivity

No systematic data on the productivity of Atlantic puffins on the Isle of Man have been submitted to the SMP.

Channel Islands

Population estimates and change 1969-2016 (census data)

	Operation Seafarer (1969-70)	Seabird Colony Register (1984-85)	Seabird 2000 (1998-2002)	Channel Islands Census (2016)
Population estimate (AOB*)	1,116	335	311	210
% change since previous census	n/a	-70	-7	-32

*AOB = Apparently Occupied Burrows

Breeding abundance

Atlantic puffins breeding on the Channel Islands have declined greatly since Operation Seafarer recorded over 1,100 AOB. Numbers during the Seabird Colony Register and Seabird 2000 were similar but were 70% less than recorded during Operation Seafarer. A recent seabird census of the Channel Islands counted 210 AOB, a 32% decrease since Seabird 2000[6].

Productivity

Data submitted to the SMP on the productivity of Atlantic puffins on the Channel Islands are sparse; thus, no meaningful average productivity value can be given.

UK phenology, diet, survival rates

Phenology

No systematic data on phenology (timing of life-cycle events) have been collected as part of the SMP.

Diet

Our understanding of puffin diet comes from data collected at a few geographically dispersed key sites. As diet is likely to vary between sites, and given that few sites are monitored, caution should be used in drawing wider geographical conclusions from these data.

Sandeels *Ammodytes* spp., an energy-rich shoaling fish, comprise a large proportion of the diet of Atlantic puffins at the two sites where diet is studied. The proportion of sandeels fluctuates yearly; at Fair Isle (Shetland, Figure 7), it has declined over the monitoring period (especially the 'large' size class which has virtually disappeared from samples since 2002), although the proportion of small sandeels since 2015 has increased. The mean mass of food loads brought to puffin chicks on Fair Isle has declined since the mid-1990s (Figure 9) and, in 2014, was at its lowest level since monitoring began (1.3g). In 2015 and 2016, mean mass increased to 2.7g and 5.1g respectively but decreased again to 2.5g the year after. This may have contributed to low productivity during some years. Surprisingly, in 2018, the mean mass of fish loads brought to Atlantic puffin chicks was a staggering 11.5g – the highest value recorded in this study.

The size and energy content of sandeels caught by and available to Atlantic puffins on the Isle of May declined over the period 1973-2002[8], and in some years (such as 2004) the energy content of sandeels was found to be far lower than would be expected for their size and coincided with very poor productivity for Atlantic puffins and other sandeel-feeders[10]. A decline in the percentage of sandeels (by weight) in the diet of young puffins between 1986 (85%) and 2018 (55%) is also evident from the data collected[7] (Figure 8).

Between 2004 and 2008, snake pipefish *Entelurus aequoreus* appeared in the diets of many seabirds around the UK[14], including Atlantic puffins during 2006-2007. The energy content of this bony fish, which before the early 2000s was scarce in UK waters, is very low[15]. Snake pipefish, therefore, did not provide an alternative energy source during a time when puffin's usual prey species (sandeels and sprats) were scare. Indeed, pipefish can choke chicks when fed to them in quantity. The reason for the appearance of snake pipefish was uncertain, although was not thought to be related to climate change. Since 2008, the snake pipefish has once again become scarce in UK waters.

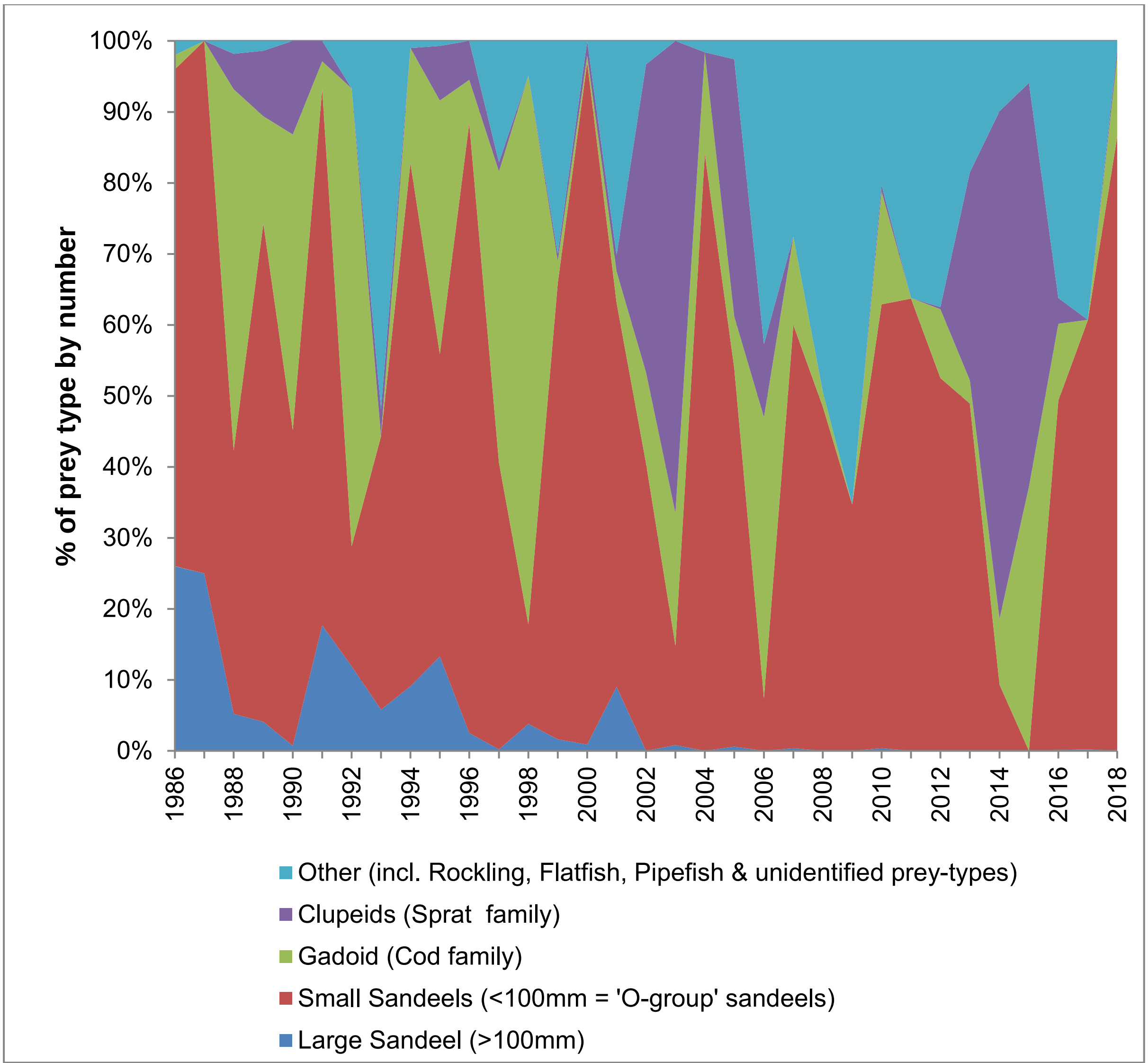

Figure 7. Composition of fish loads brought to puffin chicks on Fair Isle, 1986-2018.

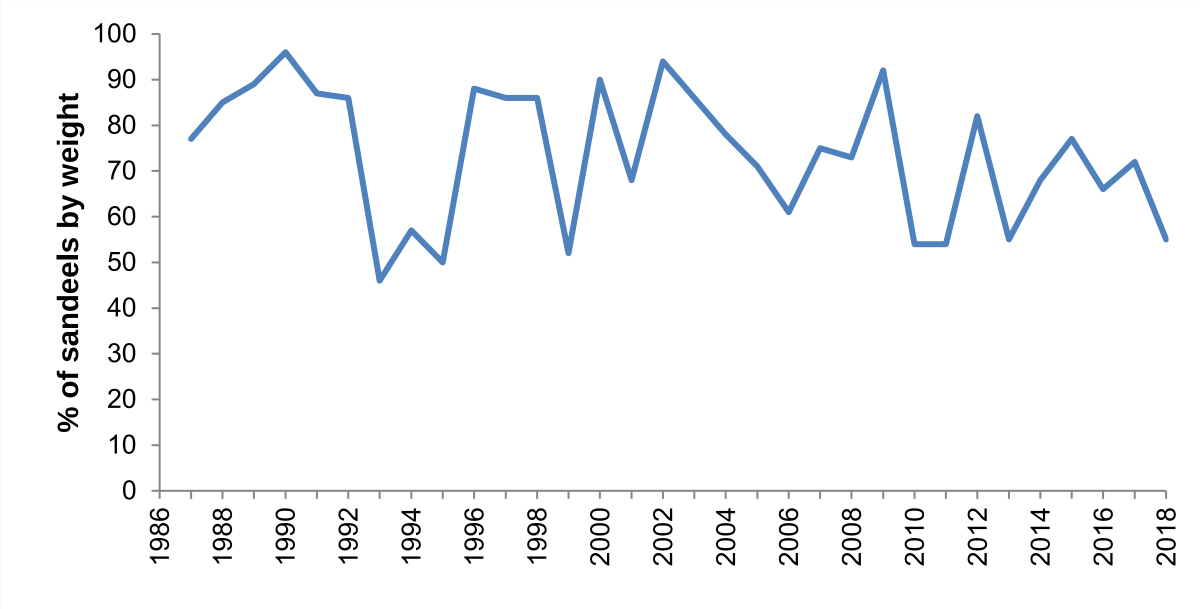

Figure 8. Percentage of sandeels (by weight) in the diet of young puffins on the Isle of May, 1987-2018.

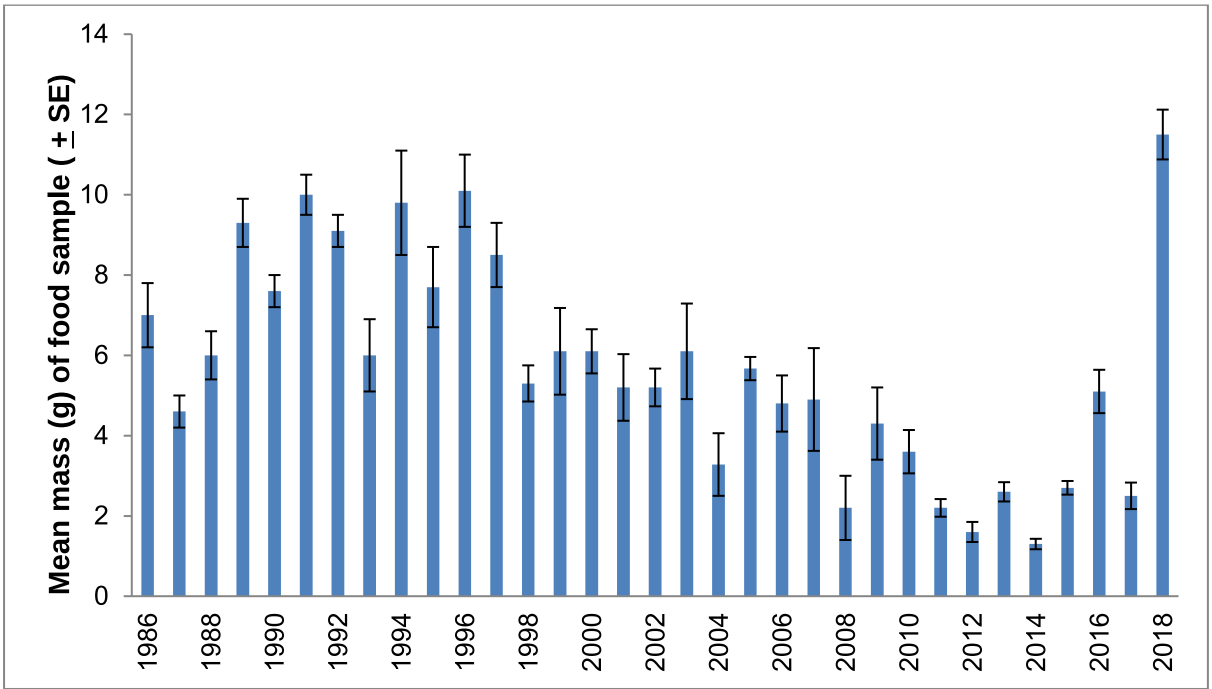

Figure 9. Mean mass (g) of fish loads brought to puffin chicks on Fair Isle, 1986-2018 (± Standard Error; 1 food sample = 1 'beak-full')

Return rates and survival rates

Important notes on interpretation: Estimation of Atlantic puffin adult return rate and survival rate is currently only undertaken at two sites within the Seabird Monitoring Programme - the Isle of May and Skomer. Return rates are based on sightings of individually colour-ringed birds and are calculated as the proportion of marked birds present in year one that is seen in the following year. Because not every adult alive is seen each year, return rates for 2018 presented here for Isle of May need to be treated as minimum estimates of survival of birds seen in 2017. In contrast, survival estimates - as presented here for Skomer - do take into account birds that are not seen one year but which re-appear in following years.

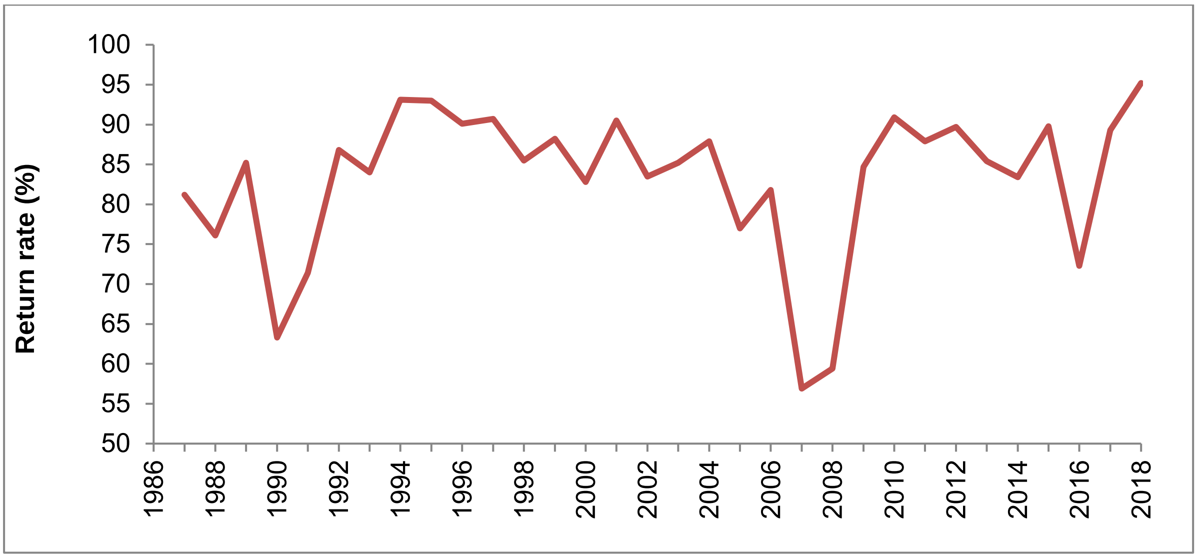

Figure 10. Annual return rate of Atlantic puffin breeding on the Isle of May, 1987-2018.

The return rates of Atlantic puffins breeding on the Isle of May (Figure 10) has shown no consistent trend, though declined slightly between the mid-1990s and the mid-2000s. It did, however, fall to extremely low levels in 2006/07 (56.9%) and 2007/08 (59.4%). Since then it has risen to more typical levels, although decreased to 72.3% in 2015/16 which was well below the study's average (1986-2014 average 82.9%, 95% CI = 79.5-86.3). In contrast, the return rate of Atlantic puffins in 2017/18 was 95.2%, the highest record since the study began in 1986[7].

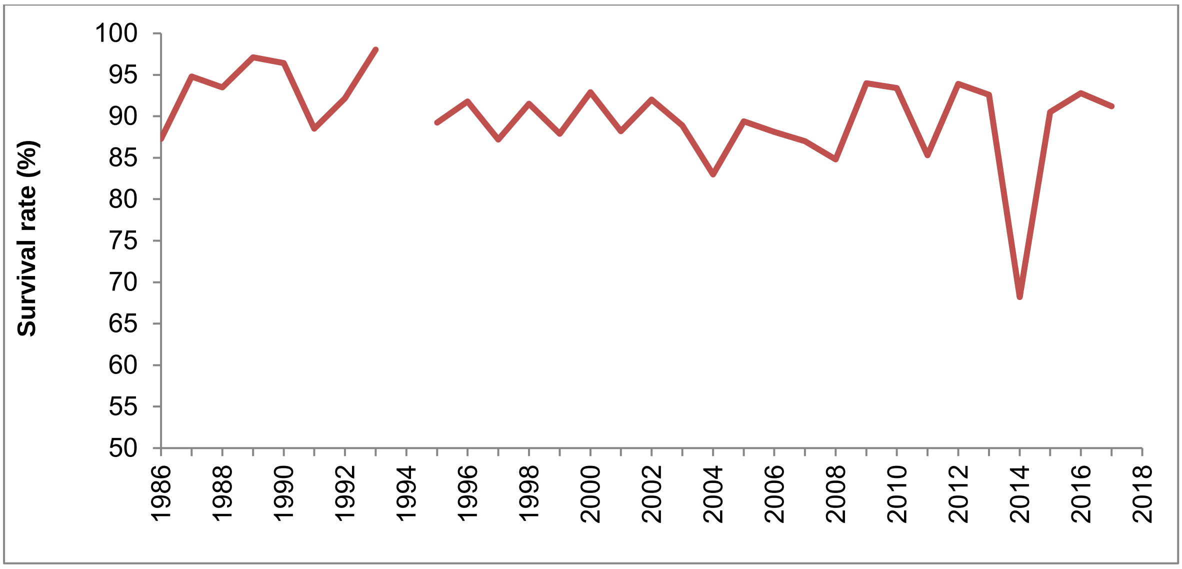

Figure 11. Annual survival rate of Atlantic puffin breeding on Skomer, 1986-2018.

Atlantic puffins breeding on Skomer (Figure 11) show a noticeable downward trend in survival, but without the sharp declines in 2007 and 2008 that were seen on the Isle of May. Little is currently known of the causes of changes in these survival rates, although recent evidence suggests a shift in overwintering range of Isle of May breeders from the North Seas into the east Atlantic, possibly reflecting deteriorating conditions in the North Sea[16].

In the winter of 2013/14, a succession of severe storms from late January to the beginning of March resulted in a large 'wreck' of seabirds along Atlantic coasts from England and Ireland to Spain. A minimum of 54,000 seabirds, mostly auks, were washed ashore dead or dying. Examination of many corpses revealed birds were emaciated with empty stomachs indicating starvation as the main cause of death although a small proportion showed signs of oil contamination[17]. About 55% of the casualties were Atlantic puffins, with recoveries of birds ringed for migration studies (over 180 were reported compared to two or three during an 'average' year) indicating many originated from UK and Irish breeding sites[17]. Examination of 350 dead puffins recovered from beaches in the UK also indicated 78% were adults and 5% birds in their first winter. Total mortality will be much higher as not all beaches were checked, birds were washed ashore over a number of weeks and many birds will be lost unrecorded at sea[17].

The effect of this 'wreck' on breeding populations is now emerging. Only 59.6% of 2013's breeding adults retuned to Skomer in 2014, the poorest on record and a drop of almost 25% on 2012-13 (84.2%). Long-term capture-recapture analyses show that the reliable estimate of average survival remains at 0.91, with signs of a recovery in survival rates after the steady decline from 1994 to 2008. The effects of the 2013-14 storms are revealed by 2015 resighting data (a total of 74.2% breeding adults), which allows the estimation of survival rates that was previously not possible with confidence. Puffin survival dropped from the study's annual average of 91% (1973-2013) to 68% in 2013-14. In 2014-15 adult breeding survival returned to the high levels of recent years (2013-14 aside), indicating a good year for adult overwinter survival. The breeding adult survival rate in 2016-17 was 0.91[2]. The long-term impacts of severe climatic events such as the 2013-14 seabird wreck remain poorly understood and more long-term seabird studies are needed

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