

Trends in the Abundances of Scotland's Seabirds



September 2024



Summary

The Scottish Government has highlighted a large decrease in the numbers of breeding seabirds in Scotland as evidence of a 'biodiversity crisis' in Scotland's seas.

The analysis of available data shows that although numbers of breeding seabirds in Scotland have fallen in recent decades, this was preceded by large increases in their abundances. As a result, despite the recent decline there are only slightly fewer seabirds breeding in Scotland now than there were 50 years ago. But the biomass of Scotland's seabirds (which may be a better indicator of the 'health' of the ocean) has increased substantially.

The decline in seabird numbers also corresponds with a period during which the number of Scottish fishing boats, an important source of food for some seabird species, had fallen substantially.

Whether the decline in the numbers of breeding seabirds in Scotland since the 1980s represents a 'crisis', or a return to more 'normal' levels of abundance, or part of a natural long-term cycle, or a response to the decline of the Scottish fishing fleet, remains at the very least an open question.

Introduction

The Scottish Government's claim that there is a 'biodiversity crisis' in Scotland's seas is largely based on a reported 38% reduction in the abundance of breeding seabirds in Scotland between 1986 and 2016.¹ Indeed, this figure appears to be the only quantitative evidence offered as evidence of a 'marine biodiversity crisis'.

It is notable that this figure is based on a relatively short period of time starting in 1986. But earlier estimates of the abundances of seabirds in Scotland are available and it is known that some species experienced large increases in abundance before 1986. Further, it appears that some important Scottish seabird species were not included in the calculation of the above figure.

Given these limitations (short timescale and omission of some species) it is not clear how representative the 38% reduction in the abundance of Scottish seabirds after 1986 is, either of the whole Scottish seabird population or of longer-term trends in abundance.

It is also debateable whether it is appropriate to focus only on numbers of seabirds given the great variation in the sizes of different species and thus of their food requirements in relation to the productivity and carrying capacity of Scotland's marine environment.

To try and address these issues available data has been collated and analysed to provide a longer time-series of seabird abundances in Scotland based on a wider variety of species. An alternative index of abundance that reflects differences in the sizes of different seabird species is also proposed.

1 Scottish Government, 2022. *Scottish Biodiversity Strategy to 2045: Tackling the Nature Emergency in Scotland*. Page 20. <https://www.gov.scot/publications/scottish-biodiversity-strategy-2045-tackling-nature-emergency-scotland/documents/>

Background

As noted above, the Scottish Government has cited a 38% decline in the abundance of breeding seabirds in Scotland after 1986 as evidence of a 'biodiversity crisis' in Scotland's seas. No specific source is given for this 38% figure but Scottish Government agencies have published several similar figures including:

- A 51% decline from 1986 to 2019 in the average numbers of 11 species of breeding seabirds in Scotland.²
- A 36% decline from 1994 to 2016 in the average numbers of 11 species.³
- A 44% decline from 1986 to 2018.⁴

None of these reports specified which seabird species the quoted declines applied to. The only clue lies in the Scotland's Marine Assessment 2020 report⁴ which lists individual changes in population size since 1986 for 11 species (*see Table 1*). It is notable that this list excludes several abundant and iconic Scottish seabird species, including gannets, puffins and great skuas (bonxies).

Arctic Skua
Arctic Tern
Black Guillemot
Kittiwake
Guillemot
Common Gull
Common Tern
Shag
Great Black-backed Gull
Herring Gull
Fulmar

Table 1

The 11 species of Scottish seabirds for which changes in abundance were included in Scotland's Marine Assessment 2020.⁴

2 NatureScot, Scottish Biodiversity Indicator – The Numbers and Breeding Success of Seabirds (1986 to 2019). <https://www.nature.scot/doc/scottish-biodiversity-indicator-numbers-and-breeding-success-seabirds-1986-2019>

3 Marine and Terrestrial Species Indicators: Experimental Statistic, Figure 1. <https://www.nature.scot/doc/marine-and-terrestrial-species-indicators-experimental-statistic>

4 Scottish Government, 2020. Scotland's Marine Assessment 2020: Seabirds. <https://marine.gov.scot/sma/assessment/seabirds-0>

Data and Analysis

The Seabird Monitoring Programme

The principal source of data on seabird numbers in Scotland (and the UK) is the Seabird Monitoring Programme,⁵ formerly managed by the JNCC,⁶ which has monitored seabird abundances through annual counts at a sample of colonies since 1986.

In addition to these annual counts, four comprehensive censuses have been carried out of seabird abundances across the whole of the UK, the first from 1969 to 1970 and the most recent from 2015 to 2022 (*Table 2*).⁷

Each of these censuses took several years to complete due to the logistical efforts involved in counting seabirds at every British colony. For simplicity, each census is referred to in this paper by a single 'reference year' (for example, the census carried out from 1985 to 1988 is referred to as 'the 1986 census') (*see Table 2*).

Years Census Carried Out	Reference Year
1969 – 1970	1970
1985 – 1988	1986
1998 – 2002	2000
2015 – 2022	2018

Table 2

The years over which each of the censuses of British seabird colonies was carried out, and the 'reference year' used in this paper to refer to each census.

5 Seabird Monitoring Programme. <https://jncc.gov.uk/our-work/seabird-monitoring/>

6 Since July 2022 the Seabird Monitoring Programme has been outsourced to the British Trust for Ornithology (BTO) and the Royal Society for the Protection of Birds (RSPB).

7 Seabird Censuses: <https://jncc.gov.uk/our-work/seabird-censuses/>

This analysis has used data from these four censuses as their results are available online and span a significant period (about 50 years). For each census the population estimates for Scotland were downloaded for 18 seabird species (*see Appendix*). For most species the censuses counted the numbers of 'apparently occupied nests' (or sites or territories or burrows). Thus, each count represents a pair of breeding birds. In a few cases (guillemots, razorbills and black guillemots) individual birds were counted.

It should be noted, therefore, that all estimates of population sizes in this paper are of breeding seabirds only, and do not include non-breeding, juvenile or immature birds.

There was no estimate for black guillemots in the 1970 census and an estimated value was interpolated for gannets for the 2000 census (gannets were actually counted a few years later).

Total population estimates were calculated for each census by summing the population estimates for each species. Totals were calculated separately for the 11 species assumed to be those included in the analyses quoted above and for all 18 species for which data were available (17 species in 1970). Estimated abundances for guillemots, razorbills and black guillemots were doubled as they were counted individually rather than as breeding pairs (apparently occupied nests, etc.).

Longer Time-Series

The 1970 census was the first comprehensive census of Scotland's (and Britain's) breeding seabird populations, but earlier abundance estimates are available for some species that experienced large (and well documented) increases in abundances and range during the 20th Century. Available data for these species was collated from published sources and used to construct longer time-series for these species.

Biomasses

The 'breeding population biomass' of each seabird species was calculated by multiplying the numbers counted in each census by an average weight for each species. Where the census counted breeding pairs (apparently occupied nests, etc.) the census number was doubled (to represent two individual birds).

This seabird 'breeding population biomass' represents the total weight of the breeding individuals of each species and is analogous to the 'spawning stock biomass' used in the assessment and management of fish stocks.

Results

The number of breeding seabirds of each species in each census are summarised in the Appendix.

The estimated total abundance of the 11 seabird species apparently included in the Government's analyses fell by 38% between the 2000 and 2018 censuses which is comparable to the figures quoted by the Scottish Government and its agencies (*see page 3*).

However, the numbers of these 11 seabird species had previously **increased** substantially. Between the 1970 and 1986 censuses their estimated total abundances increased by 39%. So, over the whole period from 1970 to 2018 the estimated abundances of these 11 species decreased by only 16% (*Figure 1*).

Over the same period the total abundances of all 17 species for which data are available decreased by only 4% with a large increase during the 1970s and 1980s preceding the later decline.

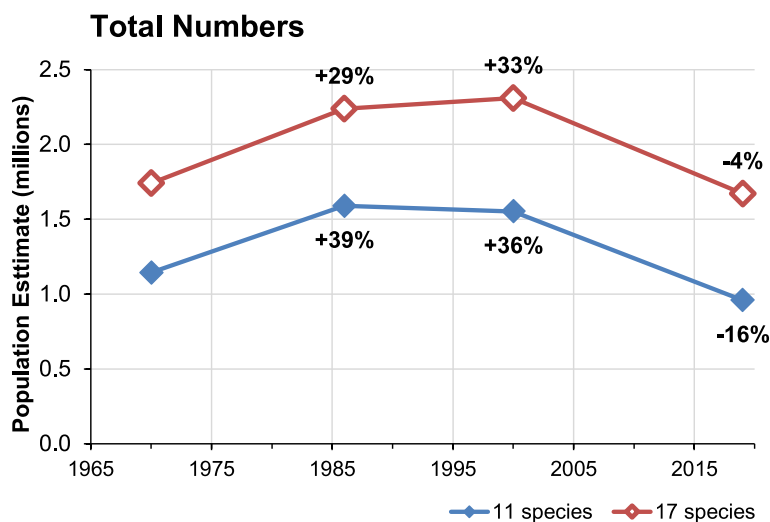


Figure 1

Estimated total Scottish populations (breeding pairs) of 11 and 17 species of seabirds from the censuses in 1970, 1986, 2000 and 2018 (*see Appendix for data*). Numbers adjacent to data points are percentage changes from the 1970 census.

Longer Time-Series

Fulmars

Until 1878 (when 12 pairs bred on Foula in Shetland) the only place that fulmars bred in the UK was St Kilda. The fulmar's breeding range and abundance in Scotland expanded rapidly during the 20th Century and was documented in detail.

By 1939 there were an estimated 45,000 breeding pairs of fulmars in Scotland and their population grew rapidly to a peak of over 500,000 breeding pairs in 1986 (*Figure 2*). That represents a more than 11-fold increase in the breeding population in less than 50 years.

The number of fulmars declined slightly after the 1986 census and then fell by 36% between the 2000 and 2018 censuses. But despite that decline the breeding population of fulmars remained larger in 2018 than it was in 1970 (by 9%) and was still almost seven times larger than it had been in 1939.

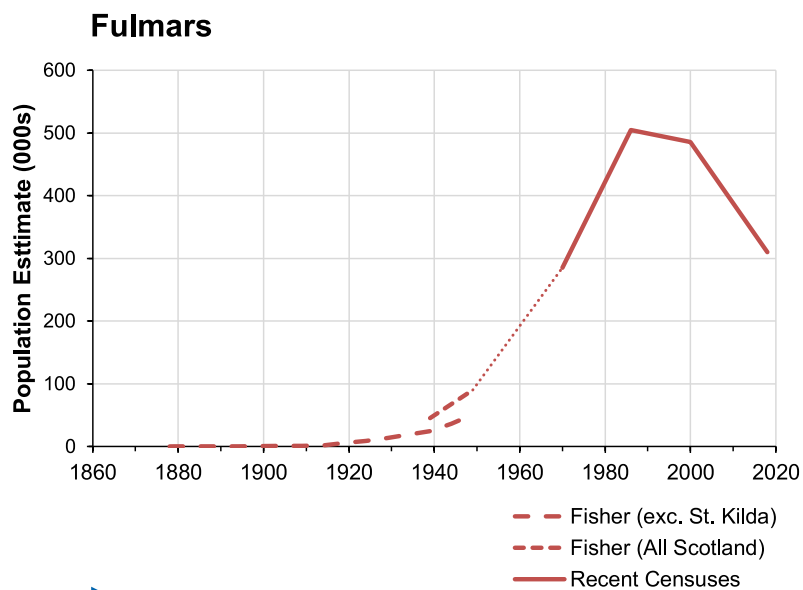


Figure 2

Estimated abundance of fulmars in Scotland (apparently occupied sites) from 1878 to 2019. Data prior to 1939 excludes St Kilda. Pre-1979 data from Fisher, J. (1952). *The Fulmar*. New Naturalist Monograph No. 6, Collins, London. (pp. 256-257 of 1984 reprint).

Fulmars and Fishing

Fulmars are well known for following fishing boats (especially trawlers) in large numbers and feeding on the offal that is discharged while catches are being gutted. They are one of the principal seabird species to do so and up to 2,500 fulmars have been counted attending a single fishing boat.⁸

It has been suggested that the expansion of large-scale mechanised trawl fisheries across the North Atlantic from the late 19th Century onwards contributed to the dramatic growth of the fulmar's abundance and range. And it has also been suggested that declines in fulmar abundances in the later 20th Century were likely linked to declining numbers of fishing fleets (due to quota reductions and decommissioning of fishing boats).⁹

There is a clear correspondence between changes in the abundance of fulmars in Scotland and in the size of the Scottish trawler fleet (*Figure 3*).¹⁰

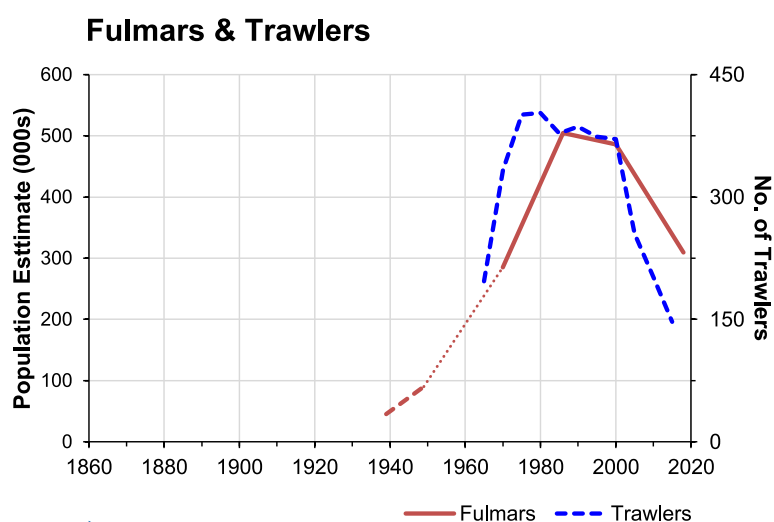


Figure 3

The estimated abundance of fulmars in Scotland from 1939 to 2018 (*see Figure 2*) compared to the number of Scottish whitefish (demersal) trawlers at 5-year intervals from 1965 to 2015 (>10m trawlers from 1990). Data from published Scottish Sea Fisheries Statistics).

8 Hudon & Furness (1989) cited in Camphuysen, C.J. (1993). Scavenging Seabirds Behind Fishing Vessels in the Northeast Atlantic. NIOZ-Rapport-1993-1. Nederlands Instituut voor Onderzoek der Zee <https://www.vliz.be/imisdocs/publications/ocrd/263203.pdf>.

9 Northern fulmar (*Fulmarus glacialis*). JNCC. <https://jncc.gov.uk/our-work/northern-fulmar-fulmarus-glacialis/>.

10 It has not been possible to test this relationship statistically due to the small number of data points available for fulmar abundance.

Gannets

Until the 1940s the estimated Scottish population of gannets remained below 40,000 breeding pairs (Figure 4). The population expanded rapidly after 1950, reaching almost 100,000 breeding pairs by the time of the 1970 census and more than 250,000 pairs in the most recent (2018) census. That is a six-fold increase in about 70 years.

Unlike some other Scottish seabird species, the abundance of gannets has not declined in recent decades. Indeed, the number of breeding gannets doubled between the 1986 and 2018 censuses.

Gannets have been affected by avian flu since 2021 but it is too early to determine what long-term effects that may have on their population.

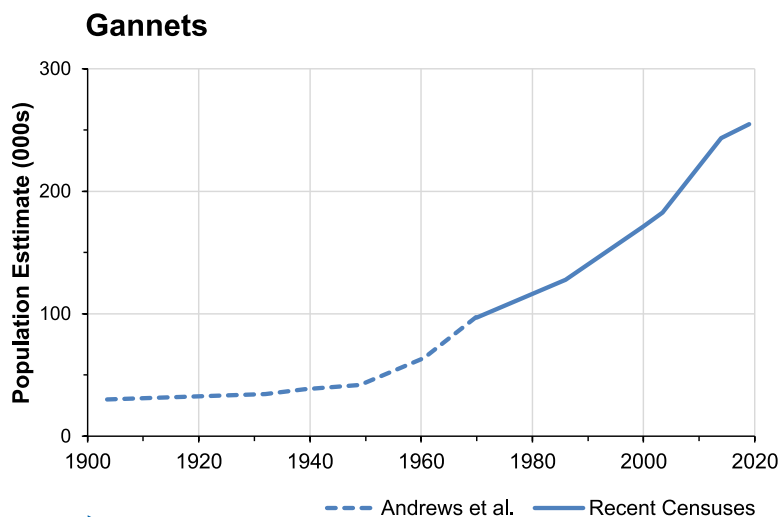


Figure 4
 Estimated abundances of gannets in Scotland (apparently occupied nests) from 1904 to 2019. Pre-1979 data from Andrews, I.J. et al. (eds) (2007). *The Birds of Scotland*. Scottish Ornithologists' Club. (Table on p.397.)

Great Skua (Bonxie)

Prior to about 1920 great skuas in Scotland bred only in Shetland where their numbers had been severely depleted during the 19th Century by egg collectors and taxidermists (despite islanders' efforts to conserve them). From the 1920s onwards the abundance and range of great skuas in Scotland expanded rapidly, from about 200 breeding pairs to almost 11,000 pairs by the time of the 2020 census (Figure 5). That represents a more than 56-fold increase in their abundance in a century, or a more than three-fold increase from the 1970 census.

Unlike some other Scottish seabird species, the abundance of great skuas has not declined in recent decades. Indeed, the number of breeding great skuas increased by more than 40% between the 1986 and 2018 censuses.

Great skuas have been affected by avian flu since 2021 but it is too early to determine what long-term effects that may have on their population.

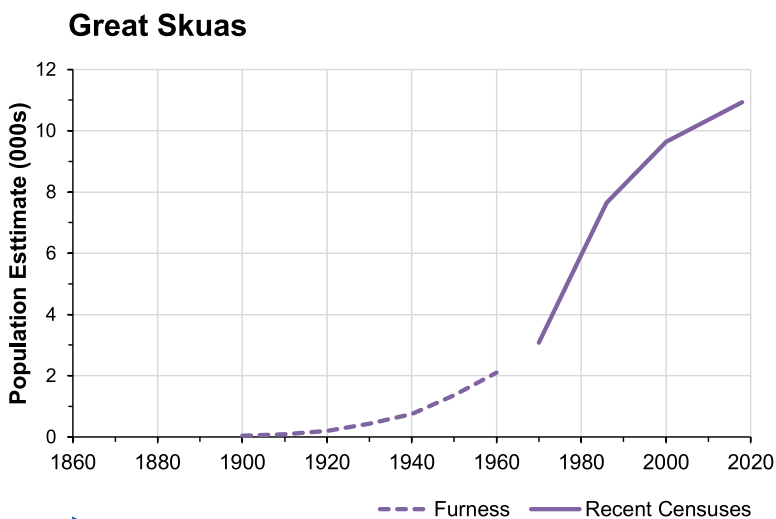


Figure 5

Estimated abundance of fulmars in Scotland (apparently occupied sites) from 1878 to 2019. Pre-1970 data are from Furness, R.W. (1987), *The Skuas*, T&AD Poyser (Table 15) and are for Shetland, Orkney and the Western Isles only.

Breeding Population Biomass

The average weights for each species together with their calculated biomasses are shown in the Appendix.

The estimated breeding population biomass of the 11 seabird species apparently included in the Government's analyses declined by about 36% between the 2000 and 2018 censuses.

However, given the large increase in their abundances during the 1970s and 1980s the decrease in their estimated biomass over the whole period from 1970 to 2018 was only 9% (*Figure 6*).

Over the same period the estimated breeding population biomass of all 17 species for which data are available increased by 29%.

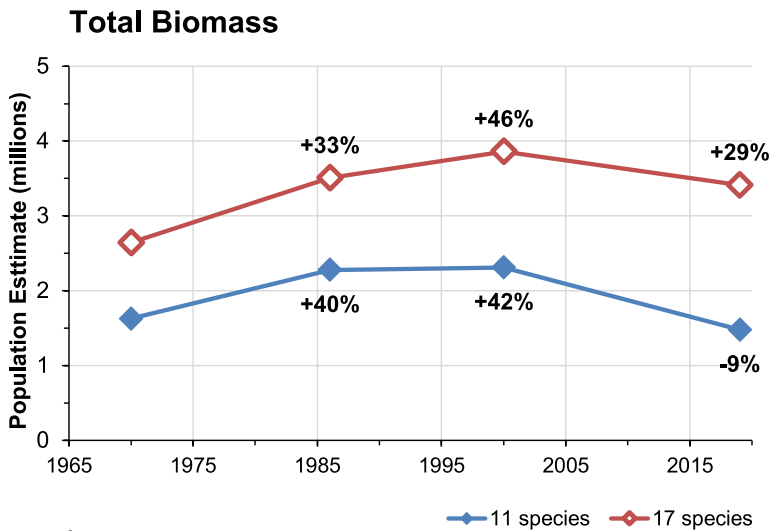


Figure 6
 Estimated total biomasses of 11 and 18 species of breeding seabirds in Scotland from the censuses in 1970, 1986, 2000 and 2018 (see Appendix for data). Numbers adjacent to data points are percentage changes from the 1970 census.

Overview of Results

In summary, while the numbers of breeding seabirds in Scotland fell between the 2000 and 2018 censuses the decline was smaller for the larger group of 18 seabird species than for the more limited group of 11 species apparently included in the Government's analyses (*Figure 7*).

While the decline in the estimated breeding population biomasses of the 11 species between 2000 and 2018 was comparable to the fall in their numbers (36% cf. 38%), the decline in the biomass of the larger group of 18 species (12%) was much less than the decline in their total numbers,

Over the longer period from 1970 to 2018 the estimated numbers of the larger group of species decreased by only 4%, compared to 16% for the smaller group. But while the estimated biomass of the smaller group declined, that of the larger group increased substantially. Overall, it is estimated that although there were 4% fewer breeding pairs of seabirds in Scotland (of 17 species) in 2020 than there were in 1970 their total biomass was 29% greater.

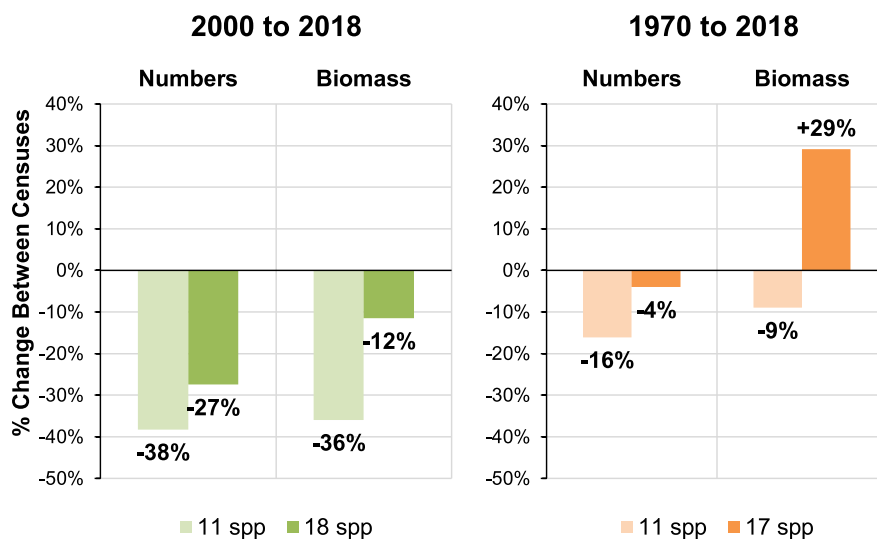


Figure 7
 Summary of the changes in numbers (left) and biomasses (right) of 11 and 17 or 18 species of seabirds in Scotland between 2000 and 2018 and between 1970 and 2018. (2000 to 2018 comparisons include black guillemots which were not counted in the 1970 census).

Discussion

The Scottish Government has highlighted a large decline in the abundance of breeding seabirds in Scotland since the mid-1980s as evidence of a 'biodiversity crisis' in Scotland's seas.

This (admittedly limited) analysis has shown that while the numbers of breeding seabirds in Scotland did decline in recent decades the decline was greater for the limited group of 11 species apparently included in the Government's analyses than for a larger group of 18 species for which data are available.

Significantly, however, these declines followed a period during which the numbers of breeding seabirds in Scotland increased dramatically. As a result, there were only slightly fewer breeding seabirds in Scotland in the most recent (2018) census than there were in 1970.

Further, although data is limited prior to 1970, very large increases in the abundances of some seabird species (gannets, fulmars and great skuas) in Scotland during the 20th Century are well documented.

These results indicate that perceptions of trends in the abundances of Scottish seabirds are very dependent both on what species are counted and on what time-period is considered. There may have been a large decline in the numbers of breeding seabirds in Scotland since the mid-1980s but there are only slightly fewer than there were in 1970. And there are many more of at least some species than there were 100 years ago.

There is a potentially interesting parallel between trends in the abundances of Scotland's seabirds and of some fish stocks in the North Sea. Starting in the 1960s – for reasons that are still unclear – there was an unprecedented increase in the abundances of some gadoid fish species (including cod, haddock, whiting and pout) in the North Sea, with five to six-fold increases in their biomasses. This so-called 'gadoid outburst' lasted into the 1970s and, in some cases, the early 1980s.¹¹

Although it has been suggested that the declines in abundances that followed this 'outburst' (lasting into the early 1990s) should be regarded as a return to 'normal' levels of abundance¹¹ the gadoid outburst has tended to distort perceptions of the 'normal' size of the fish stocks involved.

8 Hislop, J.R.G. (1996). Changes in North Sea gadoid Stocks. *ICES Journal of Marine Science* 53: 1146-1156. <https://doi.org/10.1006/jmsc.1996.0140>

It is well known that waste from fishing boats is an important source of food for some seabird species and it may be significant that the overall decline in the abundance of Scottish seabirds coincides with a period during which there was a substantial contraction in the size of the Scottish fishing fleet (the number of Scottish trawlers fell by 59% between 2000 and 2018).

Fulmars, which experienced the largest (by numbers) decrease in their abundance since 2000, are one of main seabird species known to feed at fishing boats and there is a striking correspondence between their numbers and the number of Scottish trawlers over the last 60 years. It has been suggested previously that the expansion of mechanised trawling contributed to the great increase in the abundance and range of fulmars across the North Atlantic during most of the 20th Century and that more recent declines in their numbers may be linked to reductions in fleet sizes and fishing effort.

Two other seabird species that experienced some of the largest (percentage) declines in their abundances since 2000 are great black backed gulls and herring gulls which are also among the main species known to feed at fishing boats.

Perceptions of changes in Scotland's seabird population change further if their biomass is considered rather than just their numbers. While there was a relatively large (38%) decline in the numbers of seabirds breeding in Scotland between 2000 and 2018 their biomass fell by only one-third of that amount (12%). And although there was a slight decline in the numbers of breeding seabirds in Scotland between 1970 and 2018 their estimated biomass increased substantially.

These differences reflect the different trends in different species of seabirds and their widely differing body sizes. In particular, the large increase in the population of gannets (one of the largest Scottish seabirds) has contributed to the great increase in biomass over the last 50 years.

Given that larger seabirds will consume more food than smaller ones it is arguable that seabird biomass is a better indicator of the 'health' of the ocean than numbers alone. A larger quantity of food is required to support a given number of a large seabird species than the same number of a smaller species. Thus, the existence of a large population of a large species might be assumed to indicate the availability of a greater quantity of food which in turn presumably indicates a more productive ocean.

This effect may be even greater as larger seabirds tend to feed at a higher trophic level (higher up the food chain) than smaller seabirds. Thus, it requires a much greater amount of primary production at the base of the food chain to produce a unit of food for a large seabird than the same quantity of food for a smaller seabird.

In summary, while the number of breeding seabirds in Scotland has declined in recent decades that decline followed a substantial increase in their numbers. So, there are only slightly fewer seabirds breeding in Scotland now than there were 50 years ago. However, their biomass is much greater.

The decline in seabird numbers also corresponds with a period during which the number of Scottish fishing boats, an important source of food for some seabird species, had fallen substantially.

Whether the decline in the numbers of breeding seabirds in Scotland since the 1980s represents a 'crisis', or a return to more 'normal' levels of abundance, or part of a natural long-term cycle, or a response to the decline of the Scottish fishing fleet, remains at the very least an open question.

Appendix

Seabird Abundances¹²

Estimated Scottish populations of breeding seabirds in the four large-scale censuses of British seabirds. Numbers are of breeding pairs of birds ('apparently occupied nests' or equivalent) except for guillemots, razorbills and black guillemots. 'n' indicates the unit counted: pairs or individuals. Shaded species are assumed to be those on which the reported declines in abundance are based.

TOTALs are shown for the 11 shaded species, for all species except black guillemots (17 spp.) and for all 18 species for the last three censuses. Totals include half the numbers of guillemots, razorbills and black guillemots as they were counted individually (rather than as breeding pairs).

	n	Census			
		1970	1986	2000	2018
Fulmar	2	285,067	504,640	485,852	309,545
Gannet	2	96,860	127,867	171,261	254,773
Cormorant	2	3,438	2,986	3,626	3,458
Shag	2	27,077	31,560	21,847	16,788
Arctic Skua	2	1,000	3,400	2,100	727
Great Skua (Bonxie)	2	3,079	7,645	9,634	10,935
Kittiwake	2	346,097	359,425	282,213	121,082
Black Headed Gull	2	18,226	9,554	6,888	10,785
Common Gull	2	1,229	15,134	20,467	22,755
Lesser Black-Backed Gull	2	12,031	19,524	21,565	11,001
Herring Gull	2	159,237	92,950	71,659	37,349
Great Black-Backed Gull	2	15,950	15,315	14,773	5,404
Common Tern	2	4,285	6,784	4,784	4,071
Arctic Tern	2	46,385	71,178	47,306	19,555
Guillemot	1	514,461	943,098	1,167,841	810,645
Razorbill	1	111,038	123,586	139,186	138,828
Black Guillemot (Tystie)	1	n/a	37,172	37,505	33,986
Puffin	2	410,011	438,101	493,042	369,279
TOTAL no. pairs (11 spp.)		1,143,558	1,590,521	1,553,674	959,592
TOTAL no. pairs (17 spp.)		1,742,722	2,239,405	2,310,530	1,672,244
TOTAL no. pairs (18 spp.)		–	2,257,991	2,329,283	1,689,237

NOTE

Gannets were not counted in the 2000 census. The figure shown is interpolated from a count in 2003-2004. No count for black guillemots was available from the 1970 census.

12 Results from the 1969-1970, 1985-1988 & 1998-2002 censuses are from JNCC (2021). *Seabird Population Trends and Causes of Change: 1986-2019 Report*. <https://jncc.gov.uk/our-work/smp-report-1986-2019/>. Results from the 2015-2022 census are from JNCC (2023). *Seabirds Count*: <https://jncc.gov.uk/our-work/seabirds-count/>.

Seabird Biomasses

Estimated 'Breeding Population Biomasses' of Scottish seabirds in the four large-scale censuses of British seabirds. Average weights (grammes) are listed for each species¹³ together with the estimated total biomasses (tonnes) of the birds counted in the censuses. Estimated biomasses are based on the numbers of individual birds (counts of pairs were doubled).

TOTALs are shown for the 11 shaded species, for all species except black guillemots (17 spp.) and for all 18 species for the last three censuses.

	Av. Spp. Wt. (g)	Breeding Population Biomass (tonnes)			
		1970	1986	2000	2018
Fulmar	772	440	779	750	478
Gannet	2,950	571	754	1,010	1,503
Cormorant	3,400	23	20	25	24
Shag	1,860	101	117	81	62
Arctic Skua	416	1	3	2	1
Great Skua (Bonxie)	1,206	7	18	23	26
Kittiwake	368	255	265	208	89
Black Headed Gull	289	11	6	4	6
Common Gull	407	1	12	17	19
Lesser Black-Backed Gull	831	20	32	36	18
Herring Gull	971	309	181	139	73
Great Black-Backed Gull	1,560	50	48	46	17
Common Tern	128	1	2	1	1
Arctic Tern	104	10	15	10	4
Guillemot	891	458	840	1,041	722
Razorbill	613	68	76	85	85
Black Guillemot (Tystie)	409	---	15	15	14
Puffin	387	317	339	382	286
TOTAL (11 spp.)		1,626	2,277	2,310	1,479
TOTAL (17 spp.)		2,644	3,507	3,859	3,414
TOTAL (18 spp.)		–	3,523	3,875	3,428

¹³ Average weights for each species were obtained from websites of the BTO (<https://www.bto.org/understanding-birds/welcome-birdfacts>); RSPB (<https://www.rspb.org.uk/birds-and-wildlife/a-z>); NatureGate (<https://luontoportti.com/en/c/3/birds>); or Wikipedia (<https://en.wikipedia.org/>).



These papers are published by the Shetland Fishermen's Association to promote debate and stimulate further research on issues of relevance to Scotland's fishing industry.



Shetland Fishermen's Association

Mair's Quay, Holmsgarth, Lerwick, Shetland, ZE1 0PW

Telephone: +44 (0) 1595 693197 Fax: +44 (0) 1595 694429 Email: info@shetlandfishermen.com



www.shetlandfishermen.com