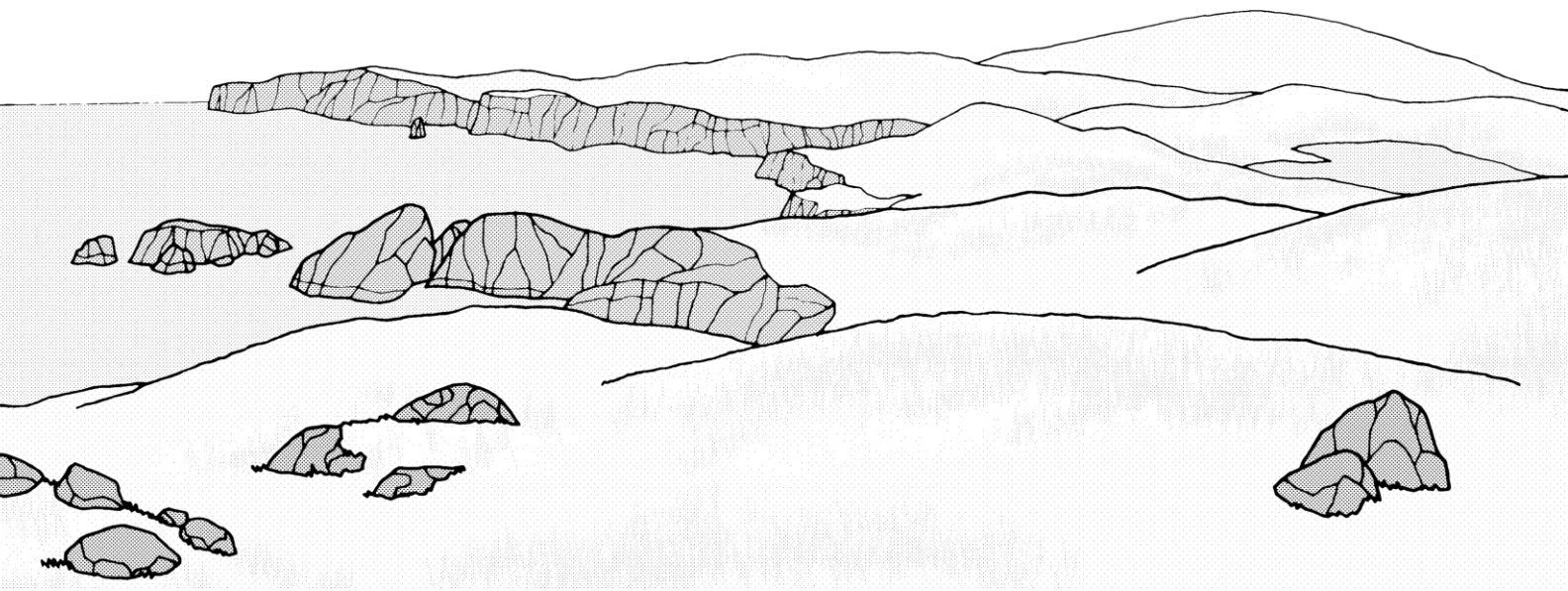
SOTEAG

Ornithological Monitoring Programme in Shetland

2022

A report to the Shetland Oil Terminal Environmental Advisory Group

by the University of St Andrews



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SOTEAG ORNITHOLOGICAL MONITORING PROGRAMME

2022 REPORT

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2022 Executive Summary

1. Population and breeding success monitoring of cliff-nesting seabirds

Northern Fulmar *Fulmarus glacialis*. Population counts (AOS) were very similar to those in 2021. Mean breeding success across the four monitored sites had changed little since 2021 (0.38 chicks fledged per AOS in 2022, 0.39 in 2021).

European Shag *Gulosus aristotelis*. Numbers of nests had substantially decreased at the monitoring sites in south Shetland but increased at those in the north. At Burravoe, Yell, breeding success was 1.32 chicks fledged per incubated nest, up from 1.17 in 2021. Breeding success at Sumburgh Head was 1.29 chicks fledged per incubated nest, up from 0.68 in 2021.

Black-legged Kittiwake *Rissa tridactyla*. The population count at Compass Head was 33 nests, compared with 35 in 2021. Numbers of nests along the new monitoring transects had increased in comparison with the 2021 count around Fetlar and in the southeast Mainland but decreased in southeast Yell. Mean breeding success across five monitored sites was unusually high at 1.10 chicks fledged per laying pair (0.31 in 2021).

Common Guillemot *Uria aalge*. The mean population counts at all four monitoring sites were similar to those in 2021. Breeding success at Sumburgh Head was 0.65 chicks fledged per apparently incubating pair, similar to 2021 (0.67). Chick diet at Sumburgh was 83% gadids and 16% sandeels.

Razorbill *Alca torda*. Mean population counts at Burravoe and Sumburgh Head were similar to those in 2021 but had increased at Esha Ness and Troswick Ness. Breeding success at Sumburgh Head was 0.59 chicks fledged per laying pair, exactly the same as in 2021.

2. Population monitoring of Black Guillemots *Cepphus grylle.* The count of 65 birds in full summer plumage at Sullom Voe oil terminal jetties was lower than in 2021 (73 birds). At the other monitored sites, the 2022 count was similar to the 2021 count at five sites, was lower at two sites, but was higher at one site.

3. Population and breeding success monitoring of breeding Red-throated Divers *Gavia stellata*. The Northmavine monitoring area was not surveyed in 2022. Population surveys of the Tingon monitoring area confirmed 17 breeding pairs, up from 13 in 2021.

4. Population monitoring of moulting Common Eiders *Somateria mollissima*. The total count across the annual Yell Sound and Sullom Voe monitoring areas was 253 birds, a 60% decrease since 2021 (637 birds). However, additional surveys were made of three adjoining areas and, in one, unusually high numbers of birds were found, meaning that in total there was no evidence of an unusually high decrease in numbers across the six areas surveyed in 2022 or of changes that could be specifically attributed to mortality from avian influenza.

5. Population monitoring of wintering seaduck and diving seabirds. Three of the standard monitoring areas were surveyed in 2022. As usual, counts were highly variable but generally fell within the normal range of variability. Notable, however, were high numbers of Great Northern Divers and Common Guillemots around Bressay, Great Northern Divers in west Mainland, and Common Guillemots in Bluemull Sound.

6. The Shetland Beached Bird Survey. Very high numbers of dead seabirds were found per km of beaches surveyed in 2022 due to a pandemic of HPAIV during the breeding season and abnormally high mortality in Gannets, Great Skuas, Guillemots and Eiders. The number of oiled seabirds found in 2022 was low, however, and similar to previous recent years.

In summary, there was no evidence that the operation of the Sullom Voe Terminal, or its associated tanker traffic, had any detrimental impact on Shetland's seabird populations during 2022.

Highly Pathogenic Avian Influenza Virus (HPAIV) in seabirds in 2022

In 2022, there was a pandemic of Highly Pathogenic Avian Influenza Virus (HPAIV) in seabirds across Shetland and the UK. Multiple species became infected and in some mortality was extremely high.

HPAIV and associated high mortality occurred in Great Skuas during summer 2021 but was not detected in any other UK seabird species that year (Banyard *et al*. 2022, Gear 2021). In 2022, HPAIV was found in Common Eiders in Shetland in late March and early April. The count of Eider corpses during the March Shetland Beached Bird Survey (p.34) was exceptionally high and six corpses, comprising three from southwest Shetland and three from around Bluemull Sound (northeast Shetland), were sent to Scotland's Rural College (SRUC) and the Animal and Plant Health Association (APHA) laboratories for post-mortem analyses. All six were confirmed positive for HPAIV H5N1. This was (a) the first occurrence anywhere of HPAIV H5N1 in a marine bird in 2022 (Falchieri *et al*. 2022), (b) the first time that HPAIV had ever been detected in Common Eider, and (c) confirmed widespread infection in Eider across Shetland.

HPAIV H5N1 was soon recorded again in Great Skuas in late April 2022, with the return of birds to their breeding colonies, and very high mortality then occurred in this species throughout the breeding season at multiple sites (Camphuysen & Gear 2022, Falchieri *et al*. 2022). Rapid infection and extensive mortality in other breeding seabird species soon followed, from May to October, in Shetland and elsewhere across the UK (Falchieri *et al*. 2022). During this period seabird corpses were extensively sampled, analysed by SRUC and APHA, and many different species tested positive for HPAIV H5N1 clade 2.3.4.4b (Falchieri *et al*. 2022). In Shetland, the species where at least one corpse was sampled and tested positive were Eider, Great Skua, Gannet, Arctic Tern, Herring Gull, Great Black-backed Gull and Long-tailed Skua. The only other species tested was Common Gull (1 corpse) but was negative. Extreme mortality occurred in Great Skuas, Gannets, Common Guillemots and Eiders but, surprisingly, not in any other seabird species in Shetland in 2022 (p. 34).

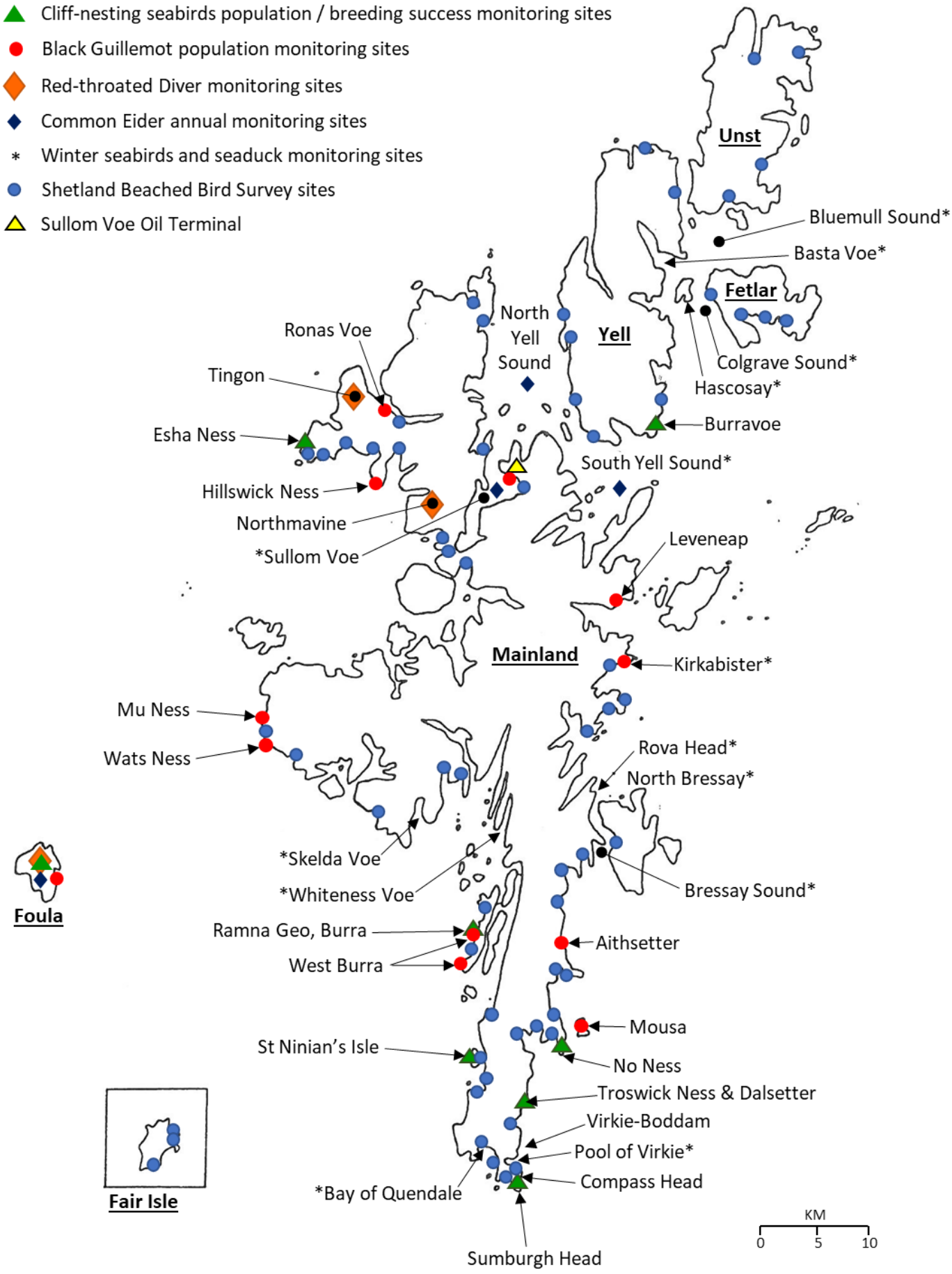
The SOTEAG Ornithological monitoring programme continued as normal through the pandemic. However, some minor alterations were made to how the Shetland Beached Birds Survey proceeded, that were made to eliminate all possible risk of SOTEAG staff and volunteers becoming infected with HPAIV H5N1 (very low risk but extremely high consequences in humans; p.34). This risk did not exist for any other part of the monitoring programme because all other work is purely observational and done from afar (well outside of breeding colony boundaries), with no foreseeable possibility of close proximity or contact with infected birds. So, the HPAIV pandemic presented no major challenges to the completion of the SOTEAG ornithology programme.

Mentally and emotionally, however, many Shetlanders found the 2022 seabird breeding season extremely difficult, and SOTEAG staff were frequently contacted by folk seeking help and support regarding seabirds. The sudden appearance of thousands of infected seabird carcasses all over Shetland - on moorland, beaches, cliffs, and even along main roads - for many locals and visitors presented a horrifying and depressing reality. Additionally, there was widespread confusion as to what could actually be done about the virus, if anything, and quite how serious a risk it posed to humans. Also, as news broke of new seabird die-offs elsewhere in the UK throughout the summer, the thought that infection and mass mortality might spread to a range of additional 'local specialty' species in Shetland, for example Arctic Skuas, Red-necked Phalaropes, Puffins, Red-throated Divers and storm-petrels, weighed very heavily in many people's minds. Indeed, it was these psychological aspects of the pandemic that presented some of the greatest challenges of the 2022 season, and it was generally a relief when, species-by-species, Shetland's seabirds dispersed back out to sea and the breeding season ended.

SOTEAG data were supplied to APHA and NatureScot as part of the nationwide government analyses and response-planning for the 2022 HPAIV pandemic in UK seabird populations. The first detailed overview of the pandemic (that includes more information on impacts, response actions and virus dynamics) was authored by staff of APHA, NatureScot and SOTEAG (University of St Andrews) and published as a short paper in October 2022 (Falchieri *et al*. 2022).

Unfortunately, it seems likely that the 2022 pandemic was not a one-off and that HPAIV H5N1 mass infection and mortality events in seabirds will occur again in future years. Highly persistent, increasingly infectious and often rapidly lethal, HPAIV H5N1 is unlikely to simply disappear, and after just two years is now the most severe, fast-moving and widespread threat to UK seabird populations ever recorded.

Location map of ornithological monitoring sites



1. Population and breeding success monitoring of cliff-nesting seabirds

1.1. Summary of weather and sea conditions during the 2022 seabird breeding season

The winter of 2021/22 was persistently stormy and rough in Shetland and calm days were exceptionally few (e.g., see Harris *et al*. 2022). The conditions were so intense that many Shetlanders compared the 2021/22 winter to that of 1992/93 and the *Braer* oil spill - the local benchmark for unabating extreme winter weather and sea conditions. The weather in April remained severe, with few days suitable for fieldwork. May was then mostly calm, clear and dry, but conditions in June, July and August were rough again, with many days of strong winds, rain and fog. Alongside the widespread pandemic of HPAIV, the harsh weather and sea conditions in 2022 made it a difficult year for fieldwork.

Table 1.1. Conditions during the annual population counts of Northern Fulmars, Common Guillemots and Razorbills at the four monitored sites in 2022, including observer, date, time, wind (direction and force), general sea state and cloud conditions (0–8 cloud coverage score).

Burravoe, Yell	Observer: Mick Mellor			
Date	**Time (BST)**	**Wind**	**Sea state**	**Cloud cover**
3rd June 2022	0900–0930	N 4	Calm	8/8
5th June 2022	0900–0930	NW 2	Calm	8/8
6th June 2022	0900–0930	NE 3	Calm	6/8
16th June 2022	0900–0930	SW 3	Calm	8/8
23rd June 2022	0900–0930	SW 4	Calm	8/8
Esha Ness	Observer: Mick Mellor			
Date	**Time (BST)**	**Wind**	**Sea state**	**Cloud cover**
3rd June 2022	1130–1330	N 3	Moderate	6/8
5th June 2022	1130–1300	NW 1	Moderate	8/8
6th June 2022	0900–1030	NE 1	Moderate	3/8
16th June 2022	1200–1300	SW 3	Heavy	8/8
21st June 2022	0830–1000	NNW 3	Moderate	8/8
Troswick Ness	Observer: Will Miles			
Date	**Time (BST)**	**Wind**	**Sea state**	**Cloud cover**
1st June 2022	0915–1015	WNW 4	Moderate	1/8
3rd June 2022	1000–1105	NW 3	Light	2/8
7th June 2022	1000–1105	NE 2-3	Moderate	8/8
9th June 2022	0900–0945	E 2	Moderate	8/8
11th June 2022	0900–0950	S 3-4	Moderate	5/8
Sumburgh Head	Observer: Will Miles			
Date	**Time (BST)**	**Wind**	**Sea state**	**Cloud cover**
1st June 2022	1410–1555	NW 3	Moderate	3/8
3rd June 2022	1310–1455	NW 1	Moderate	7/8
6th June 2022	1710–1825	N 2	Light	1/8
9th June 2022	1030–1230	E 2	Moderate	8/8
11th June 2022	1015–1130	SW 3-4	Moderate	6/8

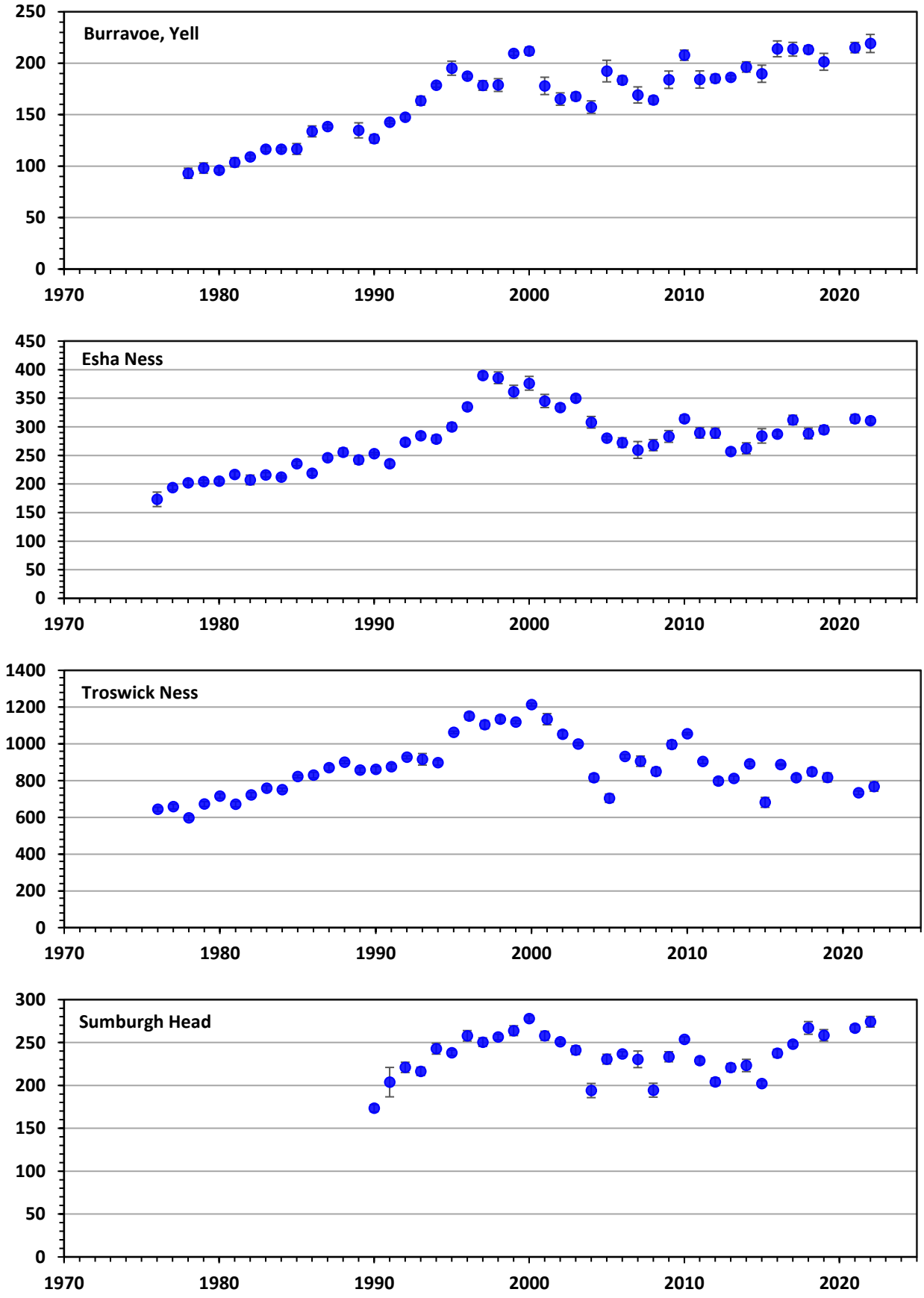
1.2a. Northern Fulmar *Fulmarus glacialis* population monitoring

In 2022, numbers of Fulmars at the four monitored sites were generally very similar to numbers in 2021, with <5% change at all sites (**Table 1.2**, **Figure 1.1**). The mean counts of AOS had increased very slightly at all sites except Esha Ness, where numbers were down by 1.0% compared with 2021 (**Table 1.2**, **Figure 1.1**). The mean count of AOS at Burravoe in 2022 (219.2) was the highest on record (**Figure 1.1**). The mean counts of individuals were very slightly up at all sites (**Table 1.2**). The size of the monitored population at Burravoe, Esha Ness and Sumburgh has increased slightly during the last 15 years, whereas at Troswick Ness numbers have slightly decreased during this period (**Figure 1.1**). Since 1976, there has been a consistent general pattern of long-term population change across the four sites, broadly comprising population increase until 2000, decrease from 2000 to c.2006, and slight population increase or (at Troswick) slight decrease thereafter (**Figure 1.1**). In comparison with the other monitored cliff-nesting species, numbers of Fulmars are high at all the monitored sites (mean AOS >200 at all sites).

Table 1.2. Fulmar population summary statistics for counts of apparently occupied nest sites (AOS) and individual birds (Individuals) at the four monitored sites, 2021–22: total counts (n), range, mean, standard deviation (SD), standard error (SE) and % change since 2021 (% Ch.). Sites are listed from north to south.

Colony	Unit	Year	n	Range	Mean	SD	SE	% Ch
Burravoe, Yell	AOS	2021	5	203–231	215.2	11.19	5.00	
		2022	5	190–245	219.2	19.66	8.79	1.9
	Individuals	2021	5	244–265	258.2	8.93	3.99	
		2022	5	234–277	258.2	15.85	7.09	0.0
Esha Ness	AOS	2021	5	296–338	314.2	16.28	7.28	
		2022	5	299–327	311.0	11.77	5.26	-1.0
	Individuals	2021	5	346–482	387.2	54.12	24.20	
		2022	5	348–422	387.8	28.20	12.61	0.2
Troswick Ness	AOS	2021	5	702–761	734.0	22.38	10.01	
		2022	5	716–856	767.4	56.52	25.28	4.6
	Individuals	2021	5	887–1010	920.2	51.10	22.85	
		2022	5	891–994	934.6	39.02	17.45	1.6
Sumburgh Head	AOS	2021	5	258–278	266.8	8.79	3.93	
		2022	5	254–293	274.2	13.88	6.21	2.8
	Individuals	2021	5	300–336	315.4	14.83	6.63	
		2022	5	306–338	325.4	12.07	5.40	3.2

Figure 1.1. Mean population counts of Northern Fulmar apparently occupied nest sites (AOS) and standard errors, at the four monitored sites, 1976–2022. Counts of all five monitoring plots at Sumburgh began in 1990. Data for 2020 are lacking due to Covid-19 restrictions.



1.2b. Northern Fulmar *Fulmarus glacialis* breeding success monitoring

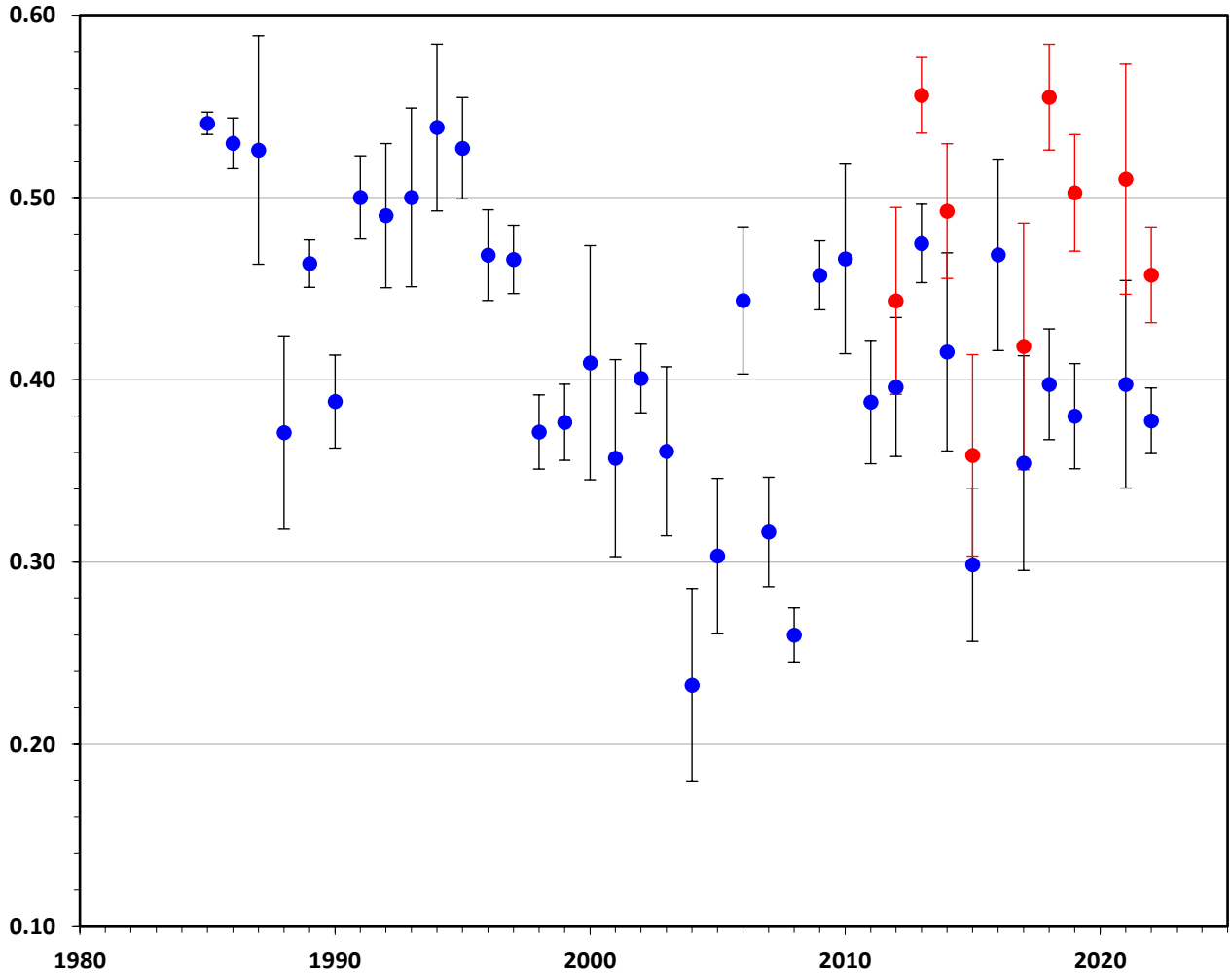
Since 1985, breeding success has been calculated by dividing the number of chicks present in the population monitoring plots in mid-August by the mean population count of AOS in June (Method A). In 2012, however, SOTEAG began measuring breeding success using an additional method (Method B, the marked photograph method), so that the same monitoring methodology was being used as elsewhere in Shetland and the UK (Walsh *et al.* 1995). Method B is calculated by dividing the number of chicks present in mid-August by the number of nest sites recorded as an AOS on all three of three site visits in late May and June (although see Table 1.2 legend for SOTEAG variant of this calculation). Each year, both methods are used.

At the individual monitoring sites, breeding success in 2022 was slightly higher than in 2021 at Burravoe and Troswick Ness (both methods) but lower at Esha Ness and Sumburgh Head (both methods; **Table 1.3**). The mean breeding success from the four monitored sites was lower in 2022 than in 2021, measured using Method A (down by 5.0% in 2022) and Method B (down by 10.3% in 2022; **Figure 1.2**). The long-term general pattern of mean breeding success has been a decrease from 1985 to 2008, a marked increase from 2008 to 2010, and since then general stability (both methods), although with high annual variation (**Figure 1.2**).

Table 1.3. Fulmar breeding success summary statistics for the four monitored sites in 2022: the dates of visits, the total number of nest sites recorded as an AOS on one or more of three checks in May/June (AOS Total), the number of nest sites recorded as an AOS on all three visits in June (AOS x3), the number of nest sites at which chicks were present in August but where an AOS was recorded on only one, two or none of the visits in June (AOS Extra), the mean of the five Fulmar population monitoring counts of AOS (AOS Mean), the total number of nest sites where chicks were present during the August visit (Chick count), Breeding Success Method A [= Chick count / AOS Mean] and Breeding Success Method B [= Chick count / (AOS x3 + AOS Extra)], with data from 2021 in parentheses for comparison. Sites are listed from north to south.

Monitoring sites (& site plots)	**AOS Total**	**AOS x3**	**AOS Extra**	**AOS Mean**	**Chick count**	**Breeding Success Method A (data from 2021)**	**Breeding Success Method B (data from 2021)**
Burravoe, Yell (visited on 3rd, 5th and 6th June and 17th August)							
	245	184	1	219.2	**79**	**0.36 (0.28)**	**0.43 (0.37)**
Esha Ness (visited on 3rd, 5th and 6th June and 15th August)							
Calders Geo	255	177	2	201.0	72	0.36 (0.50)	0.40 (0.54)
Main Colony	41	28	0	34.0	11	0.32 (0.45)	0.39 (0.62)
Fulmar Geo	69	59	0	61.4	26	0.42 (0.55)	0.44 (0.63)
Plots Mean ± SE						**0.37** ±0.03 **(0.50** ±0.03**)**	**0.41** ±0.02 **(0.59** ±0.03**)**
Troswick Ness (visited on 1st, 3rd and 7th June and 15th August)							
Brei Geo	364	250	6	320.8	119	0.37 (0.36)	**0.46 (0.44)**
Sandvis Geo				446.6	143	0.32 (0.29)	
Plots Mean ± SE						**0.35** ±0.03 **(0.32** ±0.04**)**	
Sumburgh Head (visited on 1st, 3rd and 6th June and 15th August)							
Greystane Geo	45	24	1	31.4	11	0.35 (0.51)	0.44 (0.71)
Geo of Toun South	198	153	4	187.2	93	0.50 (0.58)	0.59 (0.64)
Geo of Parks North	61	40	2	53.8	23	0.43 (0.41)	0.55 (0.56)
Plots Mean ± SE						**0.43** ±0.04 **(0.49** ±0.05**)**	**0.53** ±0.04 **(0.64** ±0.08**)**

Figure 1.2. Mean Fulmar breeding success and standard errors at three to four monitored sites, 1985–2022 (monitoring began at Burravoe, the fourth site, in 2003). Breeding success was calculated using two methods: Method A (blue) is the number of chicks present in mid-August divided by the mean of five population counts of apparently occupied nest sites (AOS) in June; Method B (red) is the number of chicks present in mid-August divided by the number of nest sites recorded as an AOS on all three of three site visits in late May and June (although see Table 1.2 legend for SOTEAG variant of this calculation). Data for 2020 are lacking due to Covid-19 restrictions.



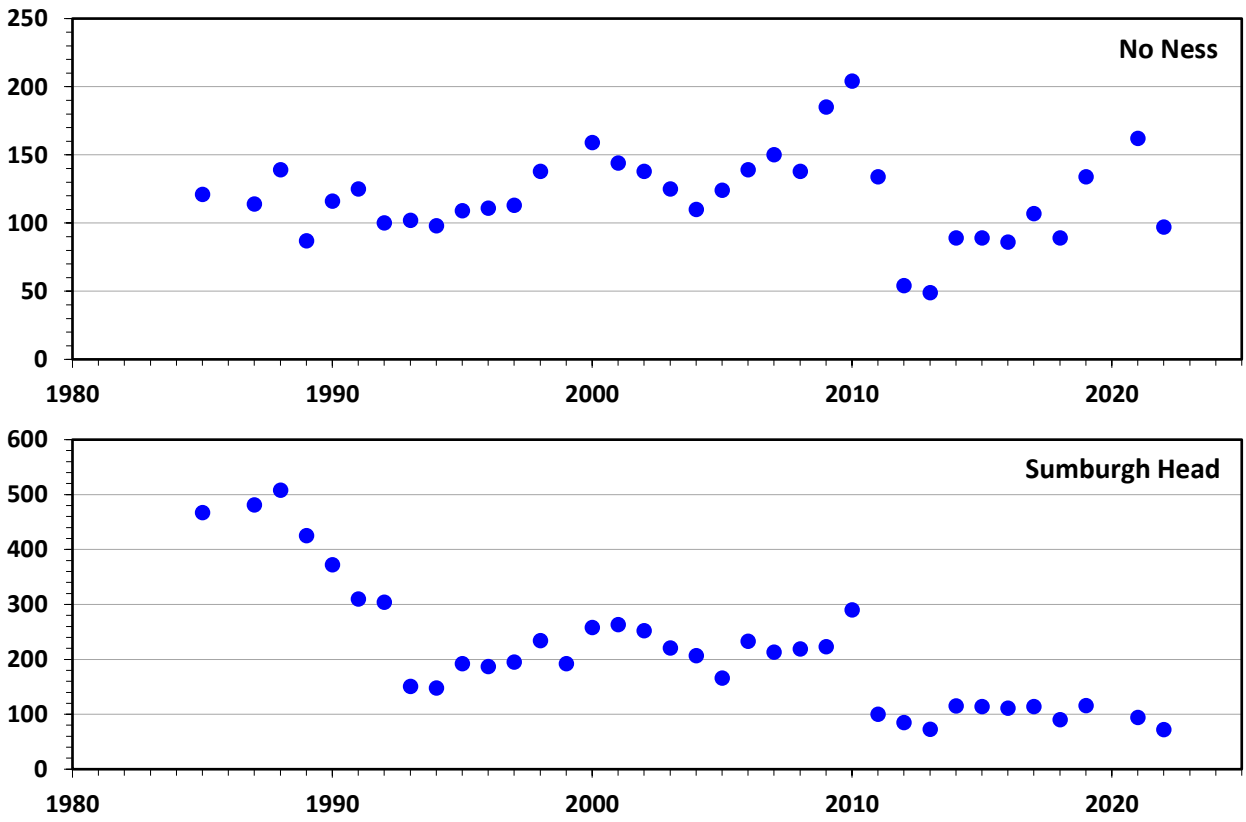
1.3a. European Shag *Gulosus aristotelis* population monitoring

In 2022, the number of Shag nests counted from land at No Ness was 97, a decrease of 41.9% since 2021, while the number counted at Sumburgh Head was 72, the lowest count on record and a decrease of 25.8% since 2021 (**Table 1.4**). The substantial decrease at No Ness was a major departure from the general pattern since 2012 of gradually increasing numbers at this site and could be due to the extremely hard winter of 2021/22 and associated high mortality or, perhaps at least, high non-breeding due to poor post-winter condition. Similarly, these factors may also have caused the very low count at Sumburgh (**Figure 1.3**). Following the *Braer* oil spill in January 1993, the number of nests at Sumburgh decreased by 50%, but there was no similarly timed decrease at No Ness (**Figure 1.3**). Currently, breeding numbers at Sumburgh are c.75% lower than in the late 1980s (**Figure 1.3**). The timing of Shag nesting is often highly asynchronous, meaning that some nesting attempts in a season will likely be missed during just a single count of nests, since some nests may fail and disintegrate prior to the count date and some may be built subsequently. However, observations from the Shag breeding success plots are a useful guide as to when the highest number of active nests occurs each season. Since 2014, timing of the population counts has coincided with a high proportion of active nests (>80%).

Table 1.4. Counts of Shag nests at No Ness and Sumburgh Head, 2011–2022, including the total count (in bold = all active, empty and trace nests), the percentage of nests which were active, and the count date. These two colonies are counted annually from land. When more than one count from land was made in a year the highest nest total is given (*). Counts were not possible in 2020 due to the Covid-19 lockdown restrictions.

Monitoring site	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022
No Ness	**134***	**54***	**49***	**89**	**89**	**86**	**107**	**89**	**134**	-	**167**	**97**
	84%	48%	47%	87%	93%	92%	92%	82%	94%		95%	77%
	27/5	12/6	10/6	12/6	16/6	1/6	7/6	7/6	9/6		15/6	8/6
Sumburgh Head	**100***	**85***	**73***	**115**	**114**	**111**	**114**	**90**	**116**	-	**97**	**72**
	67%	54%	33%	85%	92%	94%	91%	83%	97%		99%	93%
	27/5	30/5	10/6	9/6	13/6	5/6	6/6	8/6	8/6		11/6	14&15/6

Figure 1.3. Counts from land of Shag nests at No Ness and Sumburgh Head, 1985–2022 (total active, empty and trace nests). In 2020, monitoring was not possible due to the Covid-19 lockdown restrictions.



In 2018, three transects of coastline with relatively large numbers of breeding Shags and Kittiwakes were pilot surveyed by boat, the work proved useful for population monitoring of these species, and the three transects - namely: 1) Fetlar, 2) east Yell and 3) southeast Mainland - were subsequently added to the annual monitoring program (**Figure 1.4**; Miles & Mellor 2018).

Each transect is surveyed once by boat during the peak incubation period (judged from breeding success monitoring) and all visible fully built Shag nests (total apparently occupied nests, AON) are counted and mapped. In 2018, logistical difficulties resulted in an inaccurate initial count of the Fetlar and east Yell transects. These areas were counted accurately in 2019, providing the baseline data for future counts, and were counted again in 2021and 2022 (no survey for Shags in 2020 due to Covid lockdown restrictions).

The Fetlar transect was surveyed on 5th June 2022 and the total count was 250 AON, an increase on the 2021 total of 217 AON and 2019 total of 229 AON. The east Yell transect was surveyed on 6th June 2022 and the total count was 122 AON, up by 10% in comparison with the 2021 count of 111 AON, but lower than the 2019 total of 177. It was not possible to survey the southeast Mainland transect for Shags in 2022 because of poor weather conditions in June; the total count in 2021 was 396 AON, 276 in 2019 and 235 in 2018.

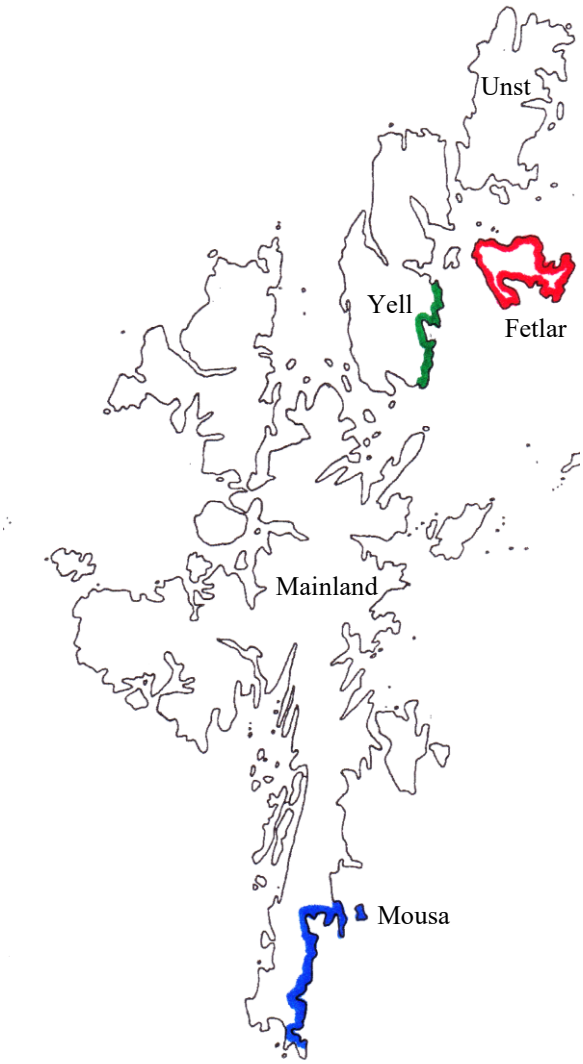


Figure 1.4. Location of the three Shag and Kittiwake annual population monitoring transects. The Fetlar transect (red) comprises the entire coastline of Fetlar. The east Yell transect (green) begins in the southeast corner of Yell at Ladies Hole (OS grid reference: HU531801) and ends on east Yell further north, at the Wick of Vatsetter (HU535896). The southeast Mainland transect (blue) begins in the south at The Slithers (HU407092) and ends further north at the Taing of Sandsayre (HU437251), but also includes the entire coastline of Mousa.

1.3b. European Shag *Gulosus aristotelis* breeding success monitoring

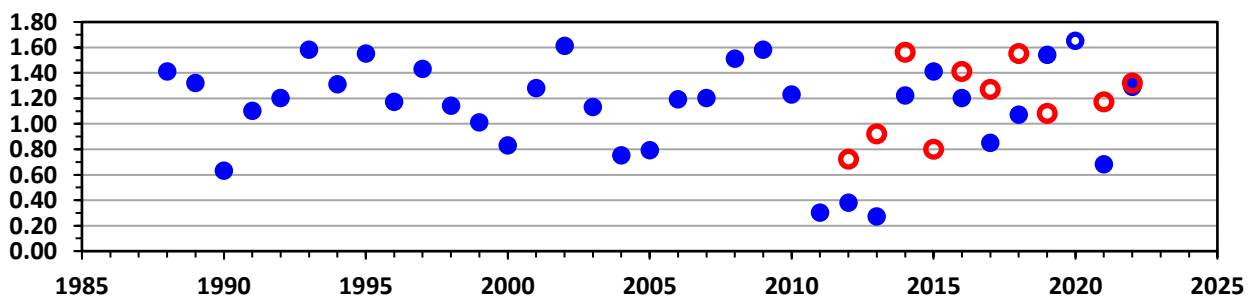
In 2022, Shag breeding success was 1.32 chicks fledged per incubated nest at Burravoe, up by 12.8% compared with 2021. Similarly, at Sumburgh Head breeding success was 1.29, up by 89.7% since 2021 (**Table 1.5**). The number of incubating pairs at Sumburgh was down by 22.7% compared with 2021 though, possibly due to the very severe winter of 2021/22 and fewer birds returning in sufficiently good condition to breed in spring 2022. Breeding success has fluctuated over the years, but the 2022 data extend the pattern at both sites of general long-term stability but with high inter-annual variation (**Figure 1.5**).

Table 1.5. Shag breeding success summary statistics at Sumburgh Head and Burravoe, Yell, 2013–22: the number of trace nests (Tr), well-built nests not being incubated (NInc) and the number of incubated nests (Inc), the percentage of all nests that were being incubated (% Inc), the percentage of incubated nests at which chicks were recorded (% H), the percentage of incubated nests from which no chicks fledged (Fl. 0), the number of chicks fledged (Ch), mean brood size at fledging (Brood), and sum breeding success (SBS [=Ch/Inc]). Due to the Covid-19 lockdown restrictions in 2020, monitoring was not possible that year at Burravoe and a reduced sample size of nests was monitored at Sumburgh, using fixed-position cameras.

Burravoe									
Year	**Tr**	**NInc**	**Inc**	**% Inc**	**% H**	**Fl. 0**	**Ch**	**Brood**	**SBS**
2013	2	1	39	92.9	64.1	46.2	36	1.71	**0.92**
2014	4	2	27	81.8	81.5	25.9	42	2.10	**1.56**
2015	2	0	35	94.6	54.3	51.4	28	1.65	**0.80**
2016	3	0	22	88.0	72.7	31.8	31	2.07	**1.41**
2017	2	2	26	86.7	69.2	38.5	33	2.06	**1.27**
2018	2	2	20	83.3	60.0	40.0	31	2.58	**1.55**
2019	2	2	39	90.7	61.5	43.6	42	1.91	**1.08**
2020	-	-	-	-	-	-	-	-	**-**
2021	1	6	35	83.3	65.7	42.9	41	2.05	**1.17**
2022	6	3	37	80.4	81.1	32.4	49	1.96	**1.32**

Sumburgh Head									
Year	**Tr**	**NInc**	**Inc**	**% Inc**	**% H**	**Fl. 0**	**Ch**	**Brood**	**SBS**
2013	15	27	56	57.1	16.1	83.9	15	1.67	**0.27**
2014	2	2	108	96.4	67.6	36.1	132	1.91	**1.22**
2015	5	3	111	93.3	76.6	28.8	157	1.99	**1.41**
2016	2	6	94	92.2	74.5	36.2	113	1.88	**1.20**
2017	6	5	108	90.8	61.1	50.9	92	1.74	**0.85**
2018	11	17	68	70.8	69.1	38.2	73	1.78	**1.07**
2019	3	8	103	90.3	80.6	25.2	159	2.06	**1.54**
2020	1	1	49	96.1	80.4	20.4	81	2.08	**1.65**
2021	8	8	66	80.5	75.8	33.3	45	1.29	**0.68**
2022	5	3	51	86.4	80.4	29.4	66	1.83	**1.29**

Figure 1.5. Shag breeding success (chicks fledged per incubated nest) at Sumburgh Head and Burravoe, 1988–2022. Monitoring began in 2012 at Burravoe (red). In 2020, monitoring was not possible at Burravoe and only a reduced sample size of nests was monitored at Sumburgh (blue open circle), due to the Covid-19 lockdown.



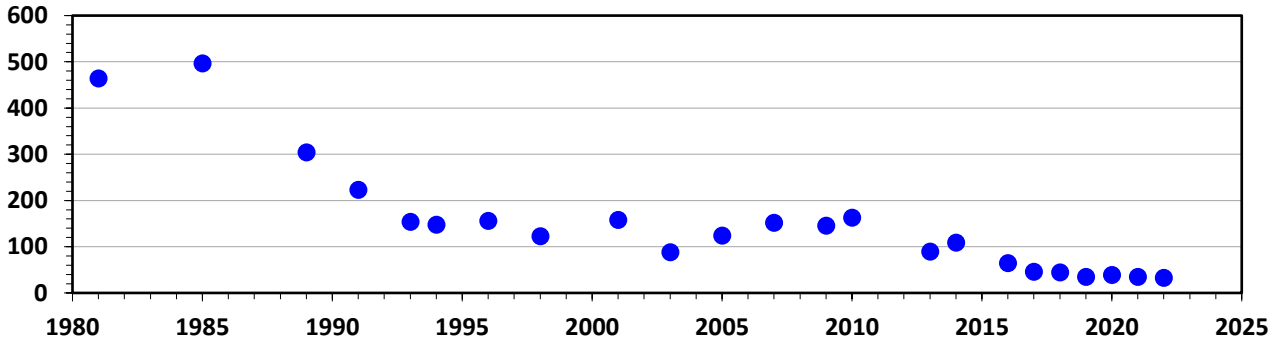
1.4a. Black-legged Kittiwake *Rissa tridactyla* population monitoring

Compass Head was surveyed by boat on 4th July 2022 and the sum total number of incubating, empty and trace nests was 33 (29 incubating/AON and 4 trace), the lowest total on record, a decrease of 5.7% compared with the 2021 count, and a continuation of the general pattern at this site since 2016 of a very low but apparently stable number of nests (**Table 1.6**, **Figure 1.6**). The late timing of the count in 2022 (early July rather than in June) was due to poor weather restricting boat access to the South Mainland transect any earlier in the season. However, this timing is unlikely to have resulted in an inaccurate count, given there was no evidence of breeding failures or nest losses in late June or July at the breeding success plots, including nearby at Sumburgh.

Table 1.6. Total number of Kittiwake nests (total of all incubating, empty and trace nests) at Compass Head in 1981 (baseline count) and from 2012–2022. All counts were made from a boat. Note that due to the Covid-19 lockdown in 2020 the count that year was made in August, much later than the standard timing (in June).

	1981		2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022
Compass Head	464			90	109		65	46	45	35	39	35	33

Figure 1.6. Total number of Kittiwake nests (total of all incubating, empty and trace nests) at Compass Head, 1981–2022. In 2020, due to the Covid-19 lockdown, the count was done late (in August rather than June).



Three large-scale transects are now used for annual Kittiwake and Shag population monitoring – the Fetlar, east Yell and southeast Mainland transects (see information and location map on p.11). Each transect is surveyed for Kittiwakes once by boat during the peak incubation period in June and all visible fully-built nests are counted and mapped (all apparently occupied nests, AON). Surveys began in 2018 (Miles & Mellor 2018). In 2020, due to the Covid-19 lockdown, counts of the Fetlar and east Yell transects were not possible, and the southeast Mainland transect was counted in August, much later than the standard timing (in June).

In 2022, the total count along the Fetlar transect was 64 AON, 12.3% up from the 2021 count of 57, and equal to the 2019 total (**Table 1.7**). Along the East Yell transect there had been a decrease in numbers, with 38 AON in 2022 compared with 51 in 2021 (-25.5%). Numbers had increased, however, along the southeast Mainland transect, by 11.1%, from 199 AON in 2021 to 221 in 2022 (note late timing of 2022 count, above; **Table 1.7**). There have been just five years of monitoring of these transects. So far, numbers of Kittiwake AON have decreased consistently along the east Yell transect but been more variable each year along the other two.

Table 1.7. Counts of Kittiwake apparently occupied nests (AON) along the Fetlar, east Yell and southeast Mainland monitoring transects, 2018–2022. All counts were made from a boat. In 2020, due to the Covid-19 lockdown, counts of the Fetlar and east Yell transects were not possible, and the southeast Mainland transect was counted in August, much later than the standard timing (in June).

Monitoring transects	**2018**	**2019**	**2020**	**2021**	**2022**
Fetlar	62	64	-	57	64
Southeast Yell	88	75	-	51	38
South Mainland	195	210	255	199	221

1.4b. Black-legged Kittiwake *Rissa tridactyla* breeding success monitoring

No birds nested at Esha Ness in 2022 (**Table 1.8**). At the five other sites breeding success was unusually high, and generally Kittiwakes seemed to have a very good breeding season in 2022, possibly due to the high mortality of Great Skuas from HPAIV and potentially reduced harassment and predation of Kittiwakes by skuas this year (**Table 1.8**). A new monitoring site was started at Dalsetter in the South Mainland, here included for the first time. However, there were very few nests at No Ness in 2022 and this site may be dropped from future monitoring. In contrast, the colony at Ramna Geo continues to grow, with an exceptional 90 nests in 2022 (**Table 1.8**).

Mean breeding success across the five monitored breeding sites in 2022 was 1.10 chicks fledged per apparently laying pair. This was an exceptional increase of 255% since 2021, when mean breeding success was 0.31. It was also the second-highest measurement on record after the 1992 record of 1.16 (**Figure 1.7**). Since 1986, mean Kittiwake breeding success has been highly variable, with no obvious trend (**Figure 1.7**).

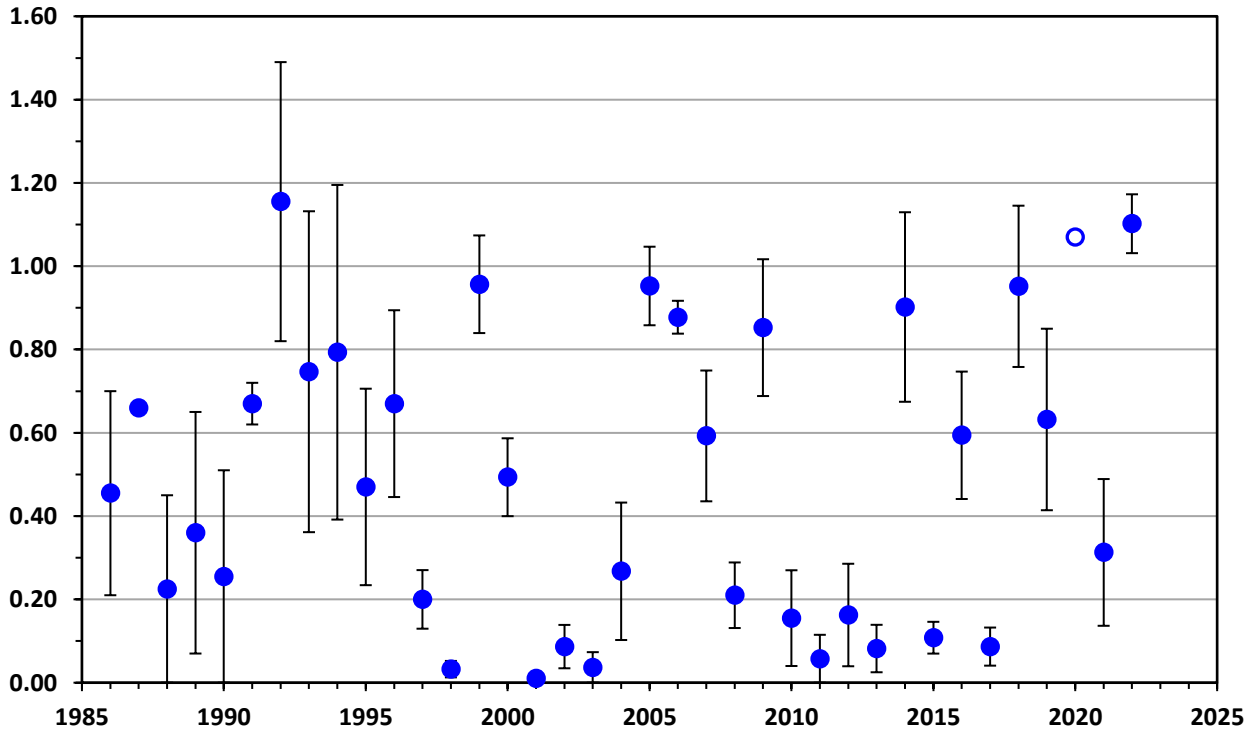
Table 1.8. Kittiwake breeding success summary statistics for six monitoring sites, 2012–22: the number of nests (Total nests [= full nests + trace nests]); the number of nests where incubation was recorded or assumed (Incubating); the percentage of nests where incubation was recorded or assumed (% Incubating [= (Incubating / Total nests) x100]); the percentage of incubated nests where at least one chick was known to have hatched (% Incubated that hatched); the percentage of hatched nests where two chicks were seen (% Hatched that b/2); the percentage of incubated nests that failed (% Incubated that failed); the total number of chicks fledged (Chicks fledged); and breeding success (Breeding success = [Chicks fledged / Incubating]). In 2020, monitoring was prevented by the Covid-19 lockdown restrictions, except at Sumburgh Head where a reduced number of nests were monitored using fixed-position cameras.

Burravoe, Yell	**2012**	**2013**	**2014**	**2015**	**2016**	**2017**	**2018**	**2019**	**2020**	**2021**	**2022**
Total nests	128	130	114	98	100	82	87	76	-	47	50
Incubating	94	99	95	84	84	69	71	64	-	38	39
% Incubating	73.4	76.2	83.3	85.7	84.0	84.1	81.6	84.2	-	80.9	78.0
% Incubated that hatched	51.1	40.4	76.8	73.8	86.9	72.5	94.4	70.3	-	76.3	84.6
% Hatched that b/2	43.8	2.5	60.3	13.1	58.9	12.0	55.3	28.1	-	55.2	81.8
% Incubated that failed	59.6	87.9	32.6	79.8	29.8	87.0	32.4	82.8	-	94.7	23.1
Chicks fledged	49	12	100	17	89	10	69	16	-	3	51
Breeding success	**0.52**	**0.12**	**1.05**	**0.20**	**1.06**	**0.14**	**0.97**	**0.25**	-	**0.08**	**1.31**
Esha Ness	**2012**	**2013**	**2014**	**2015**	**2016**	**2017**	**2018**	**2019**	**2020**	**2021**	**2022**
Total nests						38	32	38	-	12	0
Incubating						27	24	32	-	6	0
% Incubating						71.1	75.0	84.2	-	50	0
% Incubated that hatched						3.7	87.5	31.3	-	0	0
% Hatched that b/2						0.0	52.4	0.0	-	0	0
% Incubated that failed						96.3	25.0	100.0	-	100	0
Chicks fledged						1	28	0	-	0	0
Breeding success						**0.04**	**1.17**	**0.00**	-	**0.00**	**n/a**
Ramna Geo, Burra	**2012**	**2013**	**2014**	**2015**	**2016**	**2017**	**2018**	**2019**	**2020**	**2021**	**2021**
Total nests	64	48	68	37	32	29	39	53	-	79	90
Incubating	24	34	64	30	28	25	30	43	-	68	83
% Incubating	37.5	70.8	94.1	81.1	87.5	86.2	76.9	81.1	-	86.1	92.2
% Incubated that hatched	0	35.3	6.2	66.7	75.0	76.0	80.0	86.0	-	85.3	90.4
% Hatched that b/2	0	0	0	0	4.8	5.3	75.0	37.2	-	13.8	64.0
% Incubated that failed	100	70.6	100	93.3	85.7	100	26.7	37.2	-	27.9	19.3
Chicks fledged	0	10	0	2	4	0	35	34	-	52	97
Breeding success	**0**	**0.29**	**0**	**0.07**	**0.14**	**0**	**1.17**	**0.79**	-	**0.76**	**1.17**

Table 1.8. continued.

No Ness	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022
Total nests	22	19	17	14	12	11	12	13	-	9	6
Incubating	16	14	14	13	12	10	10	7	-	8	5
% Incubating	72.7	73.7	82.4	92.9	100	90.9	83.3	53.8	-	88.9	83.2
% Incubated that hatched	31.3	0	71.4	61.5	66.7	50.0	80.0	100.0	-	37.5	100.0
% Hatched that b/2	0	0	60.0	0	12.5	0	62.5	42.9	-	0.00	4.0
% Incubated that failed	100	100	35.7	92.3	66.7	100	20.0	0.0	-	100.0	20.0
Chicks fledged	0	0	15	1	5	0	12	8	-	0	5
Breeding success	**0**	**0**	**1.07**	**0.08**	**0.42**	**0**	**1.20**	**1.14**	-	**0.00**	**1.00**
Dalsetter	**2012**	**2013**	**2014**	**2015**	**2016**	**2017**	**2018**	**2019**	**2020**	**2021**	**2022**
Total nests											25
Incubating											20
% Incubating											80.0
% Incubated that hatched											80.0
% Hatched that b/2											43.8
% Incubated that failed											30.0
Chicks fledged											18
Breeding success											**0.90**
Sumburgh Head	**2012**	**2013**	**2014**	**2015**	**2016**	**2017**	**2018**	**2019**	**2020**	**2021**	**2022**
Total nests	139	138	150	135	142	148	151	156	86	139	123
Incubating	93	89	115	117	119	119	116	129	76	118	98
% Incubating	66.9	64.5	76.7	86.7	83.8	80.4	76.8	82.7	88.4	84.9	79.7
% Incubated that hatched	60.2	32.6	85.2	59.8	82.4	58.8	83.6	87.6	81.6	86.4	91.8
% Hatched that b/2	1.8	0	46.9	2.9	31.6	5.7	47.4	34.5	64.5	32.4	56.7
% Incubated that failed	84.9	100	20.9	71.8	43.7	72.3	17.2	20.2	23.7	33.1	19.4
Chicks fledged	14	0	132	33	79	34	139	127	81	85	111
Breeding success	**0.15**	**0**	**1.15**	**0.28**	**0.66**	**0.29**	**1.20**	**0.98**	**1.07**	**0.72**	**1.13**

Figure 1.7. Mean Kittiwake breeding success (chicks fledged per incubated nest) and standard errors at two to six standard monitoring sites per year, 1986–2022. In 2020, the Covid-19 lockdown restrictions meant that only Sumburgh Head and a reduced sample size of nests there could be monitored (open circle).



1.5a. Common Guillemot *Uria aalge* population monitoring

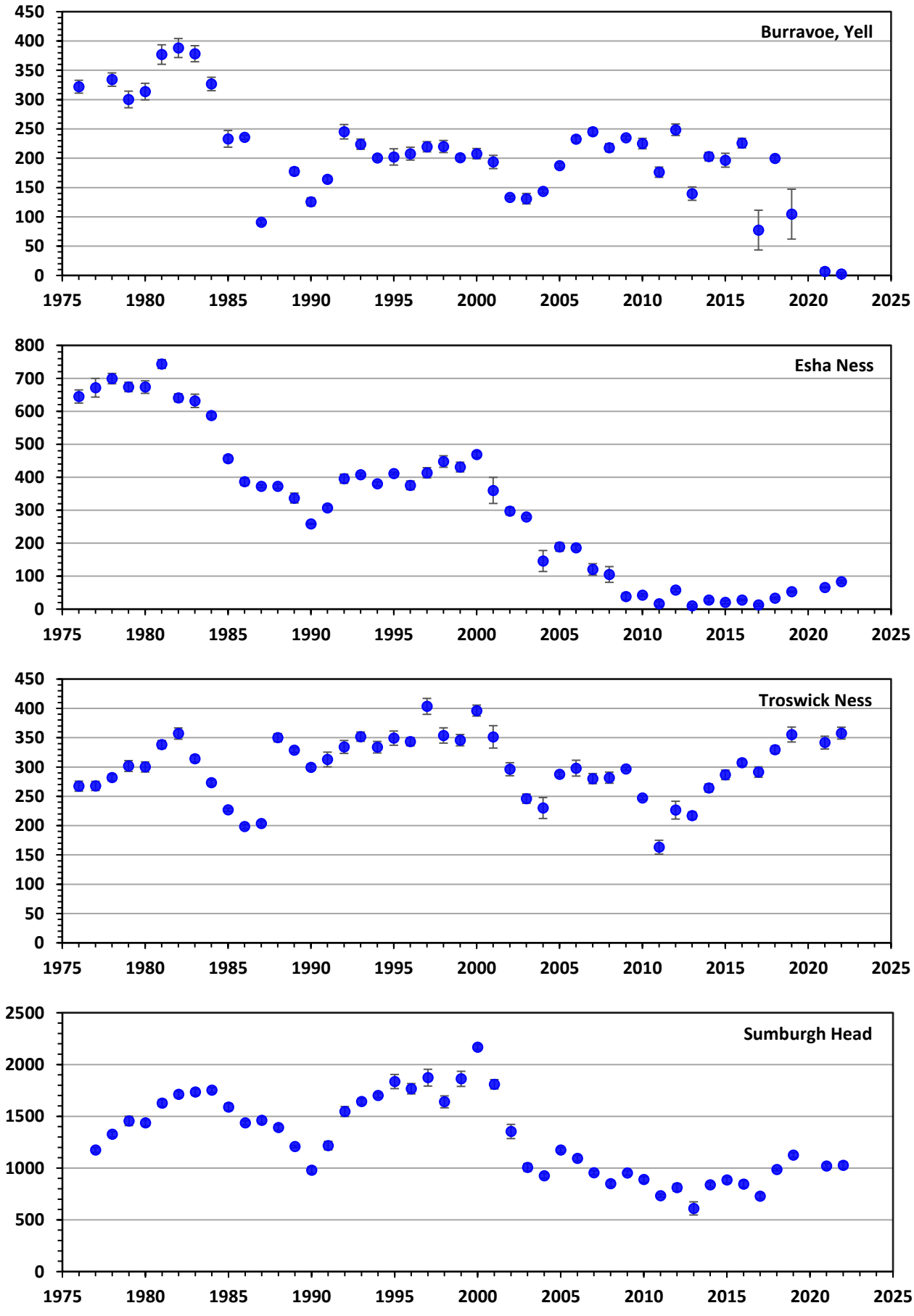
The mean population counts at all four monitoring sites were generally similar to those in 2021, with a small increase at Esha Ness, slight increase at Troswick Ness and Sumburgh Head, and a slight decrease at Burravoe (**Table 1.9, Figure 1.8**). Numbers at Burravoe remained extremely low, with a mean count of just two individuals, compared to seven in 2021 (**Table 1.9**). Here but not elsewhere, a pair of Ravens nest on the cliff very close to the Guillemot breeding ledges and it is possible, although not certain, that the unusual drop in Guillemot numbers at this site since 2019 (and potential future extinction of the colony) could be due to sustained harassment of adults and predation of eggs by Ravens. Whatever the true cause, the situation at Burravoe shows how seabird populations can change in size considerably in just a few years.

Since 1976, long-term changes in the mean population counts from the monitoring sites have been variable, with no consistent pattern shown across all sites (**Figure 1.7**). At Esha Ness, there has been near-continuous decrease in numbers since 1976, although with a slight increase now since 2017, whereas as at the other three sites numbers have been more fluctuating, with apparent stability since 2003, but then an increase since 2011 at Troswick Ness, and a decrease since 2016 to very low numbers now at Burravoe (**Figure 1.8**).

Table 1.9. Common Guillemot population counts summary statistics, 2021–22: total counts (n), range, mean, standard deviation (SD), standard error (SE) and % change since 2021 (% Ch). The population counting unit for Common Guillemot is individual birds. Sites are listed from north to south.

Colony	Unit	Year	n	Range	Mean	SD	SE	% Ch
Burravoe, Yell	Individuals	2021	5	0–29	7.0	12.57	5.62	
		2022	5	0–11	2.4	4.83	2.16	-65.7
Esha Ness	Individuals	2021	5	61–69	65.8	3.27	1.46	
		2022	5	71–92	83.0	9.51	4.25	26.1
Troswick Ness	Individuals	2021	5	311–371	341.6	24.33	10.88	
		2022	5	322–385	357.8	22.71	10.16	4.7
Sumburgh Head	Individuals	2021	5	942–1106	1019.2	59.68	26.69	
		2022	5	912–1097	1026.8	73.13	32.71	0.75

Figure 1.8. Mean population counts of Common Guillemots (individuals) and standard errors, at the four monitored sites, 1976–2022. Data for 2020 are lacking due to Covid-19 restrictions.



1.5b. Common Guillemot *Uria aalge* breeding success and chick diet monitoring

In 2022, the Sumburgh Head breeding success plot was checked from 18th April to 28th July. Monitoring was carried out every day during the main egg laying and chick fledging periods but occasionally was less than daily during the peak incubation period (mean interval between checks = 1.05 days, 18/4 to 28/7). The majority of monitoring including counts of individuals was done in the morning, starting between 0700 and 1000 BST. However, on rare occasions other work had to be prioritized (e.g., boat surveying) and visits were made later in the day.

Guillemot breeding success at the Sumburgh monitoring plot in 2022 was 0.65 chicks fledged per apparently incubating pair, above the long-term average of 0.55 and very similar to 2021, when it was 0.67 (**Table 1.10** and **Figure 1.9**). At the start of each plot check the total number of adults attending the site was recorded. As in previous years, at the start of the season the number of adults at the plot fluctuated greatly, for example from zero on 18th April up to 179 on 21st April, down to 9 on 24th April, back up to 170 on 29th April, down to 74 on 2nd May (**Figure 1.10**). Adult attendance remained high (>100 individuals) from 3rd May to 17th July, with an unusual late season peak of 214 adults on 7th July the peak count in 2022 (**Figure 1.10**). Numbers of adults decreased rapidly from 10th July onwards, with the last bird seen on 27th July (**Figure 1.10**).

The first egg was seen on 9th May, but the pair were apparently incubating from 7th May. Laying was then rapid (**Figure 1.11**), with the median laying date falling on the 15–16th May. As in 2021, six pairs were known to lose their eggs and to relay; however, without multiple frequent plot-checks every day, undetected egg loss and relaying is unavoidable. The first chicks apparently fledged on the evening of 5th July and the last chick on the evening of 27th July (**Figure 1.11**). Gulls and skuas were virtually absent around the colony and no chick predation was observed.

Table 1.10. Common Guillemot breeding parameters at Sumburgh Head, 2012–2022, including breeding success calculated as chicks fledged per apparently incubating pair. * = First date an egg was seen or apparent incubation was seen. Detailed monitoring was not possible in 2020 due to the Covid-19 lockdown restrictions.

	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022
Incubating pairs	140	98	122	135	132	130	134	129	-	132	130
First date an egg seen*	4/5	7/5	6/5	5/5	4/5	9/5	8/5	9/5	4/5	4/5	7/5
Median laying date	14/5	19/5	16/5	14/5	13/5	15/5	17-18/5	13-14/5	-	13-14/5	15-16/5
Chicks fledged	55	0	66	70	94	54	72	98	-	88	85
Breeding success	**0.39**	**0.00**	**0.54**	**0.52**	**0.71**	**0.42**	**0.54**	**0.76**	**-**	**0.67**	**0.65**

Figure 1.9. Common Guillemot breeding success at the Sumburgh Head monitoring plot, 1989–2022. Monitoring was not possible in 2020 due to the Covid-19 lockdown restrictions.

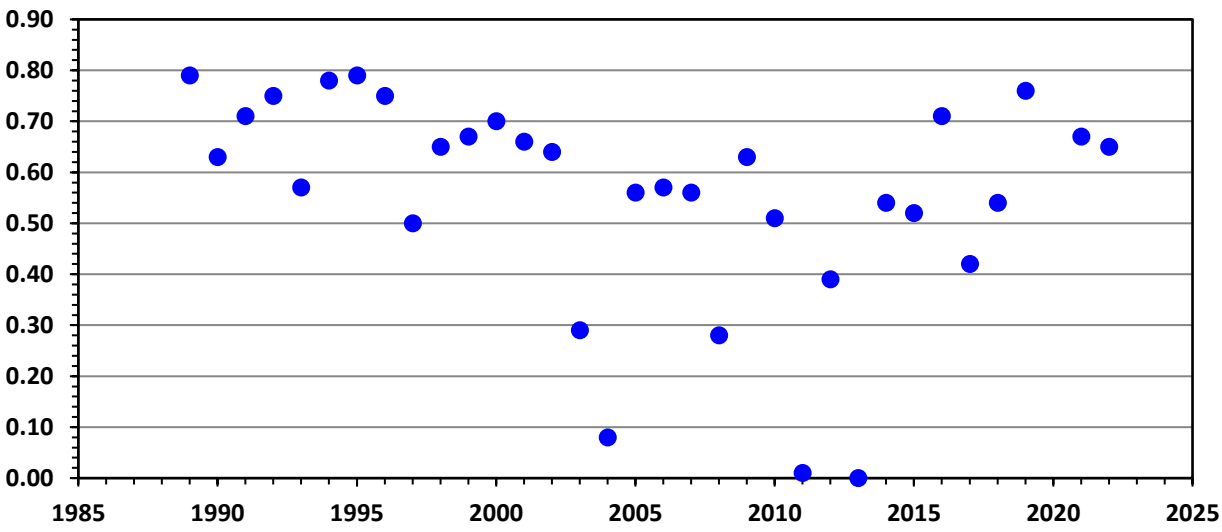


Figure 1.10. Total daily numbers of attending Common Guillemots (blue) and breeding pairs apparently with an egg or chick (red) at the Sumburgh Head breeding success monitoring plot through the 2022 breeding season.

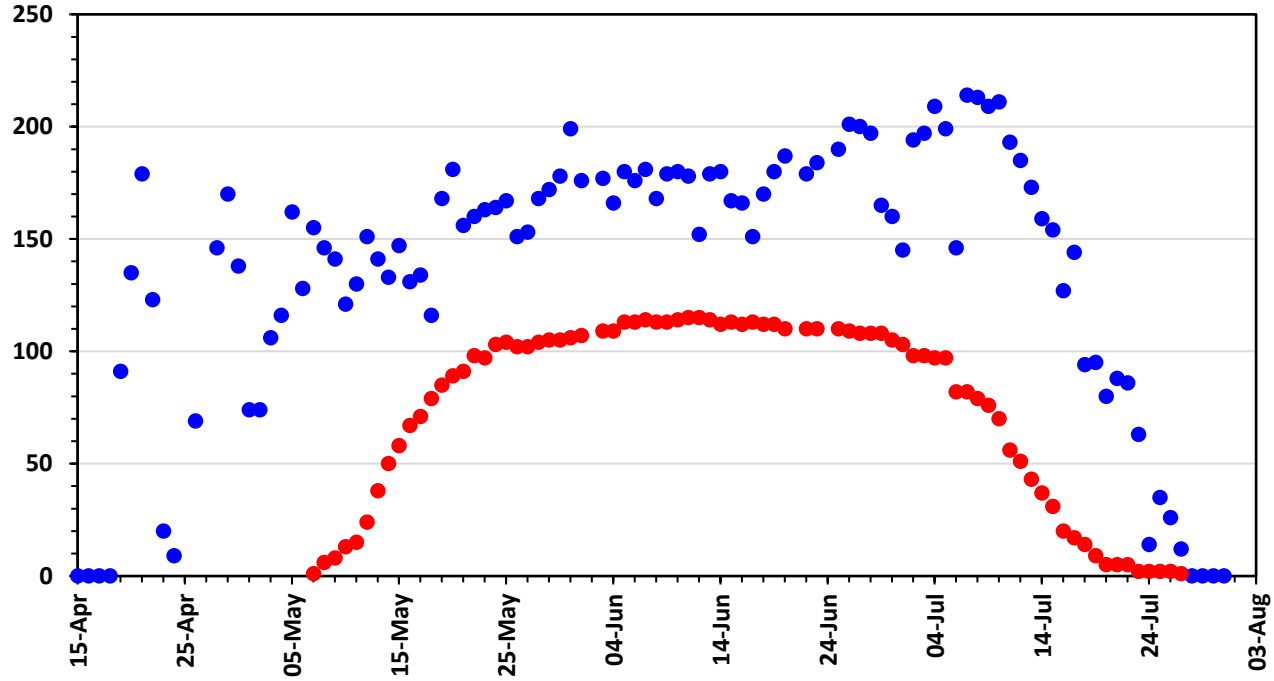
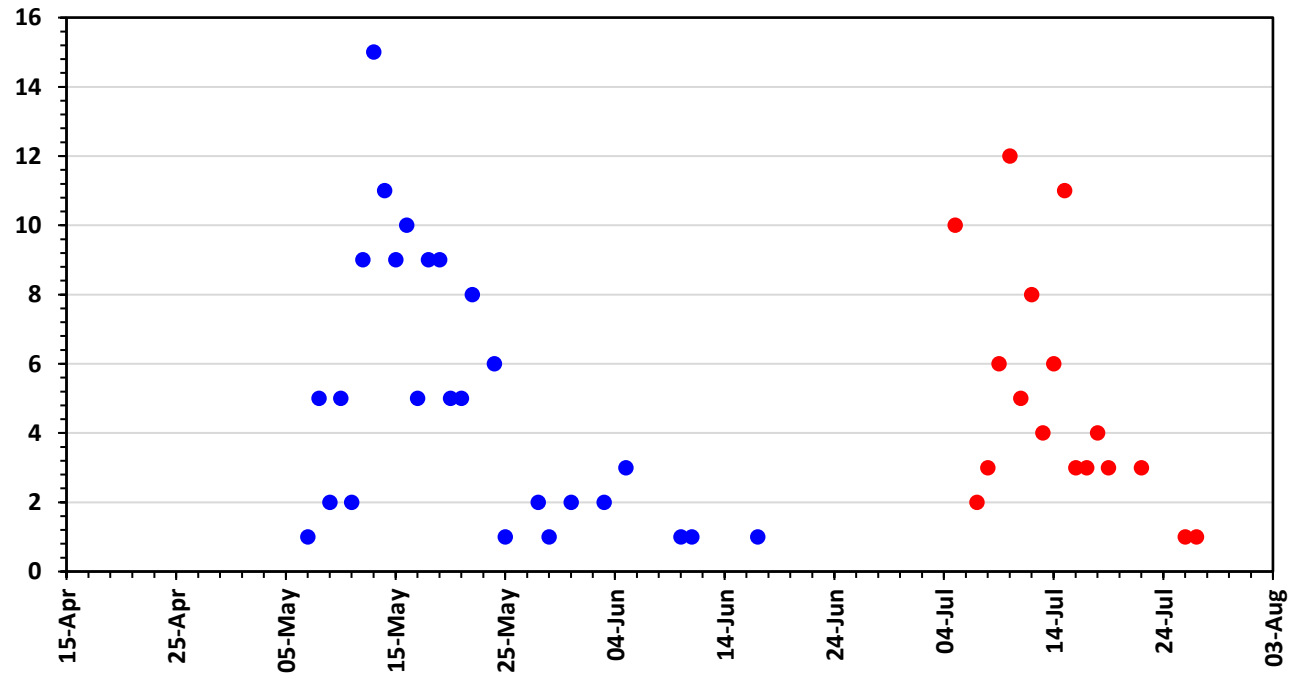


Figure 1.11. Approximate Common Guillemot egg laying and chick fledging phenology at the Sumburgh Head breeding success monitoring plot in 2022. Blue = the number of adults apparently incubating for their first day (eggs laid). Red = the number of chicks apparently fledged that day (chicks fledged).



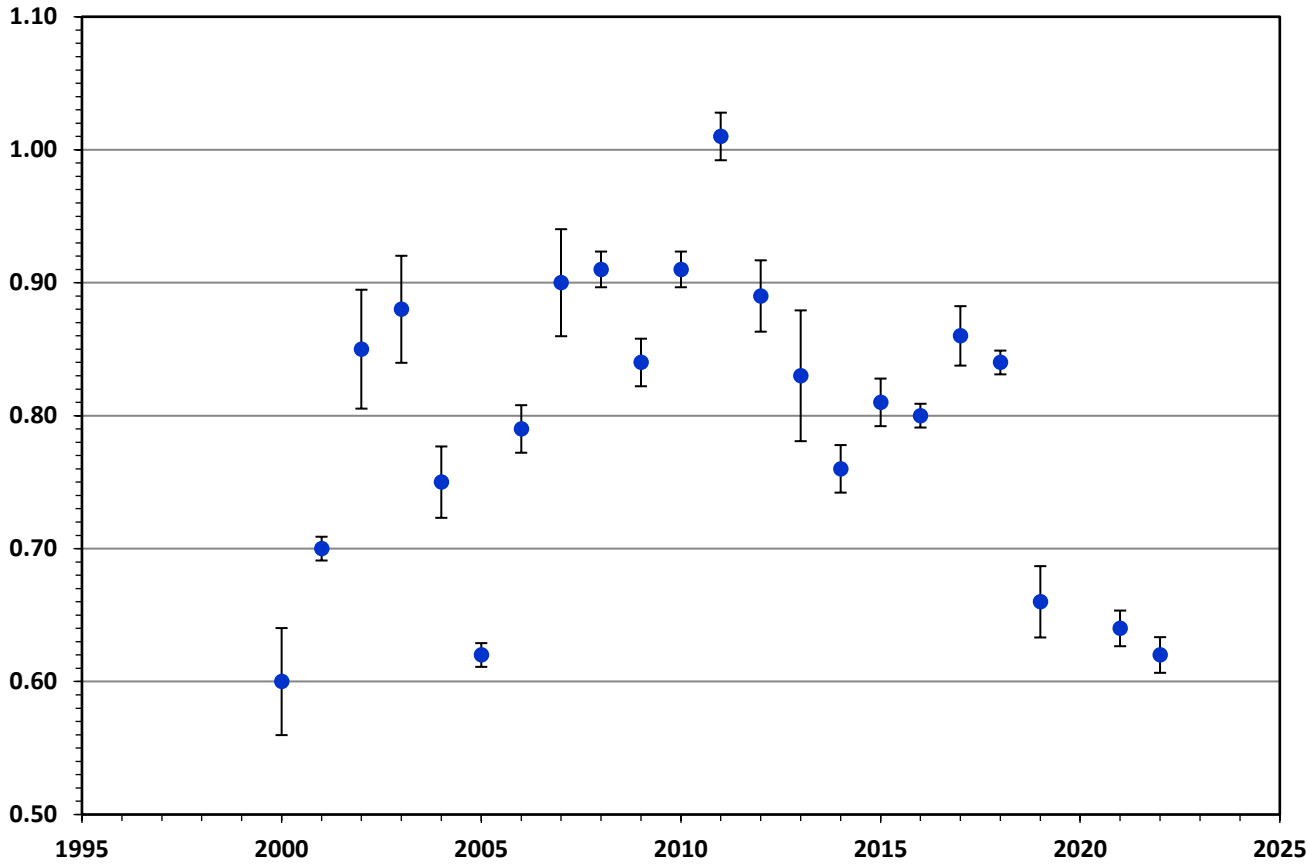
Egg laying and chick fledging phenology data from the Sumburgh Head breeding success monitoring plot (**Figure 1.11**) are approximate because of potential phenological inaccuracy. Egg laying and chick fledging are rarely directly observed, so for each breeding pair the timing of these events usually has to be inferred from the first time that an adult was seen apparently incubating (inferred egg laying date) and the first morning that the chick was absent from the plot and could have fledged the previous evening (inferred chick fledging date). Because the Sumburgh Head plot is monitored daily during the egg laying and chick fledging periods inaccuracy is reduced to ≤ 1 day.

In 2022, mean Common Guillemot attendance at the breeding success plot at Sumburgh Head during the five annual population monitoring counts was 181 individuals, 2.2% higher than 177 individuals in 2021 (**Table 1.11**). However, the mean number of breeding pairs in the breeding success plot during the five annual population monitoring counts was slightly lower in 2022 than in 2021 (111.4 pairs cf. 112.2 pairs), resulting in a slightly lower mean *k*-value in 2022 to that in 2021 (0.62 cf. 0.64; **Figure 1.12**). The results from 2022 and 2021 suggest a non-linear pattern of change comprising general increase from 2000 to 2011 and general decrease from 2011 to 2022 (**Figure 1.12**). Note there are no data for 2020 because fieldwork was prevented by the Covid-19 lockdown.

Table 1.11. The total number of adult Guillemots (site attendance), the total number of breeding pairs and *k*-values for the breeding success monitoring plot at Sumburgh Head on the dates of the five Guillemot population counts at Sumburgh in 2022, with means and standard deviations (SD).

Date	**1/6**	**3/6**	**6/6**	**9/6**	**11/6**	**Mean**	**SD**
Time (BST)	1425	1325	1725	1045	1030		
Total adult Guillemots in plot (n)	168	174	196	190	175	180.6	11.82
Total breeding pairs in plot (b)	107	109	113	113	115	111.4	3.29
k-value (b/n)	0.64	0.63	0.58	0.59	0.66	0.62	0.03

Figure 1.12 Mean *k*-values at the Common Guillemot breeding success plot from the five annual counts of individuals in the population monitoring plots and standard errors, 2000–2022.



Guillemot chick feeding watches were carried out on eight days in 2022, between 27th June and 6th July inclusive, at the standard chick diet monitoring plot at Sumburgh Head (which includes the breeding success plot). During watches, each adult Guillemot flying into the plot was checked to see if it was carrying a fish, and if so, the adult was watched to see if its fish was presented to a chick. Fish presented to chicks were identified to the lowest possible taxon. All watches lasted 90 minutes, from 0900 to 1030 BST.

In 2022, on each day that feeding watches were carried out, most fish presented to chicks were gadids (>57% each day) and sandeels occurred less frequently (<41% each day; **Figure 1.13**). In total, 371 fish were observed during feeding watches, with 82.5% being gadids and 16.4% sandeels, compared with 70.2% gadids and 28.0% sandeels in 2021 (**Figure 1.14**). Only one clupeid was seen, on 27th June, and it comprised 2.6% of the observed total prey observed that day (**Figure 1.13**). No other prey types were seen in 2022. During the feeding watches many chicks were present and very few were left unattended. The long-term pattern shown by this dataset is that the occurrence of gadids in the diet of chicks has increased across the years, the occurrence of sandeels has decreased, and other prey items remain consistently rare (**Figure 1.14**).

Figure 1.13. The percentages of different general prey types fed to Common Guillemot chicks at the Sumburgh Head monitoring plot during feeding watches on 8 dates in 2022 (date range: 27/6–6/7; total sample size of prey items presented to chicks = 371).

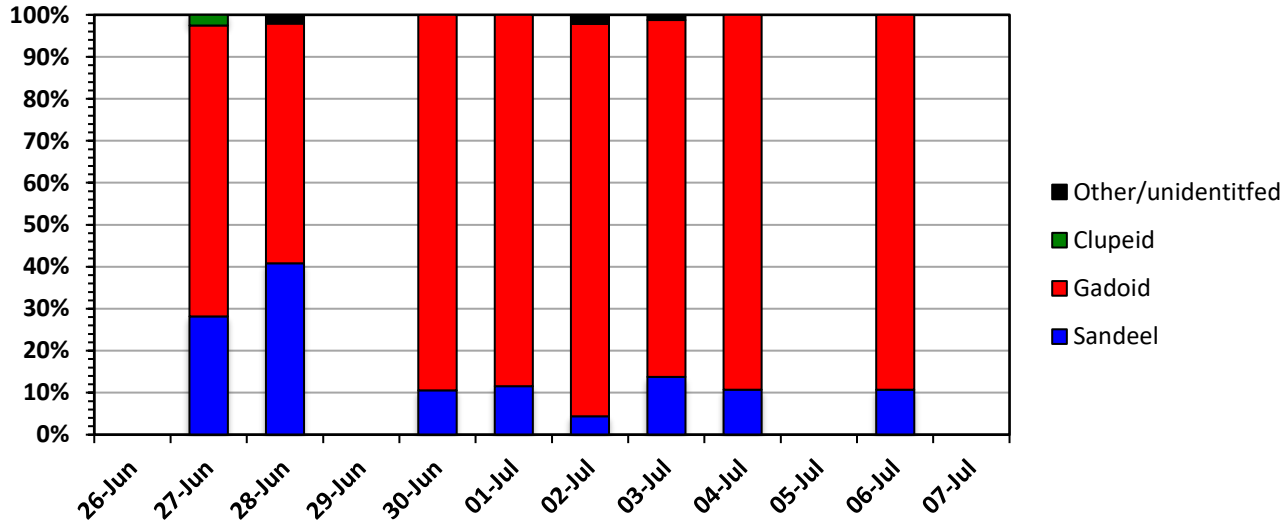
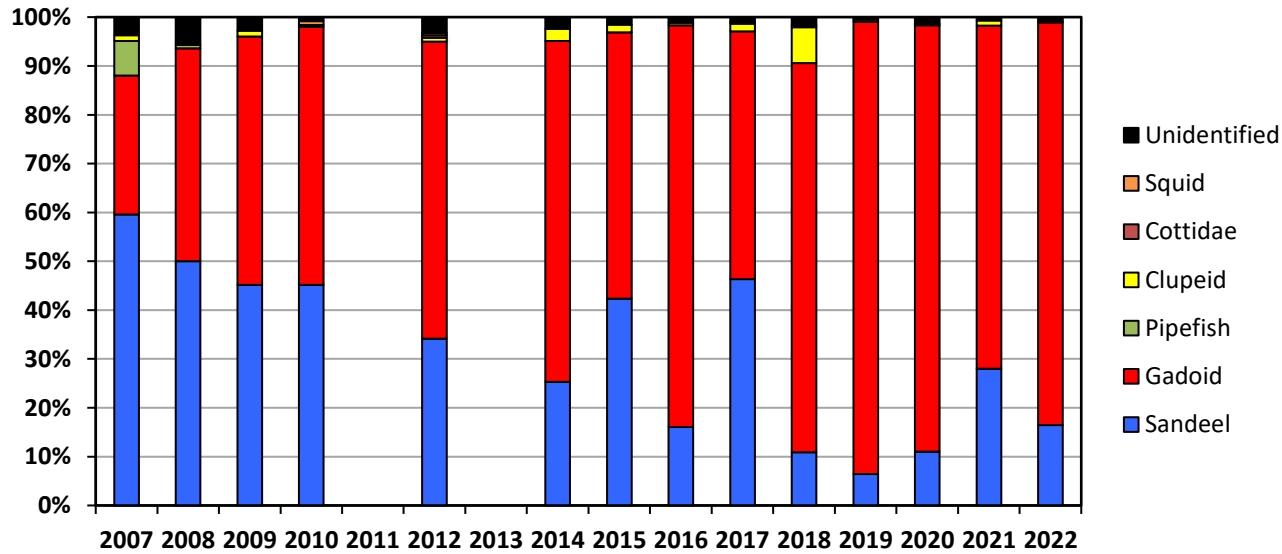


Figure 1.14. The percentages of general prey types fed to Common Guillemot chicks at the Sumburgh Head monitoring plot during feeding watches in 2007–2022. Prey sample sizes: 2007 = 324; 2008 = 140; 2009 = 250; 2010 = 250; 2012 = 401; 2014 = 629; 2015 = 515; 2016 = 790; 2017 = 509; 2018 = 492; 2019 = 202; 2020 = 354; 2021 = 282; 2022 = 371. There were too few chicks in 2011 and 2013 for meaningful observations.



1.6a. Razorbill *Alca torda* population monitoring

Mean population counts in 2022 were similar to those in 2021 at Burravoe and Sumburgh Head but numbers had increased at Eshaness and Troswick Ness (**Table 1.12**, **Figure 1.15**). There are comparatively few Razorbills at the monitoring sites now, except at Sumburgh Head where the annual mean count has always been more than 50 individuals (**Figure 1.15**). When the number of birds at a monitoring site is low (e.g., less than 20 individuals) then changes in population size calculated as a proportion (e.g., percentage changes) are comparatively large and appear far larger than changes at sites where there are higher numbers of birds (**Table 1.12**). However, the number of individuals at Burravoe is now at a critical level and this site could soon lose its Razorbills. The reason(s) for the recent decline at this site are unclear but a possible factor is harassment of adults and predation of eggs by a Raven pair that nest nearby on the cliff.

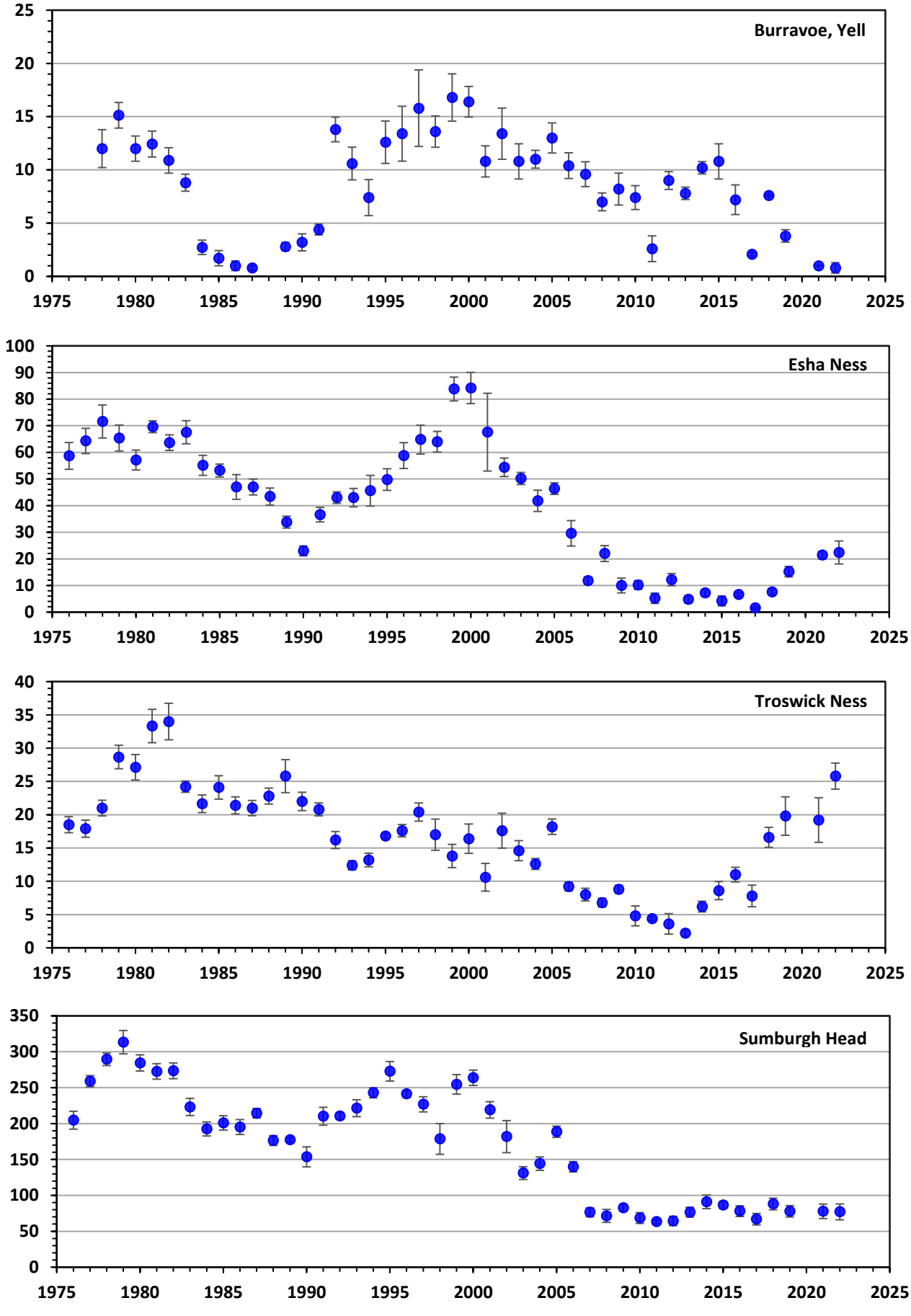
Since 1976, there has a been a broadly consistent general pattern of population change across the four monitoring sites - relatively high numbers in the late 1970s, a drop in numbers through the 1980s, an increase in the early to mid-1990s, followed by decreases thereafter (**Figure 1.15**). At Esha Ness numbers have then increased since 2017, and at Troswick Ness have increased since 2013, whereas at Sumburgh Head numbers have remained generally stable since 2007 (**Figure 1.15**). The 2022 data extended these general patterns at each site (**Figure 1.15**).

Table 1.12. Razorbill population counts summary statistics, 2021–22: total counts (n), range, mean, standard deviation (SD), standard error (SE) and % change since 2021 (% Ch). The population counting unit for Razorbills is individual birds. Sites are listed from north to south.

Colony	Unit	Year	n	Range	Mean	SD	SE	% Ch
Burravoe, Yell	Individuals	2021	5	1	1.00	0.00	0.00	
		2022	5	0–2	0.80	1.10	0.49	-20.0
Esha Ness	Individuals	2021	5	17–25	21.4	3.21	1.44	
		2022	5	11–33	22.4	9.66	4.32	4.7
Troswick Ness	Individuals	2021	5	11–31	19.2	7.50	3.35	
		2022	5	19–30	25.8	4.38	1.96	34.4
Sumburgh Head	Individuals	2021	5	58–113	77.8	22.60	10.11	
		2022	5	52–112	77.0	24.76	11.07	-1.0

Following the discovery in 2018 of a relatively large colony of Black Guillemots breeding on the jetty structures of Sullom Voe Terminal, it was considered possible that Razorbills might also breed there. However, a survey of the area on 15th June 2022, facilitated by Kristopher Wilson and carried out by Dougie Preston, found no evidence of breeding Razorbills.

Figure 1.15. Mean population counts of Razorbills (individuals) and standard errors, at the four monitored sites, 1976–2022. Data for 2020 are lacking due to Covid-19 restrictions.



1.6b. Razorbill *Alca torda* breeding success monitoring

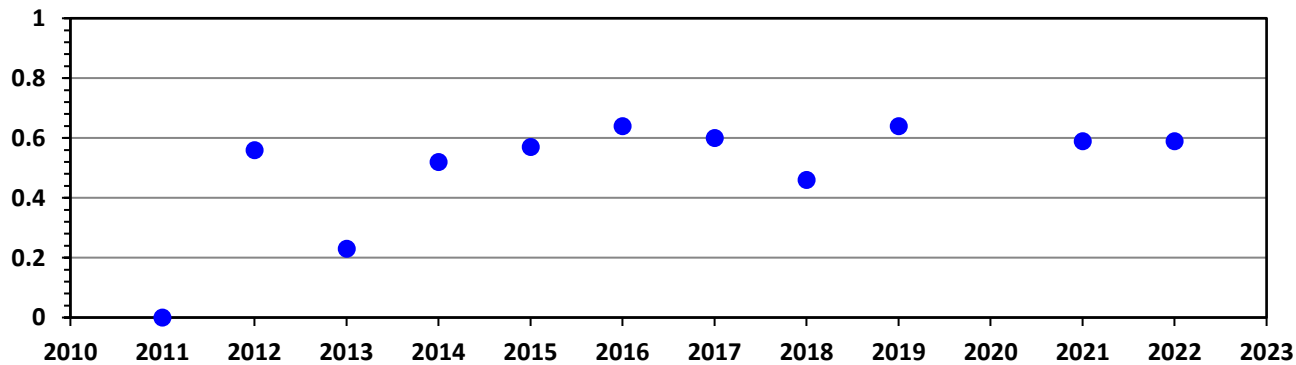
Monitoring of Razorbill breeding success using the marked photograph method began at Sumburgh Head in 2011. The presence of attending adults, adults sitting tight, and the presence of an egg or chick is recorded. At sites where no egg or chick is seen, pairs are assumed to have laid an egg if an adult is seen sitting tight on at least two consecutive monitoring visits (**Table 1.13**). An incubation period of 35 days, a minimum fledgling period of 15 days and the development of the juvenile plumage are all used to help assess probable hatching periods, chick ages and whether chicks could have fledged or not. The monitored nest sites are located all around Sumburgh Head, in areas where Razorbills are clearly visible from safe vantage points using a telescope, and for this species the whole site is treated as one breeding success plot.

Razorbill breeding success in 2022 was 0.59 chicks assumed fledged per breeding pairs (egg assumed laid), exactly the same as in 2021 (**Table 1.13**). The total number of breeding pairs in 2022 was 76 (= sites where an adult was seen sitting tight on at least two consecutive monitoring visits and/or an egg/chick was seen), compared with 92 breeding pairs in 2021 (**Table 1.13**). This, in part, was due to a slight reduction in the number of monitored nest sites in 2022 because of access limitations. Breeding success in 2022 was the joint third-highest recorded at the site (**Table 1.13**).

Table 1.13. Razorbill breeding success summary statistics at Sumburgh Head, 2012–22: the date range of site visits (Date range), total number of site visits (Visits), mean interval of days between visits (Mean interval), date that the first egg was seen or assumed to have been laid (First egg), number of nest sites where an egg and/or chick was seen (Egg/chick seen), number of nest sites where an adult was seen sat tight on two or more consecutive site visits but no egg or chick was ever seen (ST2 consecutive), total number of breeding pairs (Breeding pairs [=Egg/chick seen + ST2 consecutive]), number of sites where adults were only seen sat tight on one site visit or on two or more non-consecutive visits and were therefore assumed not to have bred (ST non-breeding), number of nest sites where chicks were seen (Chicks seen), total number of chicks assumed to have fledged (Chicks fledged) and breeding success (Breeding success [= Chicks fledged / Breeding pairs]). Monitoring was not possible in 2020 due to the Covid-19 lockdown restrictions.

	2012	**2013**	**2014**	**2015**	**2016**	**2017**	**2018**	**2019**	**2020**	**2021**	**2022**
Date range	3/5–26/7	3/5–6/8	7/5–26/7	6/5–6/8	3/5–17/8	4/5–1/8	5/5–6/8	3/5–30/7	-	29/4–1/8	29/4–3/8
Visits	42	41	26	38	54	51	47	51	-	39	42
Mean interval	2.0	2.4	3.1	2.4	2.0	1.7	2.0	1.8	-	2.3	2.3
First egg	3/5	8/5	7/5	9/5	5/5	9/5	5/5	5/5	-	10/5	2/5
Egg/chick seen	29	18	23	51	70	59	61	71	-	68	59
ST2 consecutive	25	25	35	16	11	9	20	15	-	24	17
Breeding pairs	54	43	58	67	81	68	81	86	-	92	76
ST non-breeding	5	15	10	15	16	14	7	9	-	8	9
Chicks seen	38	13	32	40	57	45	41	59	-	56	53
Chicks fledged	30	10	30	38	52	41	37	55	-	54	45
Breeding success	**0.56**	**0.23**	**0.52**	**0.57**	**0.64**	**0.60**	**0.46**	**0.64**	-	**0.59**	**0.59**

Figure 1.16. Razorbill breeding success at the Sumburgh Head monitoring plot, 2011–2022. Monitoring was not possible in 2020 due to the Covid-19 lockdown restrictions.



2. Population monitoring of Black Guillemots *Cepphus grylle*

Population counts of Black Guillemots in breeding plumage are made in late March and April (before egg laying) in dry conditions with little or no sea swell and little or no wind (at most an offshore wind of Force 4). Ideally, two counts of each of the SOTEAG standard monitoring sites are made each year. This is rarely possible however, as it requires many days in April with the right weather and sea conditions. During surveys, attempts are made to flush any birds on land out onto the sea, to join displaying groups that can be readily counted. The willingness of individuals to leave the land varies from day to day though and diminishes through April. Also, after about 09:00 displaying individuals tend to disperse, but the timing of this varies, with birds occasionally departing the colony areas unusually early. Counts are therefore subject to high variation, sometimes including low counts that are difficult to interpret.

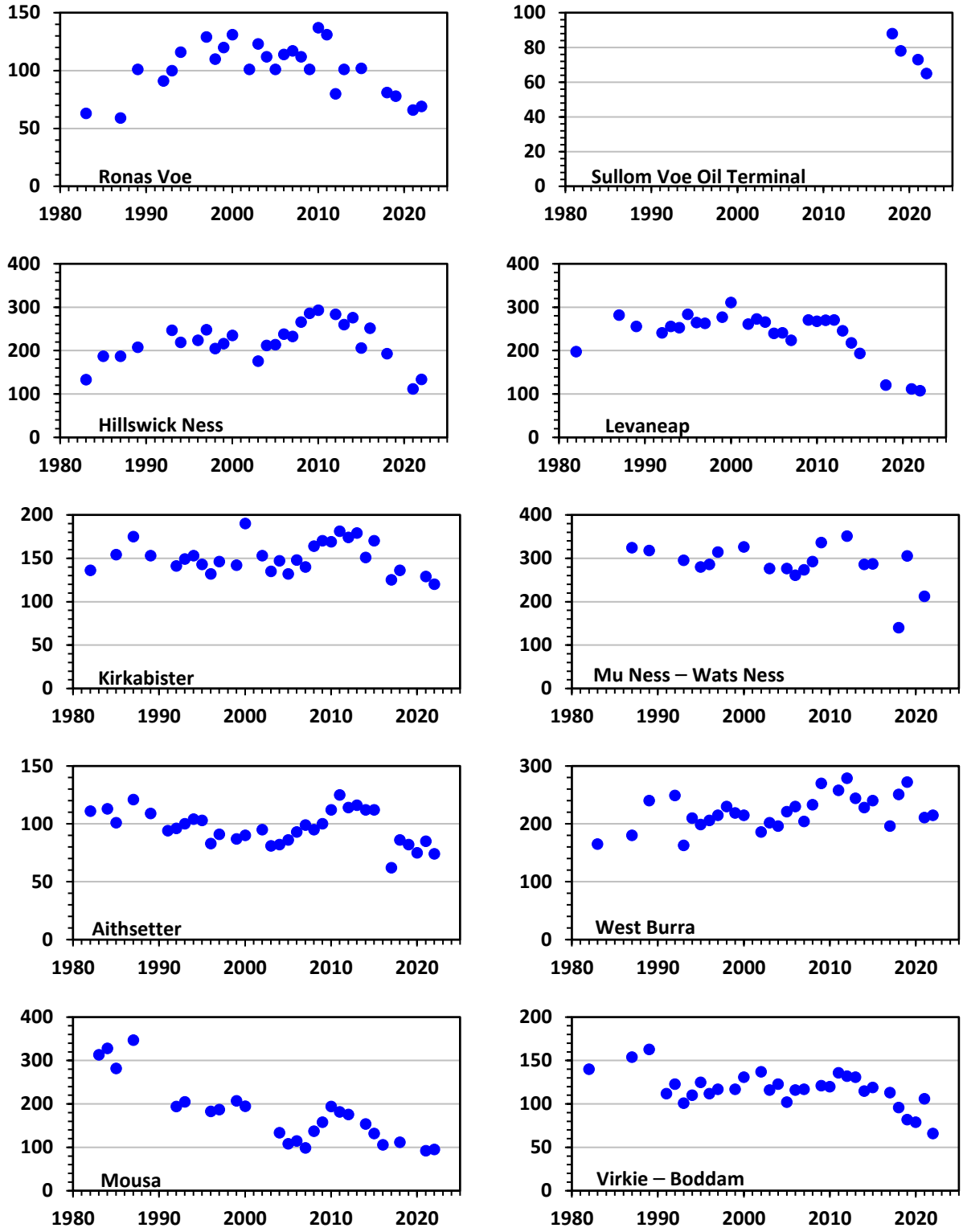
In 2022, the weather in April was mostly very wintery and the monitoring was carried out with the help of volunteers, so that multiple sites could be counted on the few days with suitable conditions. Following the discovery in 2018 of a comparatively large colony of Black Guillemots nesting on the Sullom Voe oil terminal jetties, the jetties were made a priority annual monitoring site. The jetties were surveyed on 20th April by Kristopher Wilson, who was extremely helpful and accommodating in facilitating the survey. The count of 65 birds in summer plumage was 10.9% lower than the count of 73 in 2021 (**Table 2.1**, **Figure 2.1**).

At the other monitoring sites, at Ronas Voe, Leveneap, Kirkabister, West Burra and Mousa the count totals in 2022 were similar to the most recent previous counts (<10% change; **Table 2.1**, **Figure 2.1**). At Hillswick Ness, numbers had risen since 2021 by 19.6% (**Table 2.1**, **Figure 2.1**). However, at Aithsetter the 2022 count was 12.9% lower than in 2021, and there was a substantial decreased recorded at Virkie–Boddam, where two counts were achieved in 2022 of 66 and 65 birds, compared with 106 in 2021 (**Table 2.1**, **Figure 2.1**). The developing long-term pattern at most sites is of general stability from 1990 to c.2010 but then a decrease in numbers (**Figure 2.1)**. The exceptions to this are Sullom Voe Oil terminal (consistent decrease since 2018), West Burra (gradual long-term consistent increase) and Mousa (long-term consistent decrease; **Figure 2.1**).

Table 2.1. Counts of Black Guillemots in full breeding plumage at ten standard monitoring sites, 2013–2022. Data presented are the highest early spring day counts for the year, with sites listed north to south. Percentage change (% ch.) is between 2022 and the most recent previous count. Sullom Voe Oil Terminal was first surveyed in 2018. In 2016 and 2017 Black Guillemot counts of sections of the Shetland coastline elsewhere, for the national seabird census, were prioritised over the standard monitoring sites (see 2016 and 2017 SOTEAG ornithological monitoring reports). In 2020, monitoring was limited by the Covid-19 lockdown.

	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	% ch.
Ronas Voe	101		102			81	78		66	69	4.5
Sullom Voe Oil Terminal						88	78		73	65	-10.9
Hillswick Ness	260	276	206	252		193			112	134	19.6
Levaneap	246	218	194			121			112	108	-3.6
Kirkabister	179	151	170		125	136			129	120	-6.9
Mu Ness – Wats Ness	285	286	287				305		212		
Aithsetter	116	112	112		62	86	82	75	85	74	-12.9
West Burra	244	228	240		196	251	272		211	215	1.9
Mousa		154	132	106		112			92	95	3.2
Virkie – Boddam	131	115	119		113	96	82	79	106	66	-37.7

Figure 2.1. Counts of Black Guillemots in full breeding plumage at the standard monitoring sites, 1982–2022. Data presented are the highest early spring day counts for the year, with sites listed from north to south. Monitoring at Sullom Voe Oil Terminal began in 2018.



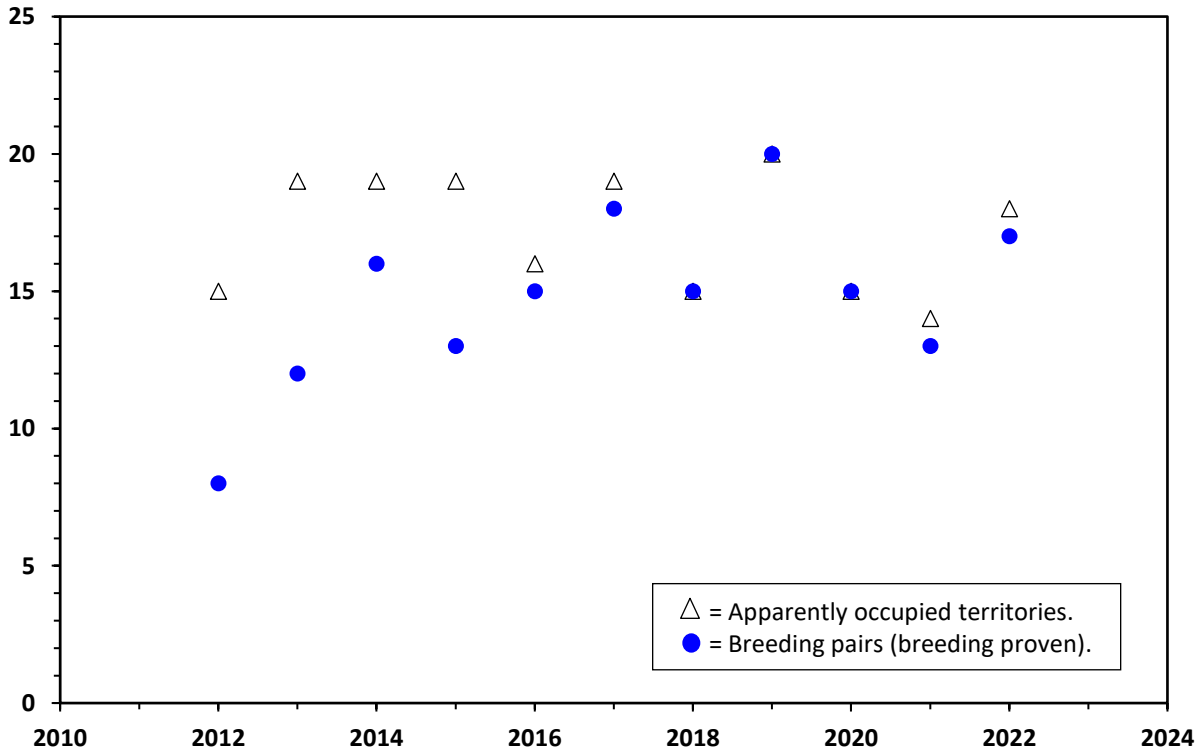
3. Population and breeding success monitoring of breeding Red-throated Divers *Gavia stellata*

The standard SOTEAG Red-throated Diver population and productivity study area of lochs, pools and moorland at Northmavine (between Sullom Voe and St Magnus Bay) has been surveyed since 1981. It is not surveyed every year because in some years, including 2022, other work such as Eider surveys take priority. The Red-throated Diver population study plot at Tingon, however, was monitored as usual in 2022.

Red-throated diver nesting activity at a study plot of 29 lochs at Tingon, in northwest Mainland, is monitored every year by the Shetland Amenity Trust under contract from SOTEAG. Monitoring began at Tingon in 2012 and two population monitoring visits are now made each year to the area (one in early June and one in early July). Prior to 2016, only one monitoring visit was made to this site per year (in June). In 2022, 17 breeding pairs (breeding proven) and one additional apparently active territory (fresh empty nest scrape but no other evidence of breeding) were found, giving a total of 18 apparently occupied territories (**Figure 3.1**).

From 2012 to 2014, the number of confirmed breeding pairs at Tingon increased sharply from 8 to 16, with the number of apparently occupied territories increasing from 15 to 19 (**Figure 3.1**). However, since then the number of confirmed breeding pairs and apparently occupied territories has fluctuated between 13 and 20 and remained relatively stable overall (**Figure 3.1**).

Figure 3.1. Red-throated Diver nesting activity in the Tingon study area, 2012–2022. The number of breeding pairs and apparently occupied territories was the same in 2018, 2019 and 2020 because no additional active territories were found where breeding was not proven.



4. Population monitoring of moulting Common Eiders *Somateria mollissima*

A Shetland-wide survey of moulting Common Eiders is carried-out every two to five years during the moult period (late July to early September). The most recent survey was in 2019 (see Miles & Mellor 2019) and the next survey was scheduled for 2022 but was not possible due to a variety of logistical limitations. The usual annual monitoring of north Yell Sound, Sullom Voe and south Yell Sound was completed in 2022, plus additional surveys were made of three of the large-scale areas immediately south of Yell Sound down the coast of east Mainland Shetland, that are counted during the Shetland-wide survey, namely: 1) Lunna to Gletness; 2) Gletness to Dales Voe; 3) Bressay Sound, Bressay and Noss. These additional three surveys aimed to help assess the potential impacts of HPAIV on Eider in 2022, after the period of high Eider mortality in March and April 2022 from HPAIV (see p.35) and high occurrence of the virus generally through the 2022 UK seabird breeding season.

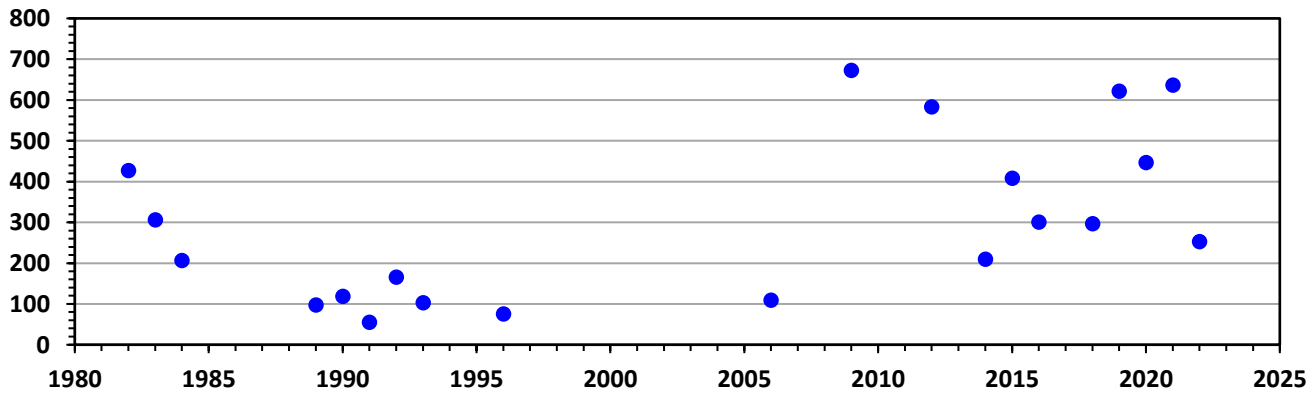
Eiders in north Yell Sound, Sullom Voe and south Yell Sound are counted once every year during the moult period. This monitoring has not always been annual and in some survey years it was not possible to count all these areas due to unsuitable weather and sea conditions. The first year of full coverage was 1988, when the total count was 426 birds (**Figure 4.1**). Since 1988, numbers have been highly variable in these areas, possibly due to local movements of flocks between different areas of coast, some outside the boundaries of the monitored region (**Figure 4.1**). However, the counts show a broad general pattern of relatively high numbers in the 1980s (>200 birds), low numbers in the 1990s and 2006 (<200 birds) and high but very variable numbers thereafter (between 200 and 700 birds; **Table 4.1**, **Figure 4.1**).

In 2022, the north Yell Sound mainland coast was surveyed on 4th August and the north Yell Sound islands on 11th and 14th August, Sullom Voe was surveyed on 11th August, and south Yell Sound on 28th July, all from a boat. In total, 17 birds were counted in north Yell Sound, comprising 2 males, 9 females and 6 juveniles, mostly located around Little Holm. In Sullom Voe, 153 birds were counted, comprising 51 males, 1 female, 2 juveniles and 99 females/juveniles ('brown' individuals), with most birds located around the jetty piers of the oil terminal. A total of 83 birds were counted in south Yell Sound, comprising 9 males, 31 females, 26 juveniles and 17 female/juveniles, with the vast majority in Dales Voe. The grand total of 253 birds counted across these survey areas in 2022 was 60.3% lower than in 2021 (637 birds) and low compared with many recent years, although not unprecedented in the post-2006 era, given the lowest count since 2006 was 210 birds in 2014 (**Table 4.1**, **Figure 4.1**).

Table 4.1. Counts of Eiders in Yell Sound and Sullom Voe during the moult period (late Jul to early Sep), 2012–2022. Totals are given only for the years with complete coverage of all three survey areas (- = no count).

Survey area	**2012**	**2013**	**2014**	**2015**	**2016**	**2017**	**2018**	**2019**	**2020**	**2021**	**2022**
North Yell Sound	12	-	0	8	5	-	15	19	24	13	17
Sullom Voe	72	118	59	160	210	146	156	123	69	228	153
South Yell Sound	499	494	151	240	86	55	126	480	354	396	83
Total	**583**		**210**	**408**	**301**		**297**	**622**	**447**	**637**	**253**

Figure 4.1. Total counts of Eiders in Yell Sound and Sullom Voe during the moult period (late July to early September), 1982–2022.



The additional three areas surveyed in 2022 were each counted once within the same moult period, Lunna to Gletness on 26th August, Gletness to Dales Voe on 17th August, and Bressay Sound, Bressay and Noss on 22nd August. Numbers of Eiders had approximately halved since 2019 (the most recent previous survey) in the Gletness to Dales Voe and Bressay Sound, Bressay and Noss areas, whereas in the Lunna to Gletness survey area numbers had approximately doubled since 2019 (**Table 4.2**).

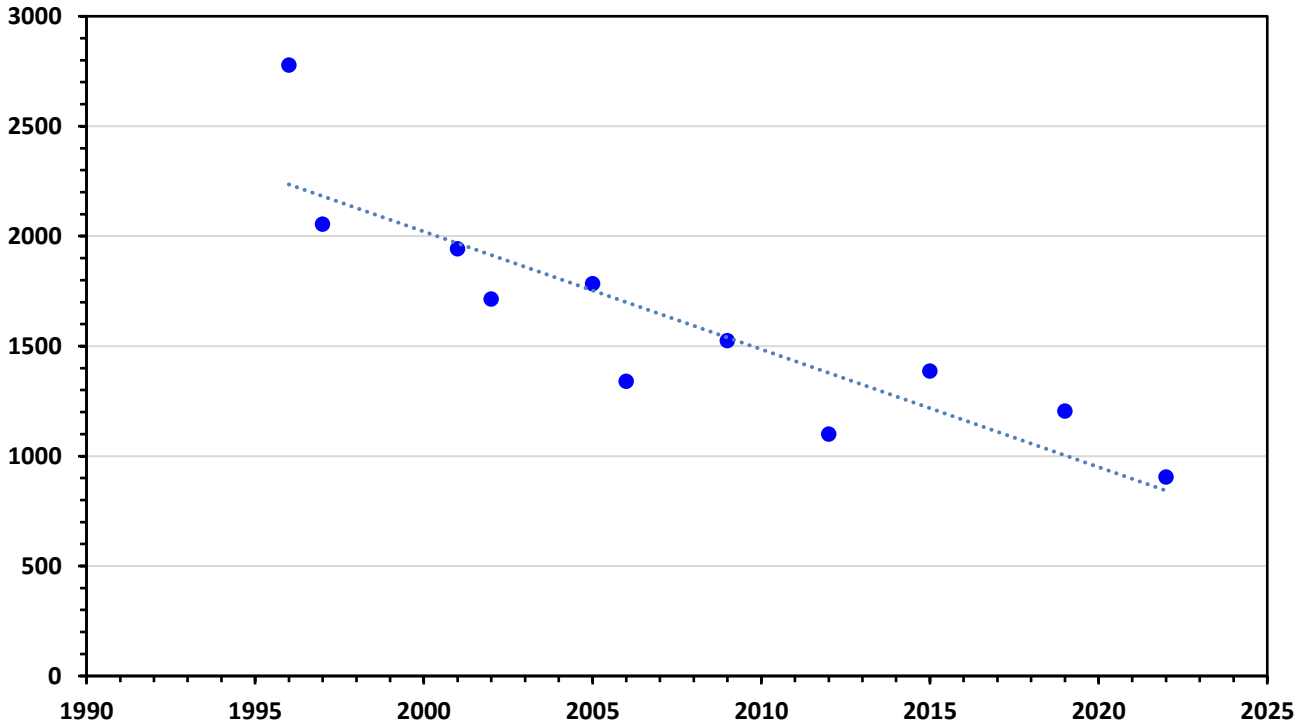
A decrease in numbers occurred between 2019 and 2022 in the north Yell Sound, south Yell Sound, Gletness to Dales Voe, and Bressay Sound, Bressay and Noss survey areas (**Table 4.2**), which is possibly indicative that in these areas Eiders were impacted by HPAIV in 2022. However, in contrast, numbers had increased in the Sullom Voe area and substantially increased in the Lunna to Gletness areas since 2019 (**Table 4.2**), so it is possible that rather than any effect of HPAIV, instead birds had simply moved to moult in different areas in 2022 compared with previous years.

The overall total count across all six areas surveyed in 2022 was 904 birds, a decrease of 24.9% since the previous survey in 2019 (1204 birds), but not of unusual or exceptional magnitude in the context of the long-term continuous decline in numbers recorded in these areas since 1996 (**Figure 4.2**). Therefore, overall, there was no evidence of an unusually high decline across these areas from the 2022 surveys or of changes in numbers that could be specifically attributed to HPAIV.

Table 4.2. Counts of Eiders during the moult period (late Jul to early Sep) in the survey areas counted in 2022, and previous counts in years when all six areas were surveyed, 1996–2022. Areas are listed north to south.

Survey area	**1996**	**1997**	**2001**	**2002**	**2005**	**2006**	**2009**	**2012**	**2015**	**2019**	**2022**
North Yell Sound	5	15	2	7	7	0	3	12	8	19	17
Sullom Voe	70	68	4	22	11	0	4	72	160	123	153
South Yell Sound	129	145	207	223	190	109	666	499	240	480	83
Lunna to Gletness	4	0	13	19	37	43	61	15	35	213	449
Gletness to Dales Voe	370	375	399	405	422	377	493	259	884	308	168
Bressay Sound, Bressay & Noss	2201	1451	1317	1039	1117	812	297	242	60	61	34
Total	**2778**	**2054**	**1942**	**1714**	**1784**	**1341**	**1524**	**1099**	**1387**	**1204**	**904**

Figure 4.2. Total counts of Eiders during the moult period (late July to early September) in the six survey areas surveyed in 2022 (listed in Table 4.2 above) for all years when all six areas were surveyed, 1996–2022.



5. Population monitoring of wintering seaduck and diving seabirds

The winter of 2021/22 in Shetland was one of the worst on record for storms and rough seas. The persistency of severe conditions was extreme, there were few opportunities for counting seaduck and diving seabirds, and only three of the usual six winter monitoring areas could be surveyed.

5.1. Bressay Sound and north Bressay

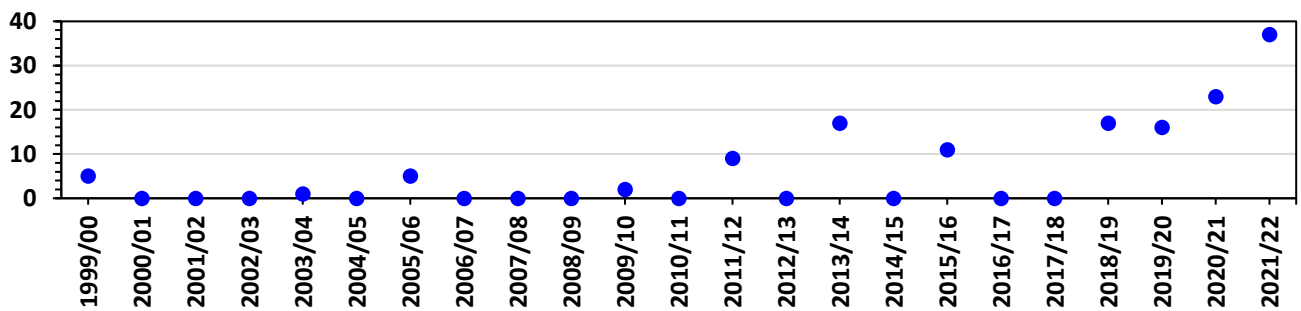
The Bressay Sound and north Bressay transect was surveyed on 7th February 2022 from MV *Seabird* with two observers. The survey began at 08:45 and finished at 11:15. The wind was westerly 0-2 knots, the sea was flat calm with no swell in Bressay Sound, but there was a heavy ripple to the southwest and northwest of Bressay and a 1m swell along the Bressay north coast. Cloud cover was complete (8/8) but visibility at sea level was excellent (>10km) and it remained dry throughout the survey.

Numbers of Great Northern Divers and Common Guillemots were unusually high during the 2021/22 survey, with both up by >60% compared with 2020/21 (**Table 5.1**, **Figure 5.1**). Counts of Common Scoter, Slavonian Grebe and Puffin as usual remained very low and this time there were no records of Velvet Scoter (3 in 2020/21) or of Little Auk (last record in 2016/17; **Table 5.1**). The counts of each of the other species were lower than during the 2020/21 survey but within the normal range of the long-term variation in the numbers seen of each, which in all cases has been high across the years (**Table 5.1**).

Table 5.1. Counts of seaduck and diving seabirds seen in Bressay Sound and along the north Bressay coastline during winter boat count surveys, winters of 2013/14 to 2021/22.

Winter	**2013/14**	**2015/16**	**2016/17**	**2017/18**	**2018/19**	**2019/20**	**2020/21**	**2021/22**
Date	**19/2**	**26/2**	**13/12**	**14/12**	**9/1**	**14/2**	**26/1**	**7/2**
No. of observers	**2**	**2**	**2**	**2**	**3**	**3**	**3**	**2**
Common Eider	150	144	109	94	94	102	111	88
Long-tailed Duck	127	78	97	31	61	33	73	42
Common Scoter	3	2	3	0	1	4	3	1
Velvet Scoter	0	0	0	0	0	0	3	0
Goldeneye	2	20	2	3	0	4	10	11
Red-breasted Merganser	16	30	28	31	36	67	58	39
Red-throated Diver	9	8	3	4	6	9	23	10
Great Northern Diver	17	11	26	31	17	16	23	37
Slavonian Grebe	0	4	3	3	3	5	5	2
Cormorant	5	3	4	28	19	22	16	5
Shag	150	221	357	681	356	345	493	318
Common Guillemot	20	12	6	3	9	24	23	39
Razorbill	7	13	11	1	2	10	16	15
Black Guillemot	326	283	279	193	374	104	323	256
Little Auk	0	0	2	0	0	0	0	0
Puffin	0	1	0	0	1	0	1	1
Total	**887**	**830**	**930**	**1103**	**981**	**745**	**1181**	**1181**

Figure 5.1. Counts of Great Northern Divers in the Bressay Sound and north Bressay survey area, winters of 1999/00 to 2021/22.



5.2. Whiteness Voe to Skelda Voe, west Mainland

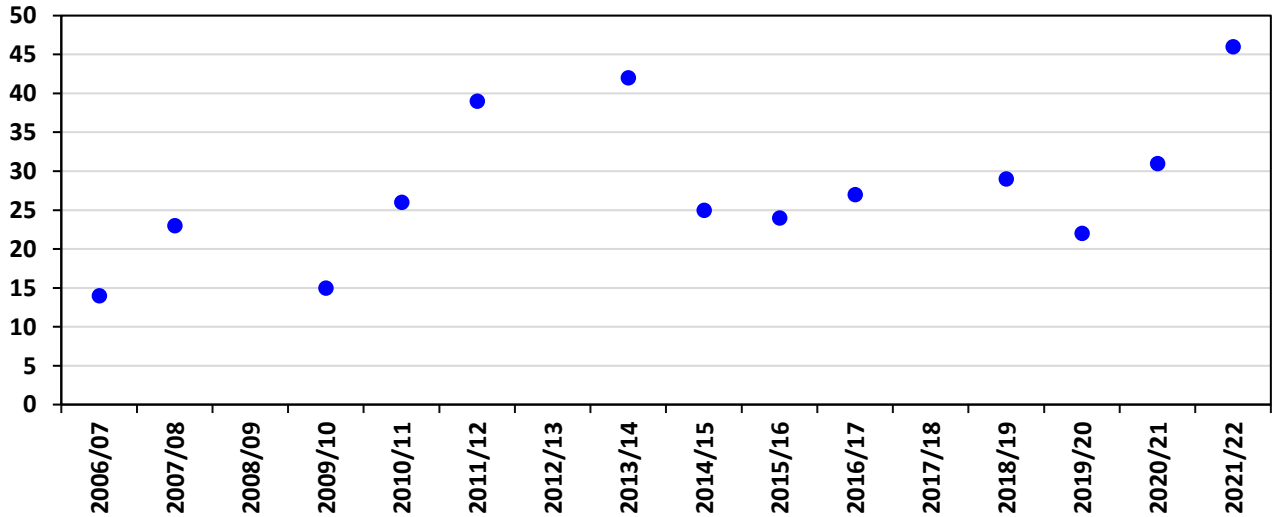
The Whiteness Voe to Skelda Voe area was surveyed on 18th February 2022 from land by two observers. The survey began at 09:30 and finished at 16:00. The wind was slight and there was a low swell offshore. Cloud cover was partial (4/8), it remained dry, and visibility was good (>10km).

Counts of Common Eiders, Great Northern Divers, Common Guillemots and Black Guillemots were higher during the 2021/22 survey than in 2020/21 (**Table 5.2**), with the count of Great Northern Divers the highest on record and up by 48% since last year (**Figure 5.2**). Numbers of Slavonian Grebes, Long-tailed Ducks, Goldeneye, Red-breasted Mergansers and Cormorants were all low in comparison to recent winters, with counts of the latter two the lowest ever recorded (**Table 5.2**). Shag and Black Guillemot numbers were within the normal variation for these species (numbers of both highly variable), while Red-throated Diver, Razorbill and Velvet Scoter numbers remained typically low (**Table 5.2**).

Table 5.2. Counts of seaduck and diving seabirds seen in the Whiteness Voe to Skelda Voe survey area during land-based winter surveys, winters of 2013/14 to 2021/22.

Winter	**2013/14**	**2014/15**	**2015/16**	**2016/17**	**2018/19**	**2019/20**	**2020/21**	**2021/22**
Date	**7/2**	**15/2**	**12/1**	**11/2**	**11/2**	**29/1**	**24/1**	**18/2**
Common Eider	42	134	16	94	42	61	40	100
Long-tailed Duck	23	20	12	12	5	2	7	7
Common Scoter	2	0	1	0	0	0	0	0
Velvet Scoter	0	0	0	0	0	0	2	3
Goldeneye	28	15	2	9	13	10	14	4
Red-breasted Merganser	188	109	72	96	110	106	110	66
Goosander	1	0	0	4	4	1	0	0
Red-throated Diver	3	0	2	3	2	1	7	4
Black-throated Diver	1	0	0	0	0	1	1	0
Great Northern Diver	42	25	29	27	29	22	31	46
White-billed Diver	0	0	0	0	1	0	0	0
Slavonian Grebe	57	66	23	69	38	44	34	31
Cormorant	27	8	0	7	1	39	3	0
Shag	127	128	146	99	71	148	124	112
Common Guillemot	76	1	26	1	11	2	0	14
Razorbill	11	4	4	8	11	3	28	7
Black Guillemot	106	81	61	117	80	60	53	110
Little Auk	0	0	23	0	0	0	0	0
Puffin	1	1	5	2	0	0	0	0
Total	**735**	**592**	**422**	**548**	**548**	**500**	**454**	**504**

Figure 5.2. Counts of Great Northern Divers in the Whiteness Voe to Skelda Voe survey area, winters of 2006/07 to 2021/22.



5.1. Hascosay, Bluemull and Colgrave Sounds, south Unst and Basta Voe.

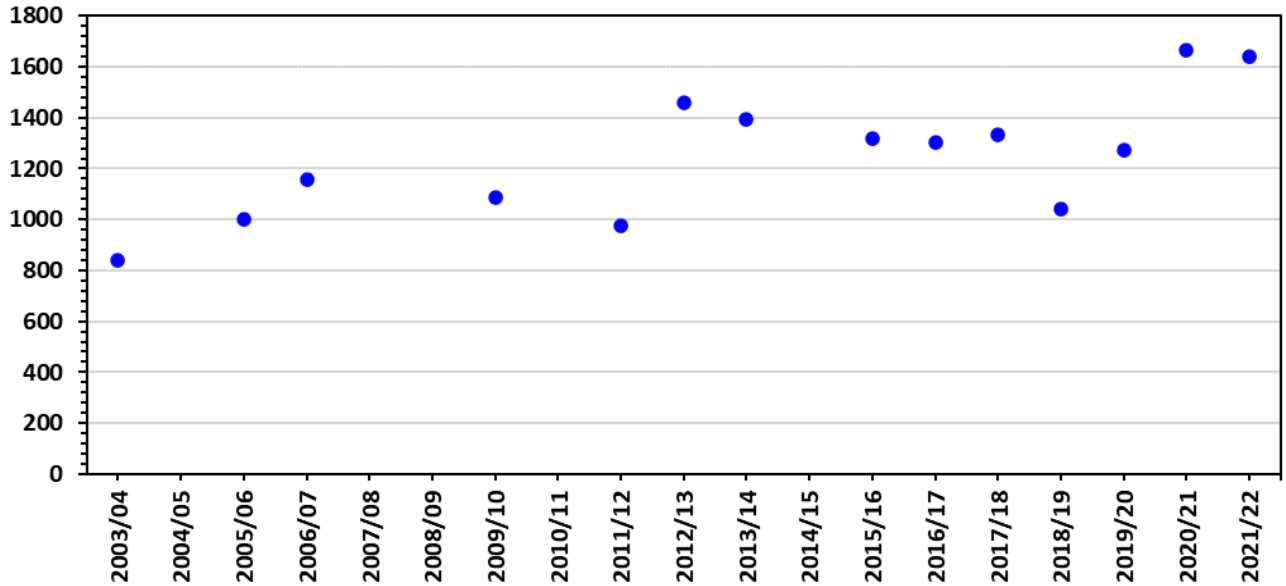
The 2021/22 winter survey of the Hascosay, Bluemull and Colgrave Sounds, south Unst and Basta Voe transect was done on 19th February 2022 from MV *Seabird* with three observers. Persistent severe weather conditions had prevented any form of survey of this area earlier in the winter, and on 19th February conditions were, unfortunately, highly variable and the smallest species and those tending to swim low in the water could not be counted accurately (counts of grebes, Cormorants, Shags, Black Guillemots, Puffins and Little Auks had to be omitted). The survey began at 10:30 and finished at 15:25. It was mostly dry and sunny but with occasional fast-moving squalls, during which there were heavy snow showers and cloud cover changed from none to full (0/8 to 8/8). The wind was highly variable, mostly northwesterly force 3 or less, but sometimes above force 6 during the most severe squalls. Sea conditions thus were also very variable. The most sheltered areas were calm, but elsewhere there were small waves, with large waves in the most exposed areas and even some white water lifting up during the periods of snow and high winds.

Numbers of Common Guillemots in the Hascosay, Bluemull and Colgrave Sounds and the south Unst survey area were up compared with the 2020/21 survey (41 cf. 12) and the number of Common Eiders and Red-breasted Mergansers remained high and similar to the 2020/21 counts (**Table 5.3**; **Figure 5.3**). Compared with the 2020/21 survey there were decreases, however, in the numbers of Long-tailed Ducks (-32.5%), Goldeneyes (-86.7%), Red-throated Divers (-42.9%) and Great Northern Divers (-60.6%). The other species recorded during the 2021/22 survey tend to be seen only irregularly in the area and in low numbers, although three King Eiders and a new (first-winter) White-billed Diver were particularly unusual (**Table 5.3**). All in all, the severity of the 2021/22 winter was particularly challenging, it was not a huge surprise to find that the numbers of birds in this area were somewhat unusual, and this was probably caused by shifts in location driven by the persistent extreme weather and sea conditions.

Table 5.3. Sum total counts of seaduck and diving seabirds seen in Hascosay, Bluemull and Colgrave Sounds and the south Unst survey area during winter boat count surveys, winters of 2013/14 to 2021/22. (- = Species could not be surveyed accurately so counts omitted.)

Winter	**2013/14**	**2015/16**	**2016/17**	**2017/18**	**2018/19**	**2019/20**	**2020/21**	**2021/22**
Survey date	**18/2**	**17/1**	**16/2**	**2/1**	**28/2**	**18/12**	**28/1**	**19/2**
No. observers	**3**	**3**	**3**	**3**	**3**	**4**	**3**	**3**
Common Eider	1394	1319	1305	1335	1042	1273	1663	1638
King Eider	2	0	0	1	0	0	0	3
Long-tailed Duck	720	707	930	764	772	668	799	539
Common Scoter	4	2	0	2	18	2	26	1
Velvet Scoter	1	0	0	0	2	4	3	1
Surf Scoter	0	0	1	1	0	0	0	0
Goldeneye	0	51	0	1	0	0	15	2
Red-breasted Merganser	20	33	13	32	7	11	26	25
Goosander	0	0	0	0	0	0	1	0
Red-throated Diver	12	0	21	9	29	11	14	8
Great Northern Diver	18	13	32	28	28	16	66	26
White-billed Diver	0	2	1	1	1	1	0	1
Slavonian Grebe	0	0	0	1	0	0	0	-
Cormorant	157	261	180	351	128	227	192	-
Shag	306	808	637	1480	433	1260	1057	-
Common Guillemot	13	6	8	0	6	10	12	41
Razorbill	1	0	1	0	0	0	6	0
Black Guillemot	364	451	379	645	415	421	530	-
Little Auk	0	1	0	0	0	0	0	-
Puffin	0	1	0	0	0	0	0	-
Total	**2974**	**3655**	**3504**	**4651**	**2881**	**3904**	**4410**	**2285**

Figure 5.3. Total counts of Common Eider in Hascosay, Bluemull and Colgrave Sounds and the south Unst survey area during winter boat count surveys, winters of 1978/79 to 2021/22 (the first standardised survey of the South Unst area was the winter of 2003/04).



Numbers of Red-breasted Mergansers counted in the Basta Voe survey area during the 2021/22 survey were very similar to the previous winter, with 50 in 2022 compared with 52 in 2021 (**Table 5.4**). Numbers of all the other species counted during the 2021/22 survey were much lower; but counts of these species have been highly variable across the years, and the 2021/22 survey counts and changes in numbers since the previous survey were within this normal variation (**Table 5.4**).

Table 5.4. Counts of seaduck and diving seabirds in Basta Voe, Yell, during winter boat count surveys, winters of 2011/12 to 2021/22. (- = Species could not be surveyed accurately so counts omitted.)

Winter	**2011/12**	**2015/16**	**2016/17**	**2017/18**	**2018/19**	**2019/20**	**2020/21**	**2021/22**
Survey date	**22/1**	**17/1**	**16/2**	**2/1**	**28/2**	**18/12**	**28/1**	**28/1**
No. of observers	**2**	**3**	**3**	**3**	**3**	**4**	**3**	**3**
Common Eider	1	0	2	2	2	0	0	8
Long-tailed Duck	1	0	0	0	0	1	0	0
Goldeneye	0	0	1	1	1	2	7	0
Red-breasted Merganser	33	47	7	7	7	41	52	50
Goosander	0	4	0	0	0	0	1	0
Red-throated Diver	7	6	3	3	30	2	9	3
Great Northern Diver	2	5	0	8	1	3	11	8
Cormorant	48	7	1	15	0	0	1	-
Shag	125	23	10	93	8	13	27	-
Slavonian Grebe	0	0	0	0	0	5	0	-
Common Guillemot	0	9	2	0	6	1	0	0
Razorbill	0	0	2	0	0	0	0	0
Black Guillemot	91	46	67	93	70	63	107	-
Total	**308**	**147**	**98**	**222**	**125**	**131**	**215**	**69**

6. The Shetland Beached Bird Survey

The Shetland-wide monthly beached bird survey has operated continuously since March 1979 and is carried out by SOTEAG staff and local volunteers. All seabird corpses down to a single wing with all primary feathers present are identified to species, aged externally as far as possible and examined for oil contamination. Samples of oiled plumage or oil residues found on beaches are analysed by FUGRO. The molecular structure of an oil sample is quantified and cross-checked with a global reference database ('fingerprinting' analysis), with the aim being to identify the origin and source of the oil.

In 2022, the beached bird survey was done every month. However, the outbreak of HPAIV in seabirds across Shetland and the UK meant the following minor alterations were made to the survey methodology in order to eliminate any possibility of human infection (low risk but very high consequence). In May, June and July the local volunteer team did not participate in the survey. In May, the survey was done entirely by SOTEAG staff (meaning several days each of additional beaches work) wearing full PPE to handle corpses. In June and July, the survey was again done entirely by SOTEAG staff, but no birds were handled at all, and a spot of paint was used to mark corpses to avoid double-counting. Fluorescent-coloured paint was deliberately used for this, as an indicator of potential danger to other beach users, who would hopefully then avoid any contact between corpses and themselves, their children or their dogs. In August and the months thereafter, the volunteers returned to the survey, but everyone continued to use the 'paint-spot' method with no birds handled. The SOTEAG staff and volunteers continued to look for oil on corpses and beaches throughout the year, but due to HPAIV and the necessary methodological alterations, from June onwards oil inspection was done purely by eye (no in-hand corpse examination) and no oil samples were collected for fingerprinting analyses. The Shetland Beached Bird survey remains unique, as the only county-wide survey in the UK to systematically measure monthly seabird corpse levels around the coast, and proved extremely useful for quantifying the effects of HPAIV on different species in 2022.

The number of seabird corpses and oiled seabird corpses found per km surveyed has generally decreased across the years (1979-2022), with the former remaining low (<3 corpses/km) since 2003, except for in 2022, and the latter remaining very low (<0.2 oiled corpses/km) since 1998 (**Figure 6.1**). The 2022 survey results continued the general recent pattern of very low oiled seabird occurrence per year, but the total number of seabird corpses found in 2022 was exceptionally high because of the HPAIV pandemic and relatively extreme mortality in Eiders, Gannets, Great Skuas and Common Guillemots (**Figure 6.1**, **Table 6.1** & **Table 6.2**).

Figure 6.1. Total seabird corpses found per km surveyed (red) and oiled seabird corpses found per km surveyed (blue) during the Shetland beached bird survey, 1979 to 2022.

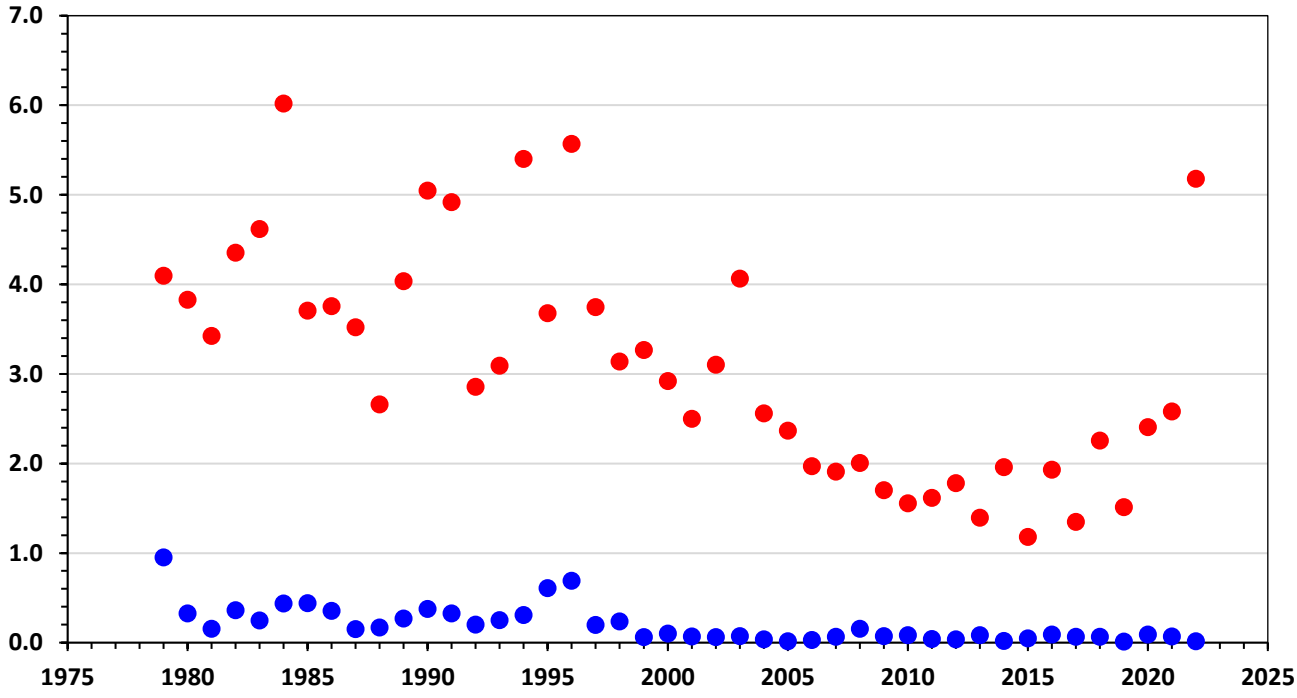


Table 6.1. Annual summary statistics from the Shetland beached bird survey, 2012 to 2022. Km = total kilometers surveyed, Corpses = total number of corpses found, Oiled = total number of oiled corpses found, % Oiled = percentage of all corpses that were oiled, Corpses/km = number of corpses found per kilometer surveyed [Corpses/Km], Oiled/km = number of oiled corpses found per kilometer surveyed [Oiled/Km].

Year	Km	Corpses	Oiled	% Oiled	Corpses/km	Oiled/km
2012	579.2	1031	21	2.04	1.780	0.036
2013	581.1	811	49	6.04	1.396	0.084
2014	587.5	1152	11	0.96	1.961	0.019
2015	585.2	691	27	3.91	1.181	0.046
2016	389.4	752	35	4.65	1.931	0.090
2017	387.8	523	25	4.78	1.349	0.064
2018	367.1	828	24	2.89	2.255	0.065
2019	358.2	542	5	0.92	1.513	0.013
2020	316.4	707	29	4.10	2.406	0.092
2021	325.3	840	22	2.62	2.582	0.068
2022	345.8	1791	6	0.34	5.179	0.017

6.1. Incidence of oiling

January to April. Just two oiled seabirds were found: one lightly oiled Fulmar on Sandwick beach, Esha Ness, and one lightly oiled Guillemot on East Sandwick beach, Unst, both in April (**Table 6.2**).

May to August. Only three oiled seabirds were found during this period: one heavily oiled Great Skua on Culswick beach and one heavily oiled Guillemot on East Mail beach, both in May, plus one lightly oiled Gannet on Urafirth beach in June (**Table 6.2**).

September to December. One oiled seabird was found during these months: a heavily oiled Kittiwake on West Voe of Sumburgh beach during the December survey (**Table 6.2**).

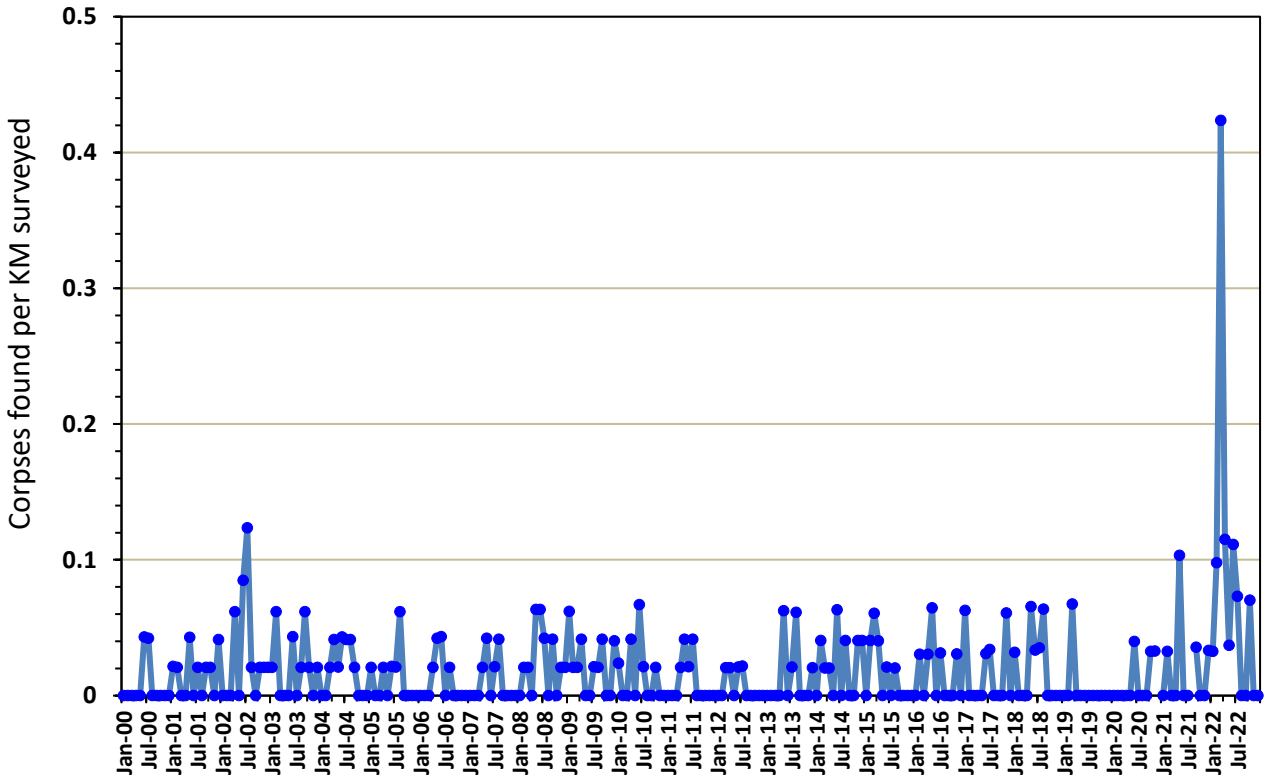
No oil samples were collected for fingerprinting analyses in 2022, primarily due to the health and safety restrictions imposed by the HPAIV pandemic and the potential risks to human health. Three oil samples that remained from 2021 were analysed by FUGRO in 2022 and the results are presented in Appendix 3 (p. 42).

6.2. Non-oiled mortality

January to April. The number of corpses found was relatively high in January (66), February (59) and March (125), probably due to the very severe winter weather and sea conditions that persisted throughout these months and associated high seabird mortality at sea. The four most frequently recorded species during this period were Common Guillemot, Shag, Fulmar and Common Eider (**Table 6.2**). The high corpse count in April (165) was normal, since numbers typically increase in April as the breeding season commences and more and more seabirds gather inshore. However, the count of Eider corpses during the March survey (13) was exceptional and six corpses were sent to Scotland's Rural College (SRUC) and the Animal and Plant Health Association (APHA) for post-mortem analyses - three birds from southwest Shetland and three from around Bluemull Sound (northeast Shetland). All six corpses were confirmed positive for highly pathogenic avian influenza virus (HPAIV): the first time that HPAIV had been detected in Common Eider and an early sign of the HPAIV pandemic to come in seabirds in the UK in 2022 (Falchieri *et al*. 2022). Since January 2000, the average Eider corpse count during the Shetland beached bird survey had been less than one found per month, so the count of 13 corpses during the March 2022 survey (0.42 found per km) represented a relatively huge increase (**Figure 6.2**). Additional systematic beach surveys for dead Eider were conducted during the first two weeks of April and a further 28 corpses were found, with more reported ad hoc across Shetland by the public, and many more likely to have washed out to sea, sunk, or otherwise remained undetected. This event appeared to be short-lived though, probably because through April in Shetland the large wintering flocks of Eider disperse and pairs split off to breed, greatly lowering the likelihood of HPAIV

transmission. During the April beaches survey at the end of the month, the Eider corpse count was back to low levels, with just three found (0.11 per km surveyed), and numbers then remained low for the rest of the year (**Table 6.2**).

Figure 6.2. Total Eider corpses found per km of beaches surveyed during the monthly Shetland beached birds survey, January 2000 to December 2022. The abnormal high peak in 2022 of 0.42 Eider corpses found per km occurred during the March survey and was caused by HPAIV.



May to August. Very high numbers of corpses were found during all four months due to widespread outbreaks of HPAIV and exceptionally high mortality in Gannets, Great Skuas and Common Guillemots (**Table 6.2**). HPAIV was confirmed from post-mortem analyses of corpses of all three of these species in the UK. In Shetland, evidence of the Guillemot mortality seemed to be confined only to the beaches, whereas the mortality in Gannets and Great Skuas was extremely dramatic, widespread and obvious elsewhere as well. Dead Great Skuas were first reported ad hoc by seabird researchers and the general public in late April, immediately after the species returned to land, and by mid-July hundreds of corpses had been found on the moorland at Hermaness and Noss, plus a staggering 1,150 dead on Foula (Campheysen and Gear 2022). Gannet corpses were first discovered in early May, on and floating below the breeding cliffs. By August, over a thousand had been seen at Hermaness and the same at Noss (also hundreds had washed up on beaches all across the isles), the vast majority adults (e.g., **Figures 6.3 & 6.4**). Although slightly more Arctic Terns, Kittiwakes, large gulls and Puffins were found dead than normal during the May to August beaches surveys (and found ad hoc by the public elsewhere), no species was observed dead in relatively extreme numbers in Shetland except for Eiders in late March and early April and Gannets, Great Skuas and Guillemots in May to September (**Table 6.2**; Falchieri *et al*. 2022).

September to December. A high number of corpses was found in September (125), primarily due to abnormally high numbers of Gannets and Guillemots found that month and the ongoing pandemic of HPAIV. In October, November and December, however, numbers of corpses dropped down to much lower levels (<100 in total each month), presumably because one-by-one each of the breeding species dispersed out to sea and HPAIV infection rates decreased, and by November and December corpse counts were back down to normal low winter levels across all species (**Table 6.2**).

Figure 6.3. Total Gannet corpses found per km of beaches surveyed during the monthly Shetland beached birds survey, January 2000 to December 2022. The extremely high and broad peak in 2022 of Gannet corpses found per km occurred due to the HPAIV pandemic during the breeding season (May to September).

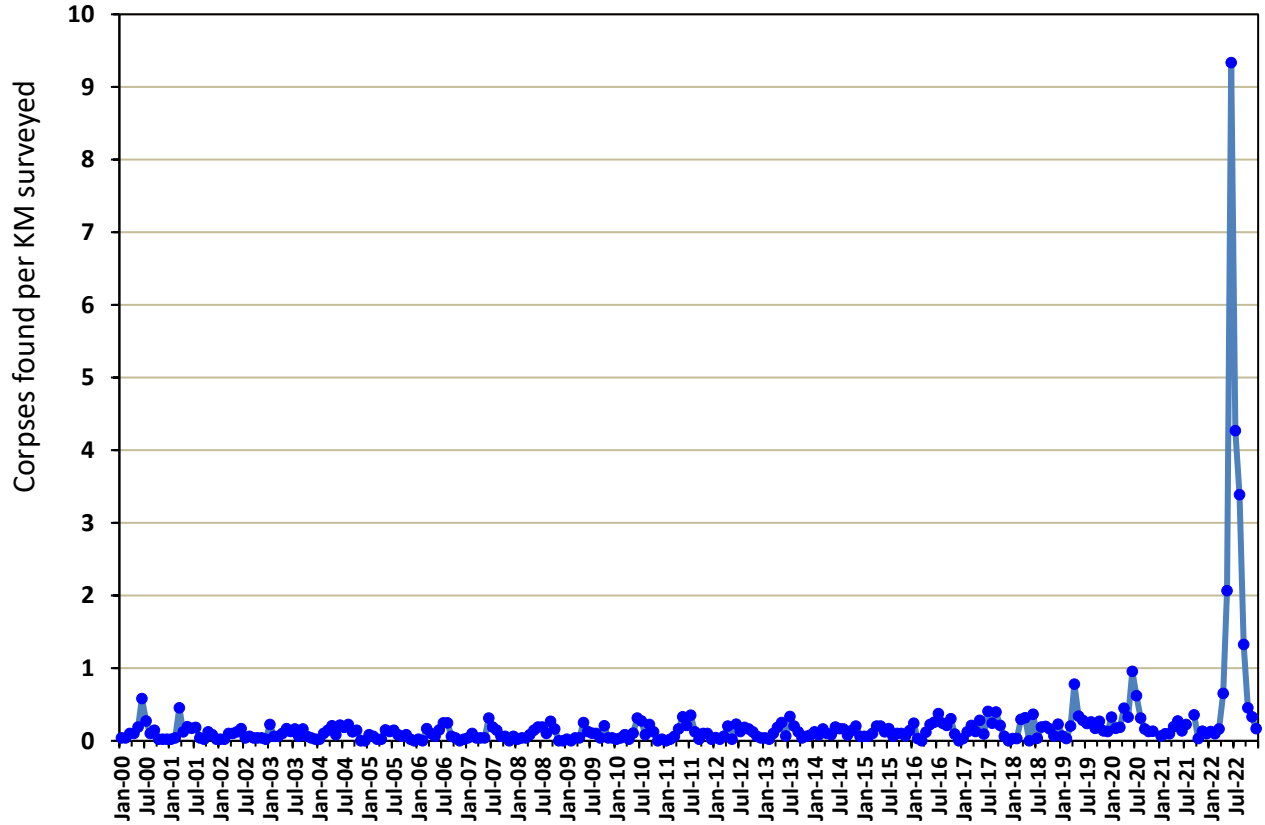


Figure 6.4. Eswick South beach photographed during the Shetland Beached Bird Survey on 27th June 2022. Fresh adult Gannet corpses were abundant in the tideline and this was a common sight all across Shetland in summer 2022 during the HPAIV pandemic.

Table 6.2. Monthly totals of seabirds and seaduck found during beached bird surveys in 2022 (number oiled in parentheses). Seabirds and seaduck found tangled in nets/ropes/hooks in 2022: 1 Gannet in March survey (hooks & line), 1 Cormorant in July survey (rope), 1 Gannet in August survey (net), 1 Fulmar in October survey (rope), 1 Herring Gull in November survey (rope) and 1 Gannet in December survey (rope).

SEABIRDS & SEADUCK	**J**	**F**	**M**	**A**	**M**	**J**	**J**	**A**	**S**	**O**	**N**	**D**	**SUM**
Red-throated Diver			1	1	1	1							4
Great Northern Diver				1									1
Common Eider	1	3	13	3	1	3	2			2			28
Long-tailed Duck											1		1
Fulmar	13	13	16	41(1)	47	66	51	34	28	12	2	3	326
Gannet	4	3	5	17	56	252(1)	117	102	37	13	10	5	369
Cormorant	5	1			1	1	1						9
Shag	16	17	28	30	17	13	5	4	2	1	1		134
Great Skua				2	24(1)	26	14	16	3	2			87
Arctic Skua								1	1		1		3
Black-headed Gull							2						2
Common Gull			1	2		1	1	1			1		7
Herring Gull	1	1	5	1	4	3	5	8	5	2	6	3	44
Great Black-backed Gull		2	7	11	3	2	5	5	8	5	8	8	64
Kittiwake		2	1	1	1	1	3	9	2	1	2	5(1)	28
Arctic Tern						5	2	1					8
Common Guillemot	18	15	45	50(1)	35(1)	42	47	18	34	32	9	6	351
Razorbill			2		1		6		2	4	2		17
Black Guillemot		1		1	2	1		2	1			1	9
Puffin	5	1	1	3	3	6	7	1	2		7	5	41
Little Auk	3									1	1		5
TOTAL FOUND	**66**	**59**	**125**	**165**	**196**	**423**	**268**	**202**	**125**	**75**	**51**	**36**	**1791**
TOTAL OILED	**0**	**0**	**0**	**2**	**2**	**1**	**0**	**0**	**0**	**0**	**0**	**1**	**6**
% OILED	**0.00**	**0.00**	**0.00**	**0.01**	**0.01**	**0.002**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**2.8**	**0.34**
TOTAL KM SURVEYED	**30.7**	**30.7**	**30.7**	**26.1**	**27.1**	**27.0**	**27.4**	**30.1**	**27.9**	**28.5**	**30.1**	**29.5**	**345.8**
(Previous year)	30.7	30.7	30.1	30.7	29.1	29.1	26.4	0.0	28.1	30.1	30.1	30.2	325.3
FOUND / KM	**2.1**	**1.9**	**4.1**	**6.3**	**7.2**	**15.7**	**9.8**	**6.7**	**4.5**	**2.6**	**1.7**	**1.2**	**5.18**
OILED / KM	**0.00**	**0.00**	**0.00**	**0.08**	**0.07**	**0.04**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**	**0.03**	**0.02**
Other species found	**J**	**F**	**M**	**A**	**M**	**J**	**J**	**A**	**S**	**O**	**N**	**D**	**SUM**
Greylag Goose	2	2	1	5	6	5	2	6	6	9	3	1	48
Eurasian Wigeon								1					1
Grey Heron			1										1
Oystercatcher					1	1	2	2	1				7
Woodcock				1									1
Curlew										1			1
Whimbrel								1					1
Turnstone		1											1
Long-eared Owl		1											1
Raven				4	1	2	2		1	1			11
Hooded Crow						1		1	1				3
Rock Dove					1	3	2		1		2	1	10
Starling												1	1
Total	**2**	**4**	**2**	**10**	**9**	**12**	**8**	**11**	**10**	**11**	**5**	**3**	**87**

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Appendix 1. Seabird monitoring in Foula in 2022 - Sheila Gear (Foula Ranger Service).

Common Eider. In 2022, the count of male Eiders was substantially lower than in 2021 (-77.5%), while the number of females had increased slightly (+14.9%). The count was done on 4th August by Penny and Sheila Gear. Breeding success was relatively poor and there were only 16 broods, mainly of just one or two chicks.

	25/7/13	27/7/14	25/7/15	24/7/16	29/7/17	12/8/18	4/8/19	26/7/20	25/7/21	4/8/22
Males	94	81	33	81	45	64	79	50	71	16
Females	71	87	52	68	69	65	58	65	74	85
Adults	**165**	**168**	**85**	**149**	**114**	**129**	**137**	**115**	**145**	**101**
Chicks	27	49	21	70	38	47	49	34	81	30
Total	**192**	**217**	**106**	**219**	**152**	**176**	**186**	**149**	**226**	**131**
Brood/1	15	5	3	14	4	10	9	7	10	6
Brood/2	3	11	2	7	6	6	8	6	12	7
Brood/3	2	6	2	7	6	7	8	3	9	2
Brood/4	0	1	2	4	1	1	0	0	1	1
Brood/5	0	0	0	1	0	0	0	0	2	0
Brood/6	0	0	0	0	0	0	0	1	1	0
Mean Br.	**1.35**	**2.13**	**2.33**	**2.12**	**2.38**	**1.96**	**1.96**	**2.00**	**2.31**	**1.88**

Red-throated Diver. Red-throated Divers were monitored from a considerable distance as is normal and had a rather poor season. Thirteen occupied sites were recorded with 12 breeding attempts. Most failures occurred during incubation or when the chicks were small. One nest was flooded. Six single chicks were deemed to have fledged. No pairs raised two chicks; all broods were of just one. Although some diver breeding pools had dead bonxies floating in them, none of the divers were observed with HPAIV symptoms.

Foula Red-throated Divers	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022
Sites occupied at least once	12	13	13	12	15	11	12	14	12	13	13
Breeding attempts	8	12	12	12	13	10	11	11	11	10	12
Sites where chicks hatched	6	7	11	11	11	6	9	9	8	6	7
Minimum number of chicks	8	9	17	12	12	7	14	13	9	8	7
Chicks presumed fledged	5	4	15	10	6	5	9	5	8	3	6
Breeding success	**0.63**	**0.33**	**1.25**	**0.83**	**0.46**	**0.50**	**0.82**	**0.45**	**0.73**	**0.30**	**0.50**

Northern Fulmar. Four of the Foula plots were picked at random and monitored by Sheila Gear. A total of 129 apparently occupied sites (AOS) were seen with adults present on all 3 observation checks and 61 chicks were seen later at these sites. However, three 'extra' chicks were seen at sites where adults had been present on less than three of the observation checks earlier in the year. Breeding success remained stable.

Plot	Total AOS	AOS on all 3 checks (%)	Chicks at all-3-check sites + 'extra' sites	Success
2	33	25 (75.8%)	16 + 1	17/26 = 0.65
5	62	37 (59.7%)	13 + 0	13/37 = 0.35
6	48	19 (39.6%)	9 + 1	10/20 = 0.50
7	75	48 (64.0%)	23 + 1	24/49 = 0.49
	218	129 (59.2%)	61 + 3	64/132 = 0.48
Mean ± SE of 4 plots				**0.49 ± 0.06**

Overall breeding success in 2022 was 0.48 chicks fledged per AON, 14.3% lower than in 2021.

Fulmar	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022
Qualifying AOS	196	135	113	123	137	119	124	233	101	172	132
'Extra' sites	0	0	33	16	10	18	28	14	15	10	3
Chicks in August	125	96	97	45	80	79	88	87	61	99	64
Mean success	**0.64**	**0.73**	**0.67**	**0.33**	**0.56**	**0.58**	**0.58**	**0.41**	**0.53**	**0.56**	**0.48**

European Shag. Shag numbers continue to be very low and many areas remain deserted. Breeding success remained relatively low, although was 27.7% higher in 2022 (0.83 chicks fledged per incubated nest) than in 2021 (0.65 chicks fledged per incubated nest).

Shag	**2011**	**2012**	**2013**	**2014**	**2015**	**2016**	**2017**	**2018**	**2019**	**2020**	**2021**	**2022**
Trace nest only	0	4	3	0	1	1	2	5	1	1	2	6
Incubating nests	27	10	4	35	29	26	22	24	33	29	23	29
% Incubating	96.4	58.8	36.4	100	93.5	96.3	91.7	82.8	97.0	96.7	0.92	0.83
Young fledged	20	5	3	66	23	19	12	44	36	28	15	24
Fledged / inc.	**0.74**	**0.50**	**0.75**	**1.89**	**0.79**	**0.73**	**0.55**	**1.83**	**1.09**	**0.97**	**0.65**	**0.83**

Arctic Skua. The first bird was seen ashore on 25th April. There were 21 AOTs, with 20 pairs observed to lay eggs, a slight decrease on 2021 (21 pairs laid). Mean 1st clutch size was 1.90 eggs per pair laid, up from 1.81 in 2021. Weather at hatching time was very poor with persistent wet mist, rain and cold wind. Several chicks disappeared around hatching and some nests were flooded. Only 3 pairs managed to raise both their chicks to fledging. Eighteen chicks fledged successfully, and these remained in the colony for three or more weeks. Once incubation began, the colony was fed throughout the season, mainly with herring and mackerel - one feed in the evening of approximately two kilos in total at the start, increasing to three kilos once the chicks fledged. One unringed adult of unknown origin was killed by the island plane on 7th June. A colour-ringed female, BBGW, was found dead near the road on 14th July. Its partner raised their two chicks to fledge successfully. Wings of a predated fledgling were found on the airstrip on 6th Sept.

Arctic Skua	**2011**	**2012**	**2013**	**2014**	**2015**	**2016**	**2017**	**2018**	**2019**	**2020**	**2021**	**2022**
First seen on land	22/4		3/5	29/4	26/4	26/4	28/4	27/4	25/4	24/4	23/4	25/4
AOT	41	37	35	24	28	27	23	20	19	21	22	21
Pairs laid	32	27	26	21	26	17	17	14	16	18	21	20
Mean clutch	1.63	1.58	1.77	1.70	1.62	1.47	1.81	1.71	1.73	1.56	1.81	1.90
Fledged	0	4	0	18	17	4	0	2	16	20	20	18
Success/AOT	**0**	**0.11**	**0**	**0.75**	**0.61**	**0.15**	**0**	**0.14**	**0.84**	**1.11**	**0.91**	**0.86**

Great Skua. Great Skuas in Foula had a catastrophic year. The first Great Skua was seen on 29th March, but most did not arrive until much later. At the end of April three birds were seen with symptoms suggestive of HPAIV, one of which was found dead three days later. By mid-May, eight dead adults had been recorded on the monitoring plot. Mortality accelerated in the second half of May and early June. Although no birds were tested from the plot, symptoms were similar to those observed in birds from other parts of Foula that tested positive for H5N1 HPAIV. By 8th June, 36 corpses had been found on the plot. Only 24 AOT were observed on the plot, a decline of 41.5 %. Initially, clutch size appeared good at 1.83. Following BTO and government guidance released on 17th June, no chicks were ringed, and all further observations were made from a distance instead of hands on, to lessen stress to the birds and the spread of HPAIV infection. By late June and early July very little activity was observed on the plot, and on 29th July it was almost completely deserted, suggesting most adults left the colony early, as happened in 2021. No fledglings were observed at all, so breeding productivity was deemed to be zero. Dr Kees Camphuysen, a senior scientist at the Netherlands Institute for Sea Research, was in Foula from 31st May until 11th July during which time he did extensive whole island counts of Great Skua corpses, supplemented by late summer counts by Sheila Gear. A minimum total of 1,500 Great Skuas corpses were found, apparently having died from HPAIV (Camphuysen & Gear 2022).

Great Skua	**2011**	**2012**	**2013**	**2014**	**2015**	**2016**	**2017**	**2018**	**2019**	**2020**	**2021**	**2022**
First seen on land	2/4	28/3	10/4	10/4	3/4	2/4	4/4	12/4	28/3	3/4	29/3	29/3
AOT monitored	53	38	41	48	42	54	54	50	46	51	41	24
Mean clutch	1.74	1.76	1.54	1.88	1.62	1.77	1.69	1.90	1.80	1.80	1.76	1.83
Fledged	14	8	3	8	3	14	2	11	12	9	0	0
Success/AOT	0.26	0.21	0.07	0.17	0.07	0.26	0.04	0.22	0.26	0.18	0.00	0.00

Black-legged Kittiwake. Due to continuing poor sea conditions, Kittiwakes were counted late, not until 2nd July. Numbers had increased slightly from 2021, with a total of 360 complete attended nests.

Black-legged Kittiwake	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022
Census count (AON)	378	327	361	277	272	256	262	259	308	317	360
% change per year	-21.3	-13.5	+10.4	-23.3	-1.8	-5.9	+2.3	-1.1	+18.9	+2.9	+13.6

Breeding productivity per well-built nest at Hodden was poor at 0.65 chicks fledged per breeding attempt. Most pairs had just one chick; only four pairs raised two chicks and none had three chicks this year. Monitoring was done from Kinglia, the cliff headland opposite the colony, using photographs. In Under da Stee was not monitored in 2022 due to the risk of spreading HPAIV infection.

In Under da Stee	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022
Completed nests	50	44	32	20	2	2	3	4	4	6	5	-
Fledged	0	0	0	0	1	1	0	0	3	7	5	-
Success	0	0	0	0	0.50	0.50	0.00	0.00	0.75	1.17	1.00	-
Hodden	**2011**	**2012**	**2013**	**2014**	**2015**	**2016**	**2017**	**2018**	**2018**	**2020**	**2021**	**2022**
Completed nests	22	20	18	18	21	20	23	27	41	55	60	69
Fledged	2	0	0	15	4	9	8	19	34	38	43	45
Success	0.09	0	0	0.83	0.19	0.45	0.35	0.70	0.83	0.69	0.72	0.65
Mean success	**0.05**	**0**	**0**	**0.42**	**0.35**	**0.48**	**0.18**	**0.35**	**0.79**	**0.93**	**0.86**	-

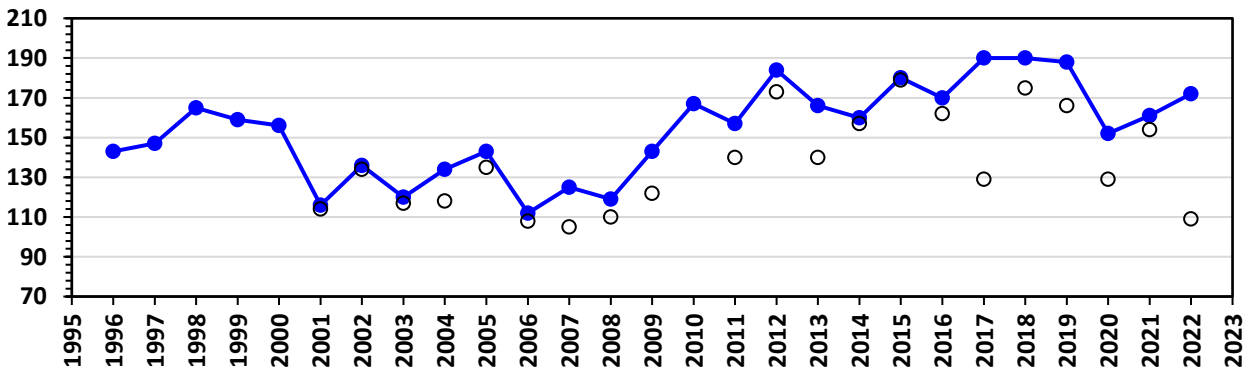
Arctic Tern. The first terns were seen on 11th May at the airstrip. On 5th June c.30 terns were observed on the same breeding site, on the west side of the airstrip, which they had used in 2021. On 10th July, after several periods of wind, rain and mist, 42 terns were counted from the airstrip. The colony was not entered because of HPAIV infection precautions, but none of the birds appeared to be incubating or feeding chicks and all nesting attempts were deemed to have failed. By 14th July most of the terns had deserted their breeding site and moved to the Hame Banks where they were still present on 4th August.

Common Guillemot, Razorbill and Atlantic Puffin. In 2022, numbers were noticeably down and very late to come ashore. Chicks were few and late. Non-breeding Puffins were only seen ashore on occasional fine days.

Black Guillemot. Counts were made by Sheila and Jim Gear on 20th and 27th April. Chop and glitter on the sea made the first count difficult and only 109 birds were seen. But conditions on the second count were perfect, with a good total of 172 birds (161 in 2021). One, possibly two, birds were seen in winter plumage.

Area counted	Date & time	Weather & tide	Count
East coast survey area	20/4 7.30–10.00am	Wind SE 3-4, sunny, sea choppy and with glitter, tide ebbing, birds mostly on the sea.	109 in breeding plumage
East coast survey area	27/4 7.15-10.00 am	Wind WSW 2, cloud, no swell or chop on sea, tide flowing then ebbing.	172 in breeding plumage

Figure 1. Counts of Black Guillemots in breeding plumage along the East coast survey area, 1996–2022. Open circles are the lower count when two were made in a year.



Appendix 2. Seabird ringing in Shetland in 2021.

Ringing of seabirds provides valuable information on population distributions, individual movements, longevity and causes of mortality. SOTEAG has supported seabird ringing in Shetland since 1980 by making a donation to the cost of seabird rings. Annual ringing totals have fluctuated due to variation in demographic factors and the number of adults and chicks available for ringing. Over the years, ringing totals have generally decreased in Shetland though, corresponding with seabird numbers decreasing and accessible colonies becoming fewer.

In 2022, due to the widespread pandemic of highly pathogenic avian influenza virus, the government and the British Trust for Ornithology (BTO) prohibited seabird ringing to help limit the spread of infection. Therefore, no seabird ringing occurred in Shetland in 2022, no rings were used and the SOTEAG donation to the cost of rings was not required this year.

Appendix 3. Oil sample analyses remaining from 2021.

In May 2021, SOTEAG requested confirmation from FUGRO that the global reference database used for fingerprinting analyses included all the different Shetland oil industry oil types. It emerged that the database was incomplete. Samples of all the missing Shetland oils were supplied through the SVA for inclusion in the database, but this process was completed in early 2022 and in the meantime oil fingerprinting analyses were temporarily put on hold (**Table 6.3**). The results of all remaining oil samples collected in 2021 but analysed in 2022, after the reference database was updated, are presented below.

Table 6.2. Results of oil sample analyses by FUGRO. These samples are all from 2021. Analyses of these samples had to be delayed while FUGRO's global oil samples reference database was updated. L = lightly oiled (< 10%).

No.	Date	Location	Sample	Type	Source information
318	29/4	Housabister, Mainland	Tar ball on beach	Refined petroleum (E.g., a marine fuel oil).	Originated from a west African feedstock. Likely released accidentally or from an illegal bilge discharge.
319	29/6	Burravoe East, Mainland	Fulmar (L)	Unrefined/crude petroleum.	No matches were found to existing samples. Likely released accidentally or from tanker washings.
320	31/12	Quendale, Mainland	Fulmar (L)	Unrefined/crude petroleum.	No matches were found to existing samples. Likely released accidentally or from an illegal bilge discharge.