



**SOTEAG**



Ornithological monitoring programme

in Shetland

**2016**



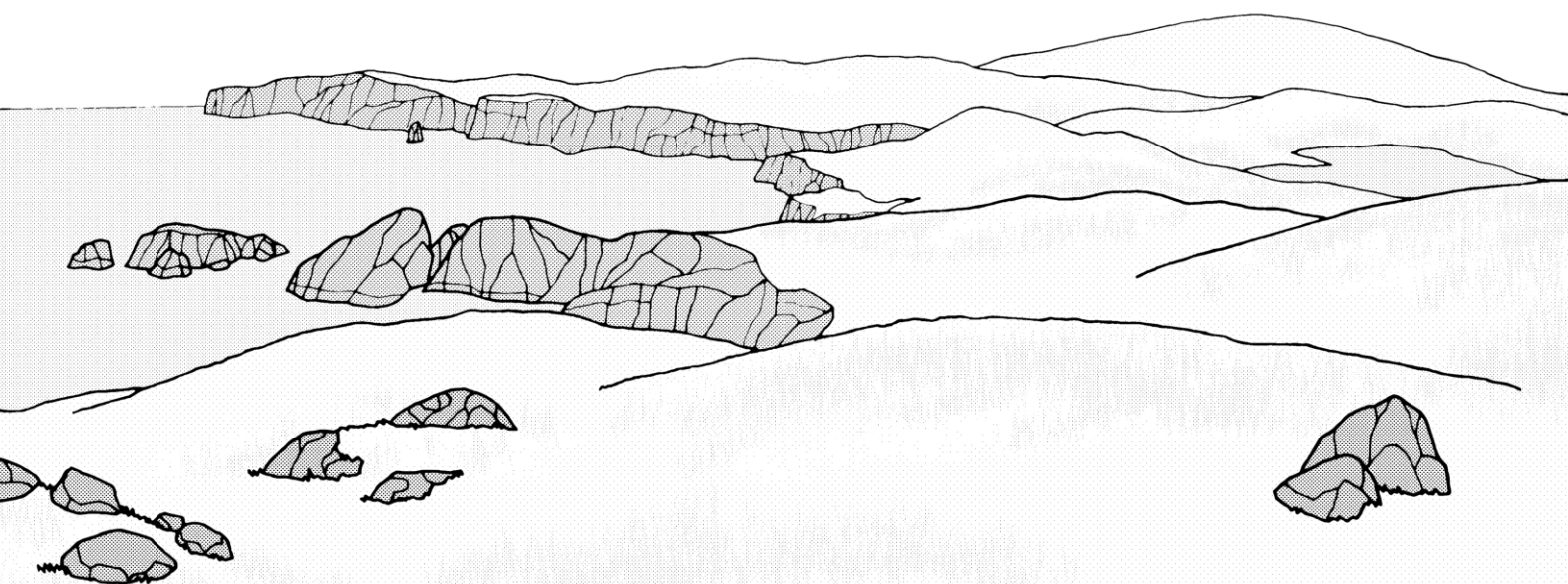
*A report to the Shetland Oil Terminal*

*Environmental Advisory Group*

*by*

*Aberdeen Institute for*

*Coastal Science and Management, University of Aberdeen*



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# SOTEAG ORNITHOLOGICAL MONITORING PROGRAMME

## 2016 REPORT

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## 2016 Executive Summary

### 1. Monitoring of cliff-breeding seabirds

**Northern Fulmar *Fulmarus glacialis*.** The number of occupied sites (AOS) recovered after low counts in 2015 thought to have been due to weather, and breeding success (0.47/AOS) was above average (1985–2015: 0.42).

**European Shag *Phalacrocorax aristotelis*.** The number of nests counted along 8 stretches of coast (690) was 36% lower than in 2009 (1,078) but with marked local variation. Breeding success was relatively high at Sumburgh Head (1.20 fledged per laying pair) and at Burravoe, Yell (1.41).

**Black-legged Kittiwake *Rissa tridactyla*.** The total of 345 nests at 14 breeding stations was 17% lower than the most recent previous counts in 2011–14. Breeding success at 5 colonies (mean: 0.59 fledged per laying pair) was above average (1986–2015: 0.39) but below that required to maintain a stable population.

**Common Guillemot *Uria aalge*.** Population counts indicated little change since 2015 and only a slight decline in the past decade, although the mean index was 52% lower than the baseline year of 1978. Breeding success at Sumburgh Head (0.71 per laying pair) was the highest since 1996, with chick diet comprising 82% gadids (mostly Saithe), and was also relatively high at Burravoe, Yell (0.60).

**Razorbill *Alca torda*.** Population counts indicated little change since 2015, with the mean index 63% lower than the baseline year of 1978. Breeding success at Sumburgh Head (0.64 per laying pair) was the highest since monitoring began in 2011.

### 2. Pre-breeding season census counts of Black Guillemots *Cepphus grylle*

Along coastline surveyed in 2015–16, the number of adults (8,360) was slightly higher than in the previous census (1999–2000: 8,207). While some local decreases are undoubtedly genuine, the Shetland population appears to be in a healthy state.

### 3. Moulting Common Eiders *Somateria mollissima* in Yell Sound and Sullom Voe

A total of 301 birds in August (c.f. 408 in 2015) included 194 off the SVT jetties and 86 around aquaculture sites in southern Yell Sound, and represented c.7% of the 2015 Shetland population estimate of 4,610 birds.

### 4. Winter counts of seaduck and diving seabirds

All standard areas were surveyed during the 2015/16 winter, but counts in Yell Sound and Sullom Voe, and Rova Head to Kirkabister, were made in December 2015 and were reported on in the previous report. In the Colgrave Sound area numbers of Common Eider (1,319) and Long-tailed Duck (707) remained high, but the latter species has declined in the Bressay Sound area, and in the voes between Whiteness and Skeld. Slavonian Grebe numbers have also declined recently.

### 5. Beached Bird Surveys

Monthly coverage in 2016 was reduced from 49.6 km to 32.9 km, mostly involving discontinuing long stretches of shoreline in Sullom Voe. Examination of 2014 and 2015 data suggested that this reduction in the total length of beaches would have little effect on the number of dead seabirds found. Of 752 dead seabirds found 35 were oiled (4.7% c.f. 3.9% in 2015), mostly in northwest Shetland during January to May (30) and mostly (24) Fulmars. Of 11 samples of oiled plumage and beached oil analysed, two involved crude oils (East Shetland Basin and Middle Eastern origins) and nine involved fuel oils from a variety of sources. Apart from small numbers of first-winter Puffins in January and February, there was no particularly unusual mortality of any species during the year.

**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 2016.**

## 1. Monitoring of cliff-breeding seabirds

### 1.1. Weather during the 2016 seabird breeding season

Weather can influence the ability to carry out seabird monitoring, and in extreme cases, can directly affect seabirds' breeding success. However, although 'typically Shetland' and at times difficult for observers, weather in the spring and summer of 2016 appeared to have little impact on the breeding performance of the species monitored, and there were no periods of swell heavy enough to wash out substantial numbers of nests.

North and north-easterly winds during **April** restricted boat surveys of Black Guillemots to the more sheltered coasts along the west of Shetland. **May** was generally cold and windy, but several short spells of heavy rain during the middle half of the month seemed to cause few problems for incubating Shags and Common Guillemots. In the last few days of the month a forecast of calm conditions ahead of strong winds at the beginning of **June** allowed an early start to census counts of cliff-nesting seabirds. Strong north-easterly winds during 1<sup>st</sup>– 5<sup>th</sup> and 12<sup>th</sup>– 17<sup>th</sup> June disrupted study plot counts, but 18 of the 20 sets of counts were made in recommended conditions of Beaufort Force 4 or less (**Table 1.1**). Generally calm seas in the first half of **July** meant there was little disruption to fledging of Common Guillemots and Razorbills.

**Table 1.1.** Details of observer, date, time, weather and sea conditions for study plot counts of Fulmars, Common Guillemots and Razorbills at four colonies in June 2016.

<b>Sumburgh Head</b>	Observer: Martin Heubeck			
<b>Date</b>	<b>Time (BST)</b>	<b>Wind</b>	<b>Sea state</b>	<b>Cloud cover</b>
6 <sup>th</sup> June 2016	1300–1500	NW 4–3	Moderate swell	1/8
8 <sup>th</sup> June 2016	1300–1455	NE 4	Moderate swell	5/8
10 <sup>th</sup> June 2016	1300–1500	NE 2–3	Slight swell	4/8, became very warm
13 <sup>th</sup> June 2016	1300–1510	SE 4	Moderate swell	0/8
19 <sup>th</sup> June 2016	1210–1400	SE 3	Moderate swell	7/8
<b>Troswick Ness</b>	Observer: Martin Heubeck			
<b>Date</b>	<b>Time (BST)</b>	<b>Wind</b>	<b>Sea state</b>	<b>Cloud cover</b>
6 <sup>th</sup> June 2016	1010–1150	NE 4–5	Heavy swell	1/8
8 <sup>th</sup> June 2016	1010–1150	NE 4	Moderate swell	8 > 3/8
10 <sup>th</sup> June 2016	1000–1150	NE 3–4	Slight swell	6/8
13 <sup>th</sup> June 2016	1000–1155	SE 4	Slight swell	7/8
19 <sup>th</sup> June 2016	0945–1110	SSE 3	Moderate swell	7/8
<b>Esha Ness</b>	Observer: Mick Mellor			
<b>Date</b>	<b>Time (BST)</b>	<b>Wind</b>	<b>Sea state</b>	<b>Cloud cover</b>
6 <sup>th</sup> June 2016	1315–1430	NNE 4	Moderate swell	0/8
8 <sup>th</sup> June 2016	1300–1400	NE 4	Moderate swell	1/8
10 <sup>th</sup> June 2016	1245–1345	N 3–4	Moderate swell	7/8
13 <sup>th</sup> June 2016	1300–1400	SE 4	Slight swell	2/8
19 <sup>th</sup> June 2016	1300–1400	SE 2–3	Slight swell	6/8
<b>Burravoe, Yell</b>	Observer: Mick Mellor			
<b>Date</b>	<b>Time (BST)</b>	<b>Wind</b>	<b>Sea state</b>	<b>Cloud cover</b>
30 <sup>th</sup> May 2016	1030–1100	NE 4	Slight swell	3/8
6 <sup>th</sup> June 2016	1030–1100	NE 4–5	Moderate sell	0/8
8 <sup>th</sup> June 2016	1000–1030	NE 3–4	Slight swell	4/8
10 <sup>th</sup> June 2016	0945–1030	NE 3	Slight swell	4/8
13 <sup>th</sup> June 2016	0950–1030	SE 3	Slight swell	3/8

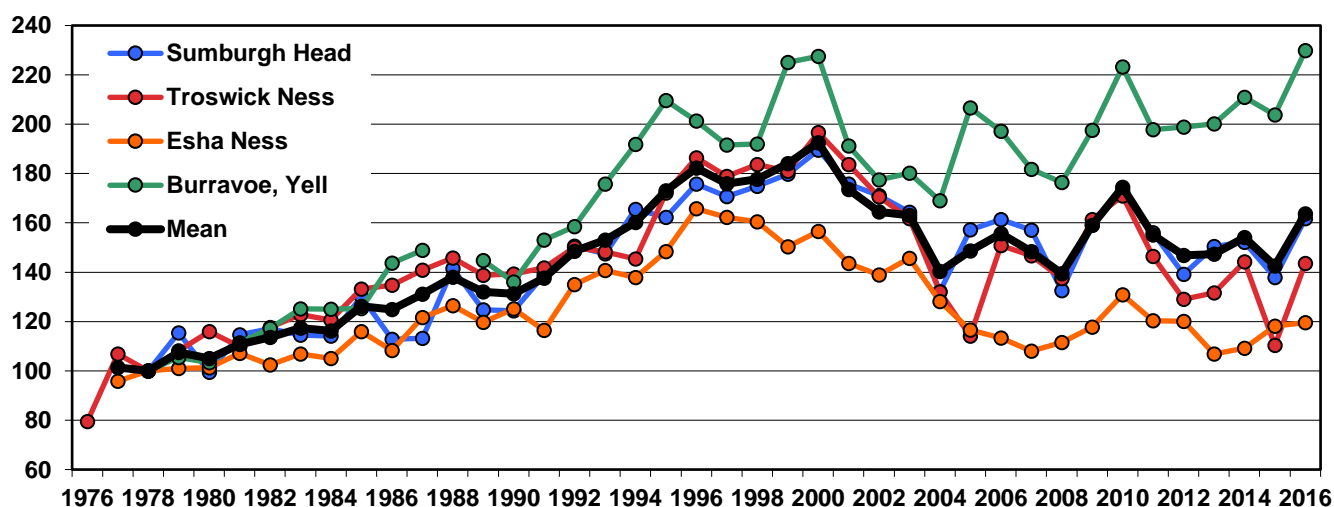
### 1.2a. Northern Fulmar *Fulmarus glacialis*: Population counts

There were marked increases since 2015 in the number of apparently occupied sites (AOS) at three of the four monitored colonies, with no overlap in the range of counts at Sumburgh Head and Troswick Ness (**Table 1.2**); the mean number of AOS at Esha Ness was similar to that in 2015, although counts were less variable. In contrast to 2015, when May had been the wettest on record and many traditional Fulmar nest sites were probably too wet in early June for occupation, the cliffs were dry in June 2016 and the increases in Fulmar numbers probably reflected this, rather than any population increase. After a decrease in the early 2000s, Fulmar numbers have fluctuated somewhat since 2004; in 2016 the mean index of AOS was 64% higher than in 1978 when SOTEAG counts began (**Figure 1.1**).

**Table 1.2.** Mean counts of Fulmars and apparently occupied sites (AOS) at four Shetland colonies, 2015–16. Statistics: number of counts, range, mean, standard deviation, coefficient of variation, % change since 2015 and population indices for AOS (1978 = 100).

Colony	Unit	Year	n	Range	Mean	SD	CV	% ch.	Index
Sumburgh Head	Birds	2015	5	249–271	256.0	8.83	0.03		
		2016	5	292–367	326.4	28.00	0.09	+26.7	
	AOS	2015	5	196–214	202.2	7.03	0.04		137.8
		2016	5	226–250	237.4	10.50	0.04	+17.4	161.8
Troswick Ness	Birds	2015	5	914–973	946.2	21.88	0.02		
		2016	5	1174–1354	1261.0	64.37	0.05	+33.3	
	AOS	2015	5	583–738	681.6	59.98	0.09		110.4
		2016	5	876–897	886.6	9.56	0.01	+30.1	143.6
Esha Ness	Birds	2015	5	261–431	350.4	63.87	0.18		
		2016	5	335–428	397.8	36.16	0.09	+13.5	
	AOS	2015	5	240–319	284.2	28.27	0.10		118.2
		2016	5	271–296	287.6	10.36	0.04	+1.2	119.6
Burravoe	Birds	2015	5	201–243	218.6	17.36	0.08		
		2016	5	254–307	287.8	21.06	0.07	+31.7	
	AOS	2015	5	170–211	189.8	18.62	0.10		203.8
		2016	5	191–234	214.0	17.22	0.08	+12.8	229.8

**Figure 1.1.** Annual index (1978 = 100) of Fulmar apparently occupied sites in study plots at four colonies, 1976–2016, and the mean index for the four colonies.



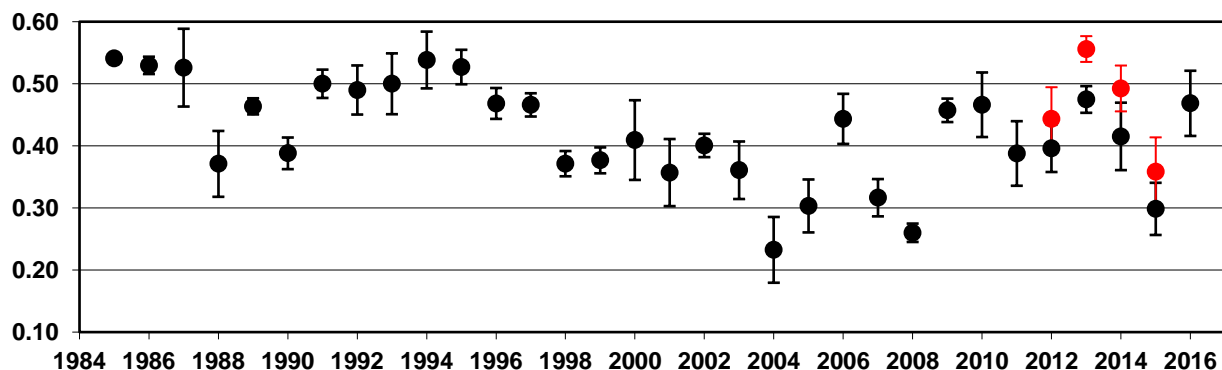
### 1.2b. Northern Fulmar *Fulmarus glacialis*: Breeding success

Since 1985 this had been calculated by dividing the number of chicks present in the population monitoring plots in mid August by the mean count of AOS in June (**Table 1.2**). In 2012 the ‘marked photograph’ method was introduced to bring methodology in line with that used at other colonies. Both methods over-estimate breeding numbers, but the number of AOS occupied on each of three dates in late May and early June will be closer to the number of birds actually incubating. However this takes six full man-days at a busy time of the season, and in 2016 it was decided to use this time to conduct RIB-based breeding seabird census counts, and restrict the breeding success estimates to the mean of the June population counts. Chicks were counted on 14<sup>th</sup> August, none were seen dead and although some were virtually free of down none were believed to have fledged (**Table 1.3**). Breeding success was markedly higher than in 2015 at three colonies, but slightly lower at Burravoe (67 chicks c.f. 72 in 2015). Mean success (0.47) was above the long-term average (1985–2015: 0.42) and well above that in the past 20 years (1996–2015: 0.38; **Figure 1.2**).

**Table 1.3.** Fulmar breeding success in 2016 calculated by the population count method (chicks on 14<sup>th</sup> August 2016 / mean June count of AOS), with 2015 figures in brackets.

<b>Sumburgh Head</b>	<b>Mean AOS</b>	<b>Chicks</b>	<b>Success (2015)</b>
Greystane Geo	28.2	14	0.50 (0.36)
Geo of Toun south	168.6	93	0.55 (0.30)
Geo of Parks north	39.2	21	0.54 (0.34)
Sum	236.0	128	0.54 (0.31)
<b>Mean ± SE</b>			<b>0.53 ± 0.02 (0.33 ± 0.22)</b>
<b>Troswick Ness</b>	<b>Mean AOS</b>	<b>Chicks</b>	<b>Success (2015)</b>
Brei Geo	340.4	172	0.51 (0.19)
Sandvis Geo	546.2	267	0.49 (0.17)
Sum	886.6	439	0.50 (0.18)
<b>Mean ± SE</b>			<b>0.50 ± 0.01 (0.18 ± 0.01)</b>
<b>Esha Ness</b>	<b>Mean AOS</b>	<b>Chicks</b>	<b>Success (2015)</b>
Calders Geo	196.4	104	0.53 (0.28)
Main Colony	31.6	14	0.44 (0.31)
Fulmar Geo	52.0	33	0.64 (0.31)
Sum	280.0	151	0.54 (0.29)
<b>Mean ± SE</b>			<b>0.54 ± 0.06 (0.30 ± 0.01)</b>
<b>Burravoe, Yell</b>	<b>Mean AOS</b>	<b>Chicks</b>	<b>Success (2015)</b>
Fulmar Plot	214.0	67	<b>0.31 (0.38)</b>

**Figure 1.2.** Mean Fulmar breeding success (± SE) at 3–4 monitored colonies, 1985–2016 (Burravoe from 2003 only), calculated as the number of chicks present in mid-August divided by the mean of five counts of apparently occupied sites (AOS) in June (black), and by the number of sites qualifying as AOS on each of three dates in late May and early June (red).



### 1.3a. European Shag *Phalacrocorax aristotelis*: Population counts

The annual counts of nests made from land at No Ness and Sumburgh Head were slightly lower than in 2015 (**Table 1.4**), with a continued (since 2014) high proportion of nests being ‘active’ but the combined total of nests at these two major colonies remained 60% lower than in the recent peak year of 2010, and 44% lower than the average annual total in 2004–09.

All other counts along regularly monitored coasts were made from the SOTEAG RIB during census surveys of all cliff-breeding seabirds, and focused on southwest Shetland and inner St Magnus Bay due to prevailing north or north-easterly winds for much of June. With no swell from the southwest, we safely accessed all nest locations previously counted from the smaller, more manoeuvrable Zodiac. In southwest Shetland, the total count of 95 nests at St Ninian’s Isle, the Havras and Kettla Ness was well below the totals of 148–167 nests (mean 157) recorded in 2007–14. In the West Mainland, numbers along the coast from Reawick Ness to Vaila were 20–25% lower than in 2009 and 2012, particularly from Silwick to Culswick, but similar to 2007. Further north, numbers at Muckle Roe were between those recorded in 2011 (a non-breeding year) and 2009. In summary, the total number of nests counted along these stretches of coast in 2016 (690) was 36% lower than in 2009 (1,078) but with marked local variation.

**Table 1.4.** Counts of Shag nests (trace, empty, and active) along regularly monitored coasts surveyed in 2016, the percentage of nests that were active, and count date. At No Ness and Sumburgh Head, where more than one count from land was made in a year the highest nest total is given (\*).

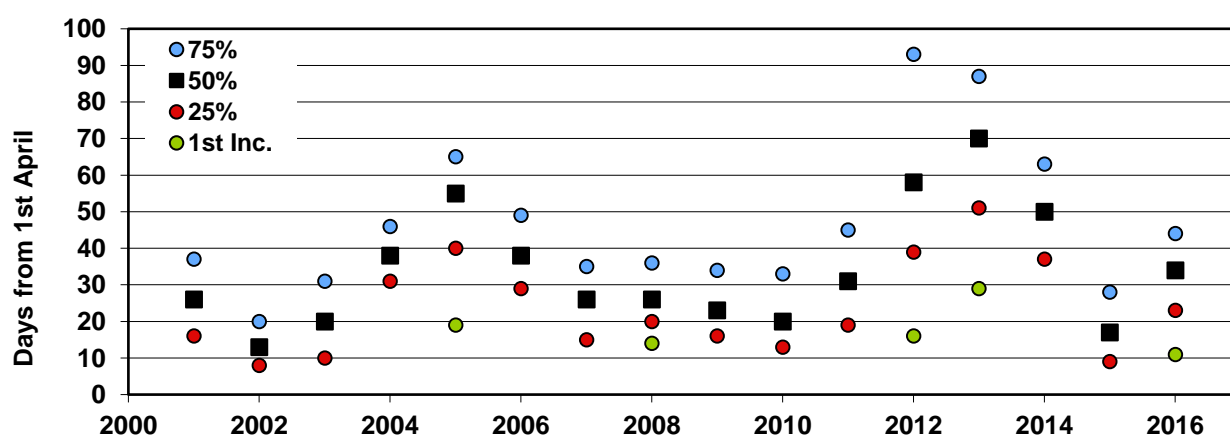
Coastline	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
No Ness (land)	<b>110*</b> 76% 1/6	<b>124*</b> 83% 14/6	<b>139*</b> 97% 13/6	<b>150*</b> 95% 22/6	<b>138*</b> 94% 13/6	<b>185*</b> 89% 23/5	<b>204*</b> 95% 9/6	<b>134*</b> 84% 27/5	<b>54*</b> 48% 12/6	<b>49*</b> 47% 10/6	<b>89</b> 87% 12/6	<b>89</b> 93% 16/6	<b>86</b> 92% 1/6
Sumburgh Head (land)	<b>207*</b> 86% 27/5	<b>166*</b> 83% 5/6	<b>233*</b> 97% 13/6	<b>213*</b> 99% 22/6	<b>219*</b> 95% 31/5	<b>223*</b> 93% 16/6	<b>290*</b> 97% 8/6	<b>100*</b> 67% 27/5	<b>85*</b> 54% 30/5	<b>73*</b> 33% 10/6	<b>115</b> 85% 9/6	<b>114</b> 92% 13/6	<b>111</b> 94% 5/6
St Ninian’s Isle				<b>53</b> 96% 9/6		<b>59</b> 93% 11/6			<b>50</b> 82% 27/6		<b>57</b> 93% 23/6		<b>35</b> 100% 29/5
South Havra & Little Havra				<b>49</b> 90% 9/6		<b>57</b> 90% 11/6			<b>53</b> 59% 27/6		<b>46</b> 78% 23/6		<b>31</b> 97% 28/5
Kettla Ness				<b>57</b> 90% 9/6		<b>51</b> 94% 11/6			<b>51</b> 82% 27/6		<b>45</b> 80% 23/6		<b>29</b> 100% 11/6
<b>SW Shetland</b>				<b>159</b>		<b>167</b>			<b>154</b>		<b>148</b>		<b>95</b>
Reawick Ness	<b>17</b> 82% 11/6		<b>18</b> 100% 27/6	<b>15</b> 87% 21/6		<b>20</b> 95% 9/6							<b>17</b> 71% 9/6
Skelda Ness	<b>76</b> 78% 11/6		<b>99</b> 97% 27/6	<b>80</b> 96% 21/6		<b>97</b> 90% 9/6			<b>87</b> 77% 20/6				<b>71</b> 92% 9/6
Silwick to Culswick	<b>143</b> 89% 11/6		<b>195</b> 99% 27/6	<b>126</b> 98% 21/6		<b>177</b> 94% 9/6			<b>204</b> 88% 20/6				<b>124</b> 98% 24/6
Culswick to Burga Stacks			<b>6</b> 100% 27/6	<b>4</b> 75% 21/6		<b>4</b> 100% 9/6			<b>4</b> 100% 20/6				<b>4</b> 100% 24/6
Vaila	<b>89</b> 66% 11/6		<b>126</b> 96% 27/6	<b>94</b> 97% 21/6		<b>112</b> 97% 9/6			<b>104</b> 92% 20/6				<b>100</b> 100% 26/6
<b>W Mainland</b>	<b>[325]</b>		<b>444</b>	<b>319</b>		<b>410</b>			<b>[399]</b>				<b>316</b>
Muckle Roe	<b>63</b> 83% 10/6		<b>62</b> 89% 7/6			<b>93</b> 94% 23/6		<b>67</b> 58% 9/6					<b>82</b> 90% 23/6



### 1.3b. European Shag *Phalacrocorax aristotelis*: Breeding success

This was again monitored in the usual plots at Sumburgh Head (27 checks, 4<sup>th</sup> April – 19<sup>th</sup> August) and at Burravoe, Yell (30 checks, 7<sup>th</sup> April – 25<sup>th</sup> August). At Sumburgh, laying was slightly later than in 2015 **Figure 1.3**), and while the total number of nests recorded (102) was lower than in 2015 (119), once again a high percentage of nests started progressed to incubation (**Table 1.5, Figure 1.4**). Chicks were recorded at a high proportion of nests, but there was some brood reduction and total loss of broods (9 broods disappeared before possible fledging and two broods were seen dead in nests), mainly in the first half of July. Few breeding failures appeared to be due to adverse weather or sea conditions, and chick loss during July was the main reason that breeding success of 1.20 fledged per incubating nest was only slightly higher than the long-term average of 1.13 (1988–2015; **Figure 1.4**).

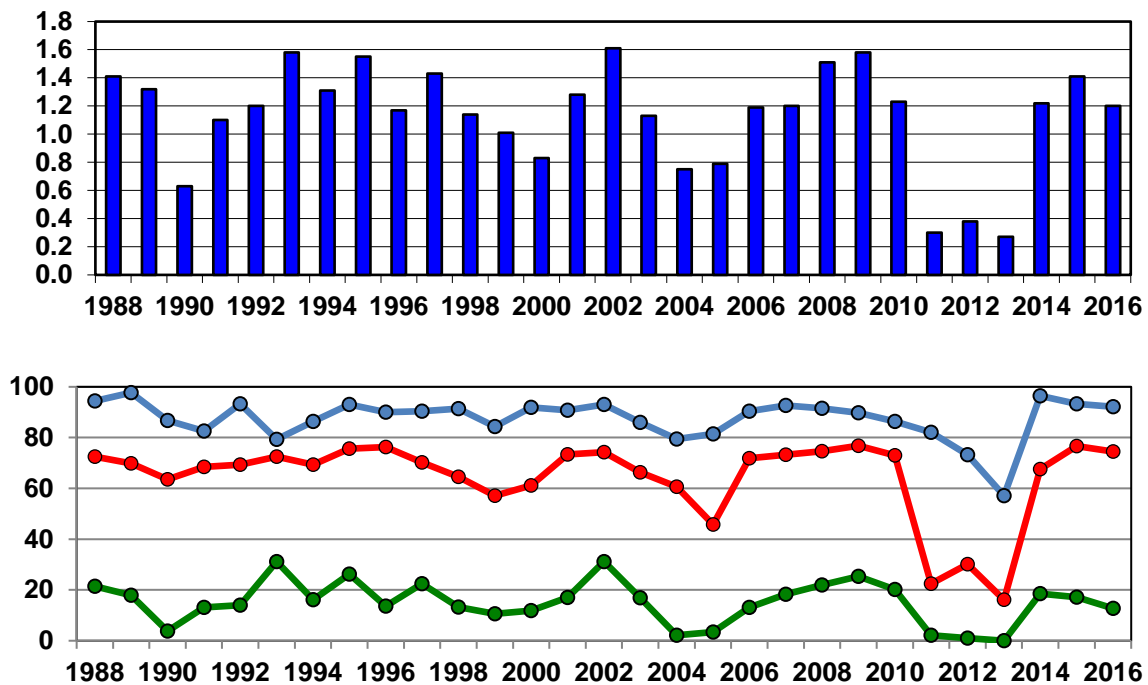
**Figure 1.3.** The estimated dates by which 25%, 50% and 75% of apparently incubating Shag nests were first recorded as such in study plots at Sumburgh Head, 1996–2016. In years when none were incubating on the first visit, the date of first recorded incubation is also shown.



**Table 1.5.** Shag breeding success at Sumburgh Head and Burravoe: the number of former nest sites where an adult(s) but no nest material was recorded (Ad.), the number of trace (Tr.), well-built but empty (AON), and incubated nests (Inc.), the percentage of all nests which progressed to incubation (% Inc.), the percentage of incubating nests at which chicks were recorded (% H.), the percentage of incubating nests from which no chicks fledged (Fl. 0), the number of chicks fledged (Ch.), mean brood size at fledging (Brood), and sum breeding success (Succ.: Ch./Inc.).

<b>Sumburgh Head</b>										
<b>Year</b>	<b>Ad.</b>	<b>Tr.</b>	<b>AON</b>	<b>Inc.</b>	<b>% Inc.</b>	<b>% H.</b>	<b>Fl. 0</b>	<b>Ch.</b>	<b>Brood</b>	<b>Succ.</b>
<b>2009</b>	13	17	4	185	89.8	76.8	28.6	293	2.22	<b>1.58</b>
<b>2010</b>	3	23	12	222	86.4	73.0	41.0	274	2.09	<b>1.23</b>
<b>2011</b>	26	21	11	141	82.1	22.5	83.0	43	1.79	<b>0.30</b>
<b>2012</b>	51	21	14	96	73.3	30.2	76.0	36	1.57	<b>0.38</b>
<b>2013</b>	36	15	27	56	57.1	16.1	83.9	15	1.67	<b>0.27</b>
<b>2014</b>	25	2	2	108	96.4	67.6	36.1	132	1.91	<b>1.22</b>
<b>2015</b>	10	5	3	111	93.3	76.6	28.8	157	1.99	<b>1.41</b>
<b>2016</b>	12	2	6	94	92.2	74.5	36.2	113	1.88	<b>1.20</b>
<b>Burravoe, Yell</b>										
<b>2012</b>	-	6	2	36	81.8	52.8	50.0	26	1.44	<b>0.72</b>
<b>2013</b>	2	2	1	39	92.9	64.1	46.2	36	1.71	<b>0.92</b>
<b>2014</b>	6	4	2	27	81.8	81.5	25.9	42	2.10	<b>1.56</b>
<b>2015</b>	2	2	0	35	94.6	54.3	51.4	28	1.65	<b>0.80</b>
<b>2016</b>	0	3	0	22	88.0	72.7	31.8	31	2.07	<b>1.41</b>

**Figure 1.4.** Shag breeding parameters at Sumburgh Head, 1988–2016. **Upper:** chicks fledged per incubated nest. **Lower:** The percentage of: (i) nests that progressed to incubation (blue), (ii) incubating nests where chicks were recorded (red), (iii) laying pairs that fledged a brood of three chicks (green).



At Burravoe, laying was again slightly earlier than at Sumburgh (**Table 1.6**) but at most nests (16/22) first recorded incubation was followed by 10–14 days with an adult standing at an empty nest, and uninterrupted incubation really only began in the last 10 days of May. As at Sumburgh, chicks were recorded at a high proportion of nests, but with only three known instances of brood reduction (all b/3 to b/2) and no complete brood losses, breeding success at 1.41 fledged per incubating nest was higher (**Table 1.5**).

**Table 1.6.** The estimated dates by which 25%, 50% and 75% of apparently incubating Shag nests were first recorded as such in study plots at Sumburgh Head (SH) and Burravoe (BRV), 2012–16. \*One nest at Sumburgh in 2016 was first detected during mid incubation so the sample size differs from that in **Table 1.5**.

Colony	SH	BRV		SH	BRV		SH	BRV		SH	BRV		SH	BRV
Year	2012	2012		2013	2013		2014	2014		2015	2015		2016	2016
25%	9/5	7/5		21/5	12/4		7/5	25/4		9/4	-		23/4	15/4
50%	28/5	15/5		9/6	25/4		20/5	9/5		17/4	9/4		4/5	29/4
75%	2/7	20/5		26/6	3/5		2/6	25/5		28/4	14/4		14/5	10/5
Sample size	96	36		56	39		108	27		111	35		93*	22

Finally, we draw attention to the declining sample size at both colonies. At Sumburgh, nests monitored for breeding success comprised 78% of nests recorded on the whole colony count from land on 5<sup>th</sup> June 2016 (**Tables 1.4 & 1.5**). The remaining 22% of nest sites were not monitored, either because they were only partially visible and it would be impossible to determine brood sizes of large chicks accurately, or because the viewing position would be unsafe in windy or wet conditions. At Burravoe, all nests clearly visible safely from land are monitored and it is to be hoped that the reduction in the number of nests since 2015 does not continue.

#### 1.4a. Black-legged Kittiwake *Rissa tridactyla*: Population counts

Whole-colony counts of Kittiwakes were made in June from the SOTEAG RIB in southwest Shetland and at Muckle Roe, while the Compass Head colony was counted on 4<sup>th</sup> July. The total of 345 nests counted in 2016 was 17% lower than the most recent previous counts at these same breeding stations, but changes in numbers varied considerably between different breeding stations (**Table 1.7**). In southwest Mainland the number of nests between St Ninian's Isle and West Burra had more than halved since 2014, with Kettla Ness again deserted, while in the west Mainland numbers had more than trebled since 2012, with a notable increase at Westerwick, and Braga Ness having been recolonised since it was last checked in 2007. As noted in 2015, the last remaining sub-colony on the south coast of Muckle Roe had been abandoned since 2012, the birds probably having moved to a completely new breeding station at Neeans (on Mainland, west of Vementry), while on the north coast of Muckle Roe a few pairs have recolonised Swabi Stack.

The term 'breeding station' refers to groups of nests separated by over an arbitrary mile of unoccupied cliff habitat, or over a mile of sea. The Kittiwake is a highly colonial species and a breeding station may comprise a single group of nests, or a number of 'sub-colonies' that are sufficiently far apart to be recorded separately on the 1:10,000 maps used in the field. Some 'sub-colonies' (e.g. those on opposite sides of a large geo) are close enough that birds nesting in one may derive social stimuli from birds nesting in the other, but in most cases they are invisible to and out of hearing from each other. The breeding stations listed in **Table 1.7** held 3,030 nests in 56 'sub-colonies' in the baseline year of 1981, i.e. with a mean number of 54 nests per 'sub-colony'. The respective figures for 2016 were 345 nests in 23 'sub-colonies', with a mean number of 15 nests. The spatial extent of these 'sub-colonies' has never been recorded but it is apparent that, in general, nest density has become considerably reduced as breeding numbers have declined; the consequence of this in terms of social stimulation and breeding performance can only be speculated on, but is most likely to be adverse (see Chapter 4 in: Coulson, J. C. 2011. *The Kittiwake*. Poyser, London).

**Table 1.7.** Counts of Kittiwake nests (incubating, empty and trace) at breeding stations surveyed from the sea in 2016, compared with counts in 1981 (used as a baseline), and from 2007. nc = not checked that year.

<b>SE Mainland</b>	<b>1981</b>		<b>2007</b>	<b>2008</b>	<b>2009</b>	<b>2010</b>	<b>2011</b>	<b>2012</b>	<b>2013</b>	<b>2014</b>	<b>2015</b>	<b>2016</b>
Compass Head	464		152		146	163			90	109		65
<b>SW Mainland</b>	<b>1981</b>		<b>2007</b>	<b>2008</b>	<b>2009</b>	<b>2010</b>	<b>2011</b>	<b>2012</b>	<b>2013</b>	<b>2014</b>	<b>2015</b>	<b>2016</b>
St Ninian's Isle	47		20		42			63		69		44
Ness of Ireland	203		69		41			47		42		30
South Havra	29		73		37			17		19		8
Kettla Ness	281		107		123			24		33		0
West Burra	615		101		110			55		65		29
<b>Total nests</b>	<b>1175</b>		<b>370</b>		<b>353</b>			<b>206</b>		<b>228</b>		<b>111</b>
<b>W Mainland</b>	<b>1981</b>		<b>2007</b>	<b>2008</b>	<b>2009</b>	<b>2010</b>	<b>2011</b>	<b>2012</b>	<b>2013</b>	<b>2014</b>	<b>2015</b>	<b>2016</b>
Reawick Ness	272		2		0			nc				0
Skelda Ness	188		0		4			1				13
Westerwick	454		9		20			25				89
Burga Stacks	58		1		12			1				1
Vaila	255		46		43			25				46
Braga Ness	12		0		nc			nc				15
<b>Total nests</b>	<b>1239</b>		<b>58</b>		<b>79</b>			<b>52</b>				<b>164</b>
<b>NW Mainland</b>	<b>1981</b>		<b>2007</b>	<b>2008</b>	<b>2009</b>	<b>2010</b>	<b>2011</b>	<b>2012</b>	<b>2013</b>	<b>2014</b>	<b>2015</b>	<b>2016</b>
Muckle Roe south	96				41		25					0
Muckle Roe north	56				0		0					5
<b>Total nests</b>	<b>152</b>				<b>41</b>		<b>25</b>					<b>5</b>

#### 1.4b. Black-legged Kittiwake *Rissa tridactyla*: Breeding success

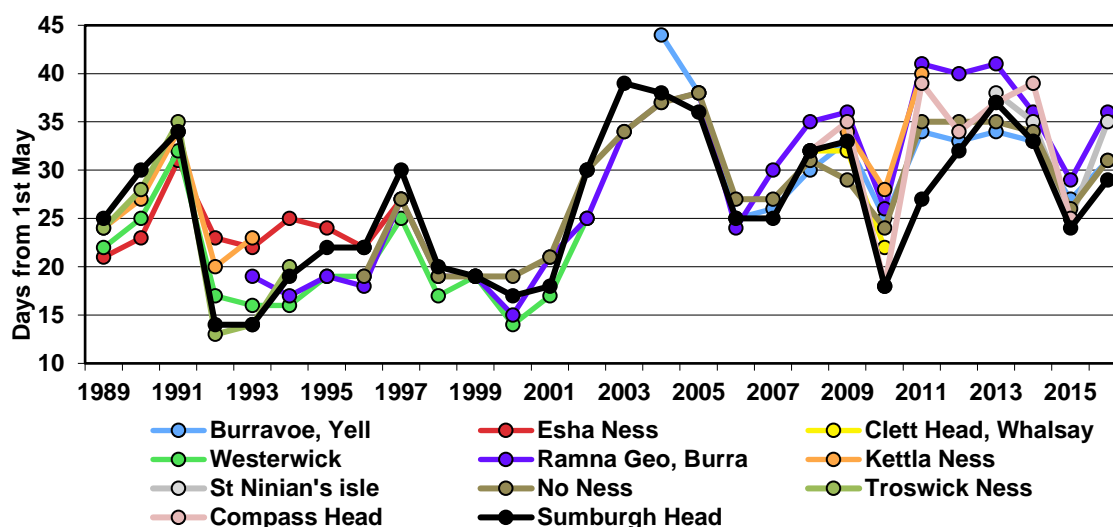
This was monitored at five colonies, Compass Head having been discontinued because there were no adults or nests in the only remaining sub-colony visible from land on the first checks in mid May (there had been 22 nests in 2015), although 4 adults and three nests were counted there from the sea on 4<sup>th</sup> July.

Laying was slightly later than in 2015 (Table 1.8, Figure 1.5) but a high proportion of nests progressed to incubation at all colonies (Table 1.9). Chicks hatched at 75% or more of incubating nests except at No Ness. At Sumburgh Head breeding failures increased in the second week of July, with nests abandoned at late incubation or hatching stages, or else broods of small chicks disappeared, but most chicks alive on 22<sup>nd</sup> July survived to fledge. Mean brood size at fledging was 1.18 (no broods of three fledged), and breeding success at 0.65 was moderate. Success was lower at No Ness, where the sample size of nests is now very low, and only four of the eight broods known to have hatched survived to fledge. The pattern of nest failure at St Ninian's Isle was similar to Sumburgh Head, with 10 of 15 breeding failures occurring between 5<sup>th</sup> and 22<sup>nd</sup> July, and all but one of the chicks alive on 22<sup>nd</sup> surviving to fledge. At Ramna Geo, 13 of 24 breeding failures occurred between 12<sup>th</sup> and 26<sup>th</sup> July, although four of the seven chicks alive on the latter date survived to fledge. At Burravoe, although 11 out of 25 breeding failures occurred between 14<sup>th</sup> and 23<sup>rd</sup> July, chick survival was higher than at the more southern colonies and mean brood size at fledging (1.51) was markedly higher than at Sumburgh.

**Table 1.8.** Dates by which 20%, 50% and 80% of Kittiwakes had laid at monitored colonies, 2014–16.

	Sumburgh Head			No Ness			St Ninian's Isle		
	2014	2015	2016	2014	2015	2016	2014	2015	2016
20%	26/5	20/5	23/5	31/5	24/5	27/5	28/5	20/5	31/5
50%	2/6	24/5	29/5	3/6	26/5	31/5	4/6	25/5	4/6
80%	9/6	30/5	5/6	7/6	31/5	8/6	10/6	29/5	9/6
	Ramna Geo, Burra			Burravoe, Yell					
	2014	2015	2016	2014	2015	2016			
20%	30/5	24/5	30/5	29/5	22/5	26/5			
50%	5/6	29/5	5/6	2/6	27/5	31/5			
80%	10/6	3/6	11/6	9/6	1/6	3/6			

**Figure 1.5.** Dates by which 50% of Kittiwakes breeding that year were presumed to have laid their first eggs, 1989–2016.



**Table 1.9.** The number of Kittiwake nests and occupied sites at monitored colonies 2007–16; the percentage of: (i) all nests at which incubation was recorded or assumed, (ii) incubating nests in which at least one chick was known to have hatched, (iii) hatched nests in which two chicks were seen, (iv) nests where young hatched in which one or more dead chicks were seen, (v) incubating nests that failed; the number of young fledged; breeding success (young fledged per incubating nest). Mean and standard error are given for plots at Sumburgh Head; all visible nests are monitored at the other colonies.

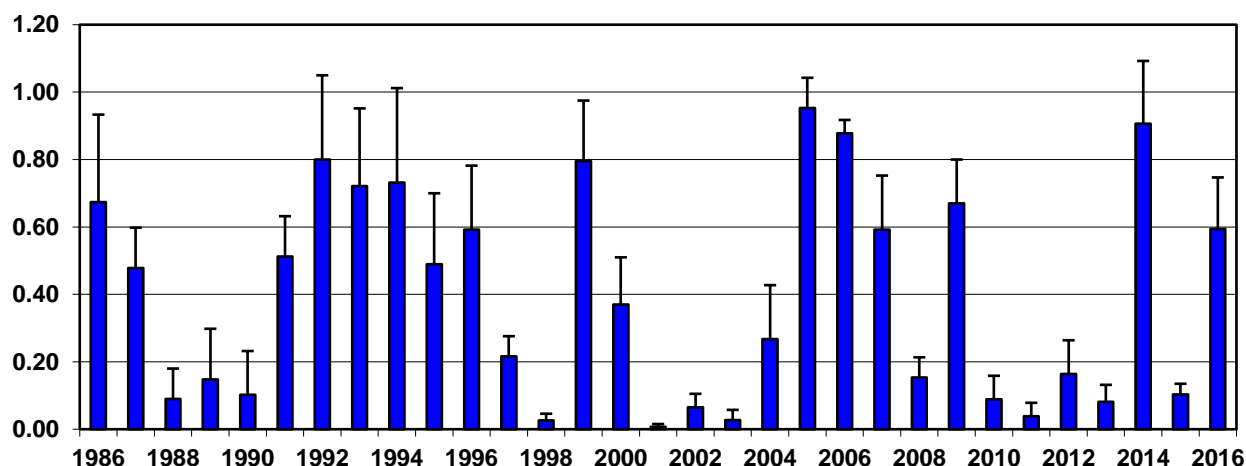
<b>Sumburgh Head</b>	<b>2007</b>	<b>2008</b>	<b>2009</b>	<b>2010</b>	<b>2011</b>	<b>2012</b>	<b>2013</b>	<b>2014</b>	<b>2015</b>	<b>2016</b>
Total nests	163	148	177	177	145	139	138	150	135	142
Incubating	128	89	128	151	94	93	89	115	117	119
% Incubating	78.0	60.1	72.3	85.3	64.8	66.9	64.5	76.7	86.7	83.8
Sites adult(s) only	20	36	39	22	39	35	40	29	21	29
% Nests hatched	82.8	21.3	80.5	86.8	21.3	60.2	32.6	85.2	59.8	82.4
% Nests hatched b/2	17.9	5.3	24.3	11.5	15.0	1.8	0	46.9	2.9	31.6
% Hatched with dead	12.3	5.3	3.9	8.4	10.0	26.8	20.7	2.0	2.9	4.1
% Nests failed	46.9	98.9	44.5	88.1	100	84.9	100	20.9	71.8	43.7
Chicks fledged	69	1	75	18	0	14	0	132	33	79
<b>Sum success</b>	<b>0.54</b>	<b>0.01</b>	<b>0.59</b>	<b>0.12</b>	<b>0</b>	<b>0.15</b>	<b>0</b>	<b>1.15</b>	<b>0.28</b>	<b>0.66</b>
<b>Mean success</b>	<b>0.47</b>		<b>0.51</b>	<b>0.11</b>	<b>0</b>	<b>0.13</b>	<b>0</b>	<b>1.20</b>	<b>0.19</b>	<b>0.65</b>
SE	0.08		0.09	0.06		0.04		0.10	0.06	0.18
<b>No Ness</b>	<b>2007</b>	<b>2008</b>	<b>2009</b>	<b>2010</b>	<b>2011</b>	<b>2012</b>	<b>2013</b>	<b>2014</b>	<b>2015</b>	<b>2016</b>
Total nests	31	43	45	50	29	22	19	17	14	12
Incubating	23	32	39	38	21	16	14	14	13	12
% Incubating	74.2	74.4	86.7	76.0	72.4	72.7	73.7	82.4	92.9	100
Sites adult(s) only	2	14	0	0	8	9	5	4	3	8
% Nests hatched	87.0	40.6	74.4	50.0	38.1	31.3	0	71.4	61.5	66.7
% Nests hatched b/2	10.0	0	34.5	15.8	0	0	0	60.0	0	12.5
% Hatched with dead	15.0	7.7	6.9	5.3	0	20.0	0	0	0	0
% Nests failed	82.6	75.0	51.3	100	100	100	100	35.7	92.3	66.7
Chicks fledged	4	8	23	0	0	0	0	15	1	5
<b>Sum success</b>	<b>0.17</b>	<b>0.25</b>	<b>0.56</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>1.07</b>	<b>0.08</b>	<b>0.42</b>
<b>St Ninian's Isle</b>							<b>2013</b>	<b>2014</b>	<b>2015</b>	<b>2016</b>
Total nests							58	61	61	46
Incubating							38	54	41	44
% Incubating							67.9	88.5	68.3	95.7
Sites adult(s) only							5	6	5	5
% Nests hatched							13.2	77.8	0	81.8
% Hatched b/2							0	61.9	-	8.3
% Hatched with dead							0	0	-	2.8
% Nests failed							100	27.8	100	34.1
Chicks fledged							0	64	0	31
<b>Sum success</b>							<b>0</b>	<b>1.19</b>	<b>0</b>	<b>0.70</b>
<b>Ramna Geo, Burra</b>	<b>2007</b>	<b>2008</b>	<b>2009</b>	<b>2010</b>	<b>2011</b>	<b>2012</b>	<b>2013</b>	<b>2014</b>	<b>2015</b>	<b>2016</b>
Total nests	124	91	111	117	76	64	48	68	37	32
Incubating	100	55	81	74	45	24	34	64	30	28
% Incubating	80.6	60.4	73.0	63.2	59.2	37.5	70.8	94.1	81.1	87.5
Sites adult(s) only	6	16	14	11	22	15	8	13	8	11
% Nests hatched	80.0	16.9	85.2	18.9	2.2	0	35.3	6.2	66.7	75.0
% Hatched with b/2	30.0	10.0	62.3	7.1	0	0	0	0	0	4.8
% Hatched with dead	7.5	0	0	14.3	0	0	8.3	0	5.0	4.8
% Nests failed	30.0	83.1	17.3	98.6	100	100	70.6	100	93.3	85.7
Chicks fledged	80	11	103	1	0	0	10	0	2	4
<b>Sum success</b>	<b>0.80</b>	<b>0.19</b>	<b>1.27</b>	<b>0.01</b>	<b>0</b>	<b>0</b>	<b>0.29</b>	<b>0</b>	<b>0.07</b>	<b>0.14</b>

**Table 1.9.** continued.

<b>Burravoe, Yell</b>	<b>2007</b>	<b>2008</b>	<b>2009</b>	<b>2010</b>	<b>2011</b>	<b>2012</b>	<b>2013</b>	<b>2014</b>	<b>2015</b>	<b>2016</b>
Total nests	104	98	113	135	117	128	130	114	98	100
Incubating	94	85	99	107	87	94	99	95	84	84
% Incubating	91.0	86.7	87.6	79.3	74.4	73.4	76.2	83.3	85.7	84.0
Sites adult(s) only	1	7	4	8	12	9	15	16	14	12
% Nests hatched	87.2	34.1	72.7	69.2	28.7	51.1	40.4	76.8	73.8	86.9
% Hatched with b/2	25.6	34.5	51.5	6.8	8.0	43.8	2.5	60.3	13.1	58.9
% Hatched with dead	4.9	0	1.4	8.1	4.0	2.1	15.0	1.4	4.9	2.7
% Nests failed	26.6	72.9	35.4	53.3	78.2	59.6	87.9	32.6	79.8	29.8
Chicks fledged	81	33	95	52	20	49	12	100	17	89
<b>Sum success</b>	<b>0.86</b>	<b>0.39</b>	<b>0.96</b>	<b>0.49</b>	<b>0.23</b>	<b>0.52</b>	<b>0.12</b>	<b>1.05</b>	<b>0.20</b>	<b>1.06</b>

At  $0.59 (\pm 0.15 \text{ SE})$  fledged per laying pair, breeding success in 2016 was well above the long-term average for those colonies that have been monitored by SOTEAG (1986–2015: 0.39; **Figure 1.6**), but still below an estimate of that which would be sufficient to maintain a stable population (0.80; Coulson 2011), and far below any productivity that could begin to redress the population decrease of the past 35 years through recruitment of first-time breeders.

**Figure 1.6.** Mean Kittiwake breeding success ( $\pm$  SE) at colonies (4–7 per year) monitored by SOTEAG, 1986–2016. Breeding success is defined as chicks fledged per apparently laying pair.



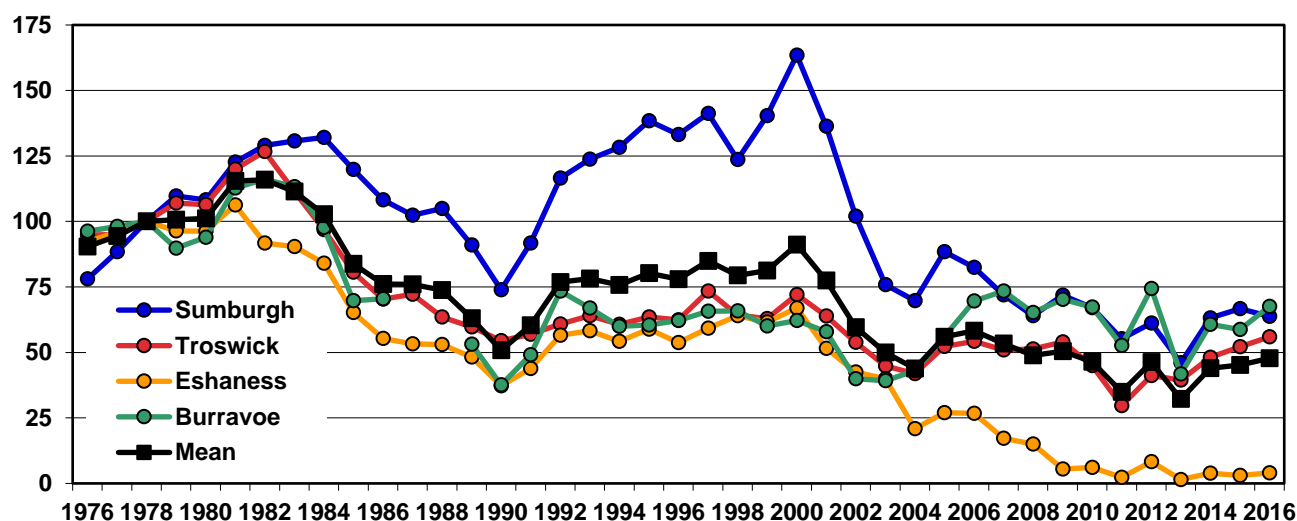
### 1.5a. Common Guillemot *Uria aalge*: Population counts

In south Mainland, there was little change since 2015 in the number of adults in study plots at Sumburgh Head and Troswick Ness, while on Yell there was a modest increase in numbers at Burravoe (**Table 1.10**). During the 1990s and early 2000s the population index at Esha Ness broadly tracked those at Troswick Ness and Burravoe (**Figure 1.6**), but this changed in 2004 (a year of widespread breeding failure among many seabird species) and since 2009 only small numbers of birds have been recorded erratically on former breeding ledges. Allowing for years of low colony attendance in 2011 and 2013, the mean population index suggests only a slight decline over the past decade, but a decrease of 48% since 2000 and of 52% since the baseline year of 1978 (**Figure 1.6**).

**Table 1.10.** Mean counts of individual Common Guillemots in study plots at four Shetland colonies, 2015–16. Statistics are: number of counts, range, mean, standard deviation, coefficient of variation, percentage change since 2015, and population indices (1978 = 100).

Colony	Unit	Year	n	Range	Mean	SD	CV	% ch.	Index
Sumburgh Head	Birds	2015	5	805–951	884.2	62.68	0.07		66.7
		2016	5	795–965	846.0	68.77	0.08	-4.3	63.8
Troswick Ness	Birds	2015	5	264–307	286.6	18.09	0.06		52.2
		2016	5	289–320	307.4	12.34	0.04	+7.3	55.9
Esha Ness	Birds	2015	5	5–32	20.8	11.32	0.54		3.0
		2016	5	23–35	27.8	4.44	0.16	+33.7	4.0
Burravoe	Birds	2015	5	169–227	196.6	26.43	0.13		58.8
		2016	5	206–246	225.8	18.31	0.08	+14.9	67.6

**Figure 1.6.** Annual index (1978 = 100) of Common Guillemot numbers in study plots at four monitored colonies, 1976–2016, and the mean index for the four colonies.



### 1.5b. Common Guillemot *Uria aalge*: Breeding success, chick diet and weights at Sumburgh Head

The single success plot on the east side of the Head was checked daily from 19<sup>th</sup> April until 18<sup>th</sup> July, with the number of adults present at the start of the check being recorded. The normal pre-laying cyclical pattern of attendance occurred, with 212 adults on 22<sup>nd</sup>, 28<sup>th</sup> and 29<sup>th</sup> April being the highest counts of the season and the afternoon of 2<sup>nd</sup> May being the last occasion when no birds were seen (**Figure 1.7**).

The first egg was seen on 4<sup>th</sup> May and the next (5) on 6<sup>th</sup> May, after which laying was fairly rapid with a median laying date of 13<sup>th</sup> May; the last presumed first eggs (3) were recorded on 29<sup>th</sup> May (**Table 1.11**). Colony attendance was stable throughout the second half of May and June (**Figure 1.7**). Casual observations of individual pairs with one bridled and one non-bridled mate indicated frequent change-overs during incubation and no eggs were recorded as abandoned on site, suggesting off-duty mates were foraging fairly close to the colony; the first display fish seen were small pout-type gadids on 9–10<sup>th</sup> May.

The first chick was seen on 5<sup>th</sup> June (from the first egg laid), and hatching success was relatively high. While a few eggs from the fringes of the plot were probably lost to Herring Gulls none were seen being taken (**Table 1.12**). Similarly, Herring Gulls occasionally attempted to take chicks from fringe sites but colony defence was very strong and none were seen predated in the plot, although one was taken from a neighbouring area. Great Skuas and Great Black-backed Gulls have caused considerable alarm in previous years when they have shown an interest in Guillemot eggs or chicks but both species were largely absent this year. From 24<sup>th</sup> June increasing numbers of chicks were being brooded by neighbours, but these were invariably fed when one of their parents came in with a fish. Only one chick was seen dead in the plot, lying in a deep pool of slurry after heavy rain on 1<sup>st</sup> July.

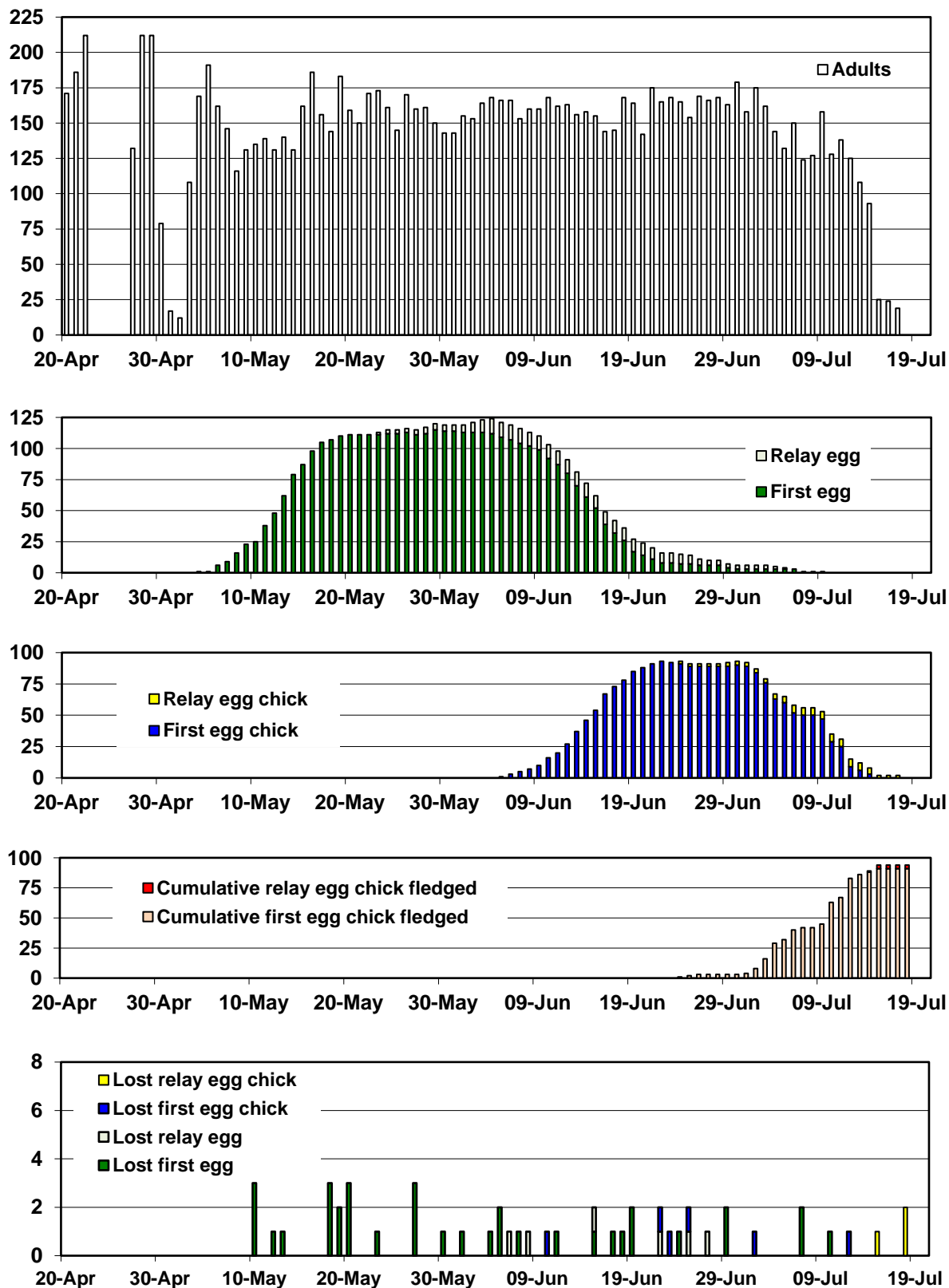
The first three chicks assumed to have fledged were missing on the mornings of 24<sup>th</sup>, 25<sup>th</sup> and 26<sup>th</sup> June, aged 16, 18 and 20 days, respectively. This was a period of mist, light NE wind and calm seas and there was no reason to believe they had not fledged successfully (the site with the chick missing on 25<sup>th</sup> had an adult standing for most of the morning with a fish). Moderate to heavy swell during 28–30<sup>th</sup> June probably delayed further fledging, but following calm seas and light westerly winds from 1<sup>st</sup> – 14<sup>th</sup> July, by 15<sup>th</sup> July only two chicks from relay eggs remained in the plot, accompanied by 25 adults. These chicks were still present on 17<sup>th</sup> July (with 19 adults) but the plot was deserted on the morning of 18<sup>th</sup> and it was assumed they had been predated, aged 12 and 13 days. Breeding success at 0.71 fledged per laying pair was the highest since 1996 and well above the long-term (1989–2015) mean of 0.54 (**Figure 1.8**).

**Table 1.11.** Common Guillemot breeding parameters and success in a study plot at Sumburgh Head, 2007–16, calculated as young fledged per regularly attended site, and per site at which eggs were laid.

	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
Attended sites	165	166	169	169	164	163	155	158	153	150
Sites with egg laid	142	137	144	154	142	140	98	122	135	132
% sites laid	86%	83%	85%	91%	87%	86%	63%	77%	88%	88%
First egg date	4/5	4/5	2/5	2/5	29/4	4/5	7/5	6/5	5/5	4/5
Median laying date	11/5	16/5	10/5	9/5	9/5	14/5	19/5	16/5	14/5	13/5
% Hatched first egg	66%	49%	65%	68%	21%	68%	11%	66%	70%	74%
Chicks fledged	80	39	91	78	2	55	0	66	70	94
Fledged/site	0.48	0.23	0.54	0.46	0.01	0.34	0.00	0.42	0.46	0.63
<b>Fledged/egg</b>	<b>0.56</b>	<b>0.28</b>	<b>0.63</b>	<b>0.51</b>	<b>0.01</b>	<b>0.39</b>	<b>0.00</b>	<b>0.54</b>	<b>0.52</b>	<b>0.71</b>

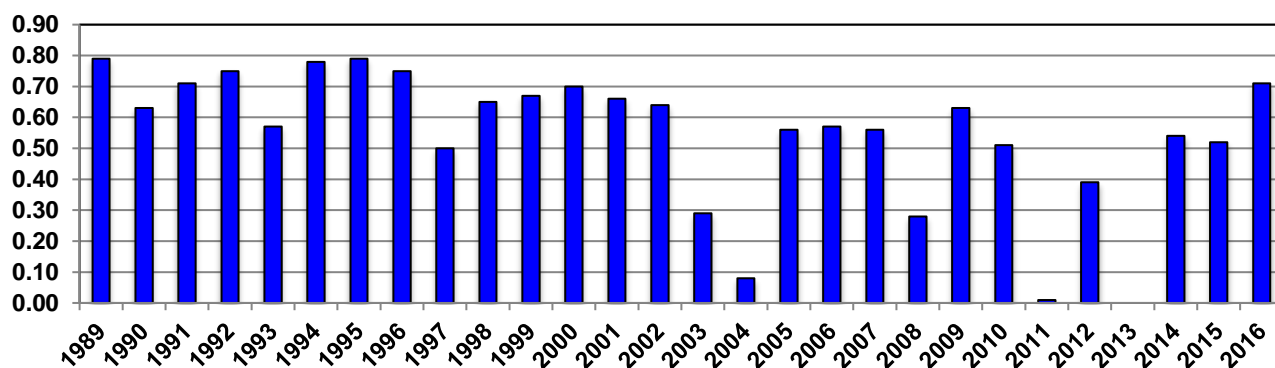


**Figure 1.7. Upper:** The daily number of adults, first eggs and relay eggs, first egg chicks and relay egg chicks in the breeding success plot at Sumburgh Head in 2016, and the cumulative number of fledged first-egg chicks and relay-egg chicks.  
**Lower:** The number of eggs and chicks missing from the previous day, or known to have been lost that day.



**Table 1.12.** Outcome (%) of Common Guillemot breeding attempts in a study plot at Sumburgh Head.

	2012	2013	2014	2015	2016
Number of breeding pairs	140	98	122	135	132
Lost first egg before possible hatching (< 29 days), no relay	15.0	50.0	11.5	8.1	9.8
Lost first egg around possible hatching (29–37 days), or chick died hatching	2.9	4.1	7.4	7.4	3.0
Presumed infertile first egg, incubated 38+ days	0.7	0.0	2.5	3.7	4.5
Lost relay egg before possible hatching (< 29 days)	7.1	34.7	4.9	7.4	3.8
Lost relay egg around possible hatching (29–37 days), or chick died hatching	2.1	0.0	0.8	0.0	0.8
Presumed infertile relay egg, incubated 38+ days	0.7	0.0	0.8	0.0	0.0
First egg chick missing before presumed fledging (< 15 days)	20.7	11.2	12.3	8.1	3.8
First egg chick seen dead	4.3	0.0	0.0	5.2	0.8
First egg chick seen predated	0.0	0.0	0.8	0.7	0.0
First egg chick missing 15+ days, assume predated	5.7	0.0	2.5	5.9	0.0
Relay chick missing before presumed fledging (< 15 days)	1.4	0.0	3.3	0.7	2.3
Relay chick seen dead	0.0	0.0	0.0	0.0	0.0
Relay chick missing 15+ days, assume predated	0.0	0.0	0.0	0.7	0.0
Fledged chick from first egg	37.9	0.0	50.8	50.4	68.9
Fledged chick from relay egg	1.4	0.0	3.3	1.5	2.3

**Figure 1.8.** Common Guillemot breeding success in the study plot at Sumburgh Head, 1989–2016.

Adult attendance at the breeding success plot (mean of 125 adults per 100 breeding pairs) on the dates of the five population counts elsewhere around Sumburgh Head was very similar to 2015 (mean of 124), giving an almost identical *k*-value (0.80 c.f. 0.81 in 2015) (**Table 1.13**).

**Table 1.13.** Details of counts of Common Guillemots in the Sumburgh Head breeding success plot in 2016 (with mean and standard deviation), breeding numbers, derived *k*-values (with mean and standard deviation), and the deviation of counts in population monitoring plots on the same dates from the monthly mean.

Count date in 2016	6/6	8/6	10/6	13/6	19/6	Mean	SD
Time (BST)	13.10	13.10	13.10	13.10	12.20		
Total birds in plot (n)	162	159	168	166	170	165.0	4.47
Total regularly attended sites (a)	150	150	150	150	150		
Total breeding pairs (b)	132	132	132	132	132		
<i>k</i> -value regular sites (a/n)	0.93	0.94	0.89	0.90	0.88	0.91	0.03
<b><i>k</i>-value breeding pairs (b/n)</b>	<b>0.81</b>	<b>0.83</b>	<b>0.79</b>	<b>0.80</b>	<b>0.78</b>	<b>0.80</b>	<b>0.02</b>
Population count as % of mean for 2016	99%	94%	95%	98%	114%		

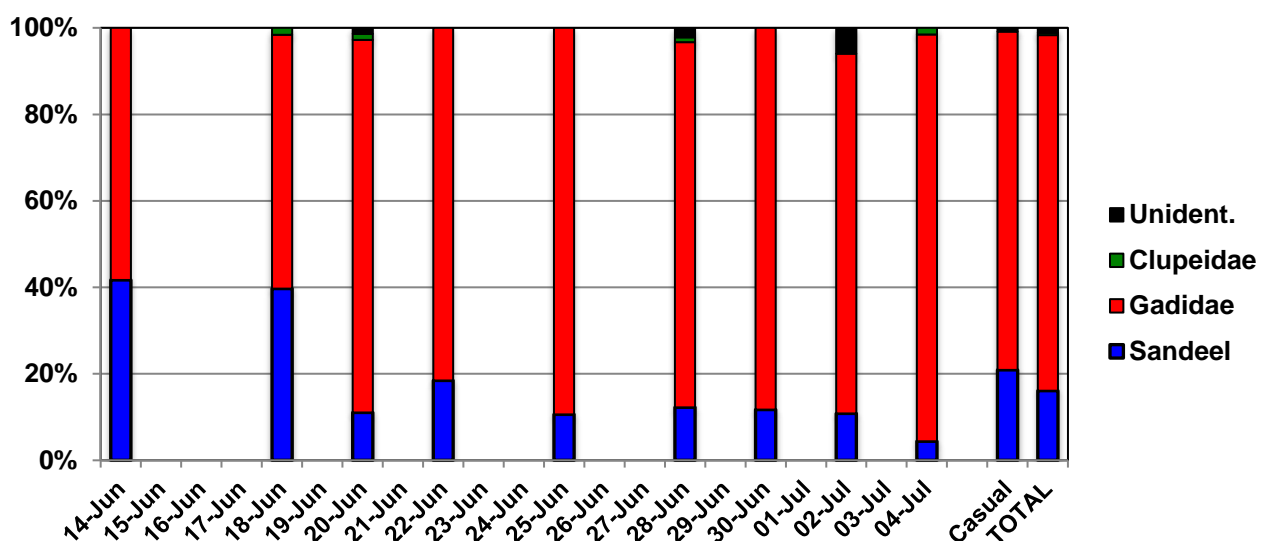
Feeding watches were carried out on nine days from 14<sup>th</sup> June – 4<sup>th</sup> July at and around the breeding success plot. Each incoming adult was checked by telescope to see if it was carrying a fish, and if so it was followed until the fish was presented to a chick. The session on 14<sup>th</sup> June lasted 90 minutes while all other sessions lasted 120 minutes. Casual observations of feeds when an adult with a fish wandered into the field of view of the telescope during routine checks of the plot were also recorded, but casual observations of incoming birds were not as these would have been biased towards birds carrying larger fish visible to the naked eye.

Gadids comprised 82% of fish seen fed to chicks, thought mostly to have been small to medium sized Saithe *Pollachius virens* (**Table 1.14**), which are fairly easy to identify by their blackish back, white belly, and bronze shallowly-forked tail and ventral area. The incidence of sandeels was highest on 14<sup>th</sup> June (42%, n = 24) and 18<sup>th</sup> June (40%, n = 63) and lowest on the last watch, on 4<sup>th</sup> July (4%, n = 68; **Figure 1.9**). Incoming parents carrying fish were largely ignored by other adults brooding chicks and the few instances of fighting over fish appeared to involve failed or non-breeders parading around with display fish. In contrast to 2015, when some smaller chicks struggled to ingest medium to large Norway Pout *Trisopterus esmarkii* (which comprised 48% of fish delivered to chicks), chicks in 2016 seemed to have little difficulty swallowing fish. On 14<sup>th</sup> June most fish were still wet despite it being a sunny, breezy day, and on 20<sup>th</sup> June some Saithe appeared to be still alive (tails flapping), suggesting that most Guillemots were foraging for their chicks very close to the colony. Sequences of three or more feeds during a 2-hour watch or feeds 30 minutes or less apart are given in **Table 1.15**. This was the eighth year of such feeding watches in the past decade, and the percentage of sandeels in chick diet was the lowest yet recorded (**Figure 1.10**).

**Table 1.14.** The percentages (and number) of fish types fed to Common Guillemot chicks at Sumburgh Head on nine feeding watches, 14<sup>th</sup> June – 4<sup>th</sup> July (n = 680), and seen casually by telescope during checks of the breeding success plot (n = 110).

Fish type	Small	Medium	Large	Total
Sandeel	3.4 (27)	8.7 (69)	3.9 (31)	16.1 (127)
‘Norway Pout-type’ gadid	1.0 (8)	2.9 (23)	3.7 (29)	7.6 (60)
‘Rockling-type’ gadid	0.4 (3)	0.1 (1)	0	0.5 (4)
‘Saithe-type’ gadid	56.2 (444)	17.5 (138)	0.5 (4)	74.2 (586)
Clupeid	0.4 (3)	0.1 (1)	0	0.5 (4)
Unidentified/other but not sandeel	0.5 (4)	0.6 (5)	0	1.1 (9)

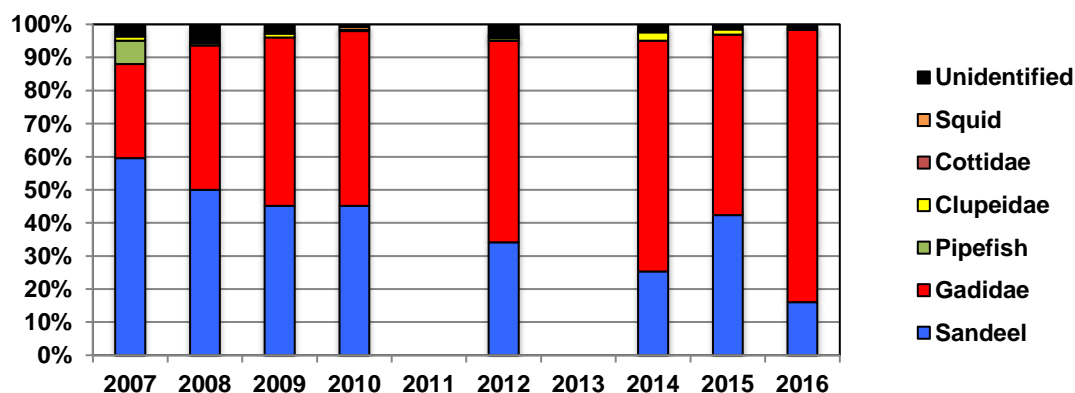
**Figure 1.9.** The percentage of prey items of different fish families fed to Common Guillemot chicks on feeding watches on 9 dates in 2016 (n = 680), casually during checks of the success plot (n = 110), and the total (n = 790).



**Table 1.15.** Instances of Common Guillemot chick feeds 30 minutes or less apart (**bold**), or of three or more feeds during the watch. These are minima, as some chicks may have received additional feeds un-noticed; “too quick” = chick definitely fed but too quickly for the fish to be identified to type.

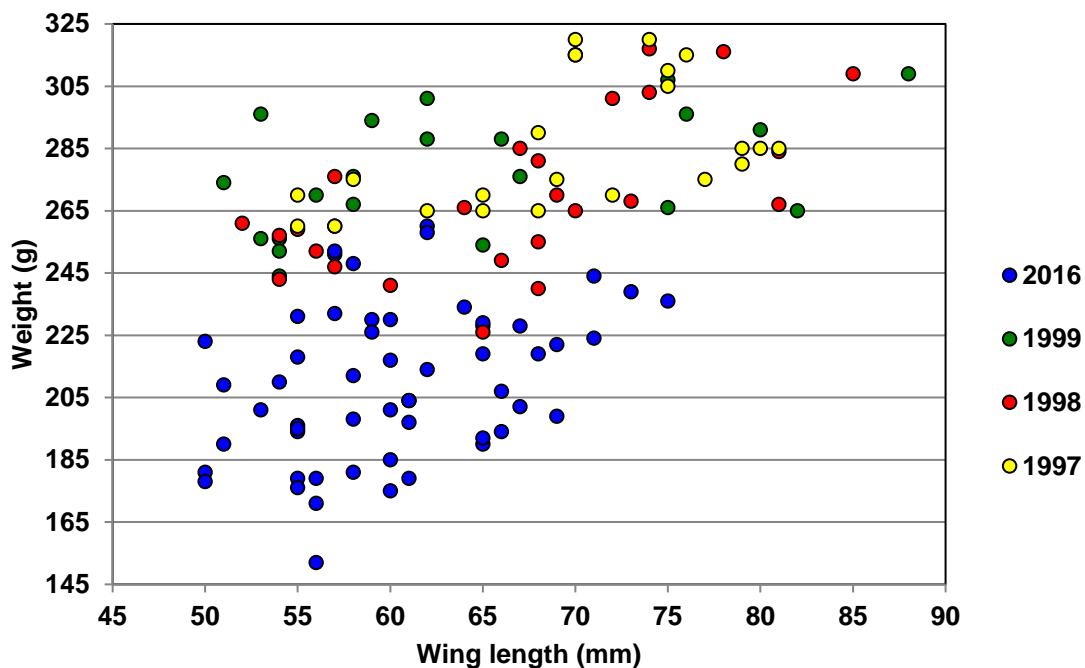
Date	Chick (age)	Feeds (time and fish type)
20/6	72 (2 days)	13:19 small saithe; <b>13:39 small saithe</b>
“	87A (10 d)	13:22 too quick; <b>13:42 too quick</b>
“	85 (9 d)	13:34 small saithe; <b>13:49 small saithe; 14:12 too quick; 14:28 small saithe</b>
“	32C (5 d)	13:37 small saithe; 14:13 small saithe; 14:50 medium saithe
“	30 (9 d)	14:43 small saithe; <b>14:55 small saithe</b>
22/6	8 (6 d)	09:18 small saithe; <b>09:44 too quick</b>
“	41 (9 d)	09:31 small saithe; 10:10 small saithe; <b>10:40 small saithe; 11:00 small saithe</b>
“	17 (6 d)	10:12 small sillock; <b>10:32 small saithe; 10:42 small saithe</b>
“	7B (15 d)	10:16 large pout; <b>10:43 small saithe</b>
25/6	14D (10 d)	12:17 small saithe; <b>12:37 small saithe; 13:05 small saithe</b>
“	87 (12 d)	12:19 small saithe; <b>12:34 small saithe</b>
“	36A (10 d)	12:28 small saithe; 13:12 small saithe; <b>13:24 small saithe; 14:10 small saithe</b>
“	30 (14 d)	12:41 medium saithe; <b>12:52 small saithe; 13:30 small saithe; 14:00 small saithe</b> , chick refused it, delivering parent ate it
“	57 (14 d)	12:52 small saithe; <b>13:10 small saithe</b>
“	41 (12 d)	13:36 small saithe; <b>14:03 small saithe</b>
28/6	7 (19 d)	08:55 medium saithe; <b>09:21 small saithe; 11:13 medium saithe</b>
“	8 (12 d)	09:14 medium saithe; <b>09:30 small saithe</b>
“	33 (16 d)	09:18 large pout; <b>09:48 small saithe</b>
“	22 (16 d)	09:31 medium saithe; 10:56 medium saithe; <b>11:26 small saithe</b>
30/6	78B (17 d)	09:00 medium saithe; 09:52 small saithe; 10:34 medium saithe
“	78A (14 d)	09:10 medium saithe; 09:58 medium saithe; <b>10:22 small saithe</b>
“	8B (14 d)	09:27 small saithe; <b>09:44 medium saithe; 10:05 medium saithe</b>
“	46A (17 d)	09:44 medium saithe; <b>10:13 small saithe</b>
2/7	87A (22 d)	10:17 small saithe; <b>10:31 medium saithe; 11:19 medium saithe</b>
“	78A (16 d)	10:24 medium saithe; <b>10:44 medium saithe; 11:25 medium saithe</b>
“	99 (15 d)	10:29 small saithe; <b>10:51 small saithe; 11:20 small saithe</b>
4/7	34A (16 d)	09:12 medium pout; <b>09:41 small saithe</b>
“	8 (18 d)	09:14 small saithe; <b>09:31 small saithe; 10:15 medium sandeel; 10:56 small saithe</b>
“	23A (9 d)	09:43 small saithe; <b>10:09 medium saithe</b>
“	50A (19 d)	09:45 small pout; <b>09:56 small saithe; 10:58 small saithe</b>
“	5 (19 d)	09:54 ‘auntie’ fed chick a medium saithe; <b>10:15 parent fed it a medium saithe</b>
“	81 (22 d)	10:09 small saithe; <b>10:25 medium saithe</b>
“	36B (16 d)	10:17 small saithe; <b>10:30 small saithe</b>
“	36A (19 d)	10:40 medium saithe; <b>10:54 small saithe</b>

**Figure 1.10.** Guillemot chick diet (% of feeds) at Sumburgh Head, 2007–16. Sample sizes: 2007 = 324; 2008 = 140; 2009 = 250; 2010 = 250; 2012 = 401; 2014 = 629; 2015 = 515; 2016 = 790. Too few chicks survived long enough in 2011 and 2013 for meaningful observations.

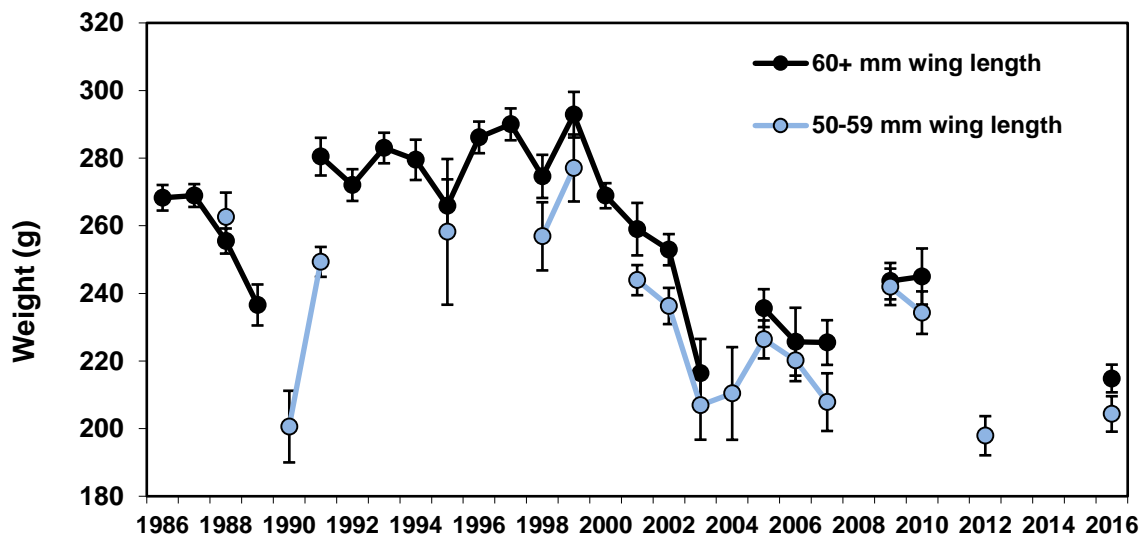


Shetland Ringing Group weighed and measured wing lengths of 90 Guillemot chicks at Sumburgh Head on 28<sup>th</sup> and 30<sup>th</sup> June, and at Compass Head on 4<sup>th</sup> July, the first reasonable sample size of these parameters since 2010. On average, the larger chicks in 2016 (wing lengths of 60 mm or greater) weighed 25% less than in 1997–98 (**Figure 1.11**), and were among the lightest in the years for which such measurements were made (**Figure 1.12**). Four discarded fish found were a Whiting *Merlangius merlangus* (140 mm in length), and three smaller gadids (82, 80 and 75 mm) identified from their otoliths as Saithe (2) and Norway Pout *Trisopterus esmarkii*. While there is no evidence (from studies elsewhere) that chick fledging weight affects post-fledging survival, and chick diet in the late 1990s is unknown, it would appear that chicks fledge at a relatively light weight in years when their diet is dominated by small to medium gadids.

**Figure 1.11.** Weight plotted against wing length for 55 Guillemot chicks with wing lengths of 50 mm or more in 2016, compared with 69 chicks at the same colonies in 1997–99.



**Figure 1.12.** Mean ( $\pm$  SE) weights of Guillemot chicks with wing lengths of 50+ mm at Sumburgh and Compass Heads, 1986–2016. Minimum sample size = 5.



### 1.5c. Common Guillemot *Uria aalge*: Breeding success at Burravoe, Yell

This was monitored in the same plot as in 2012–15. Because viewing distances from safe vantage points are greater than at Sumburgh Head, the presence of an egg is more difficult to confirm, and sites at which eggs were assumed to have been laid were defined as those where an adult was sitting tight (ST) throughout the visit on two consecutive dates (**Table 1.16**, a). Other sites where an adult was sitting tight on one or more non-consecutive dates from the date of first assumed laying to 30<sup>th</sup> June (**Table 1.16**, b), or where adults were only ever recorded as standing upright on two or more dates (**Table 1.16**, c) are listed separately. An incubation period of 32 days and a minimum fledging period of 15 days were used to calculate breeding success, while the state of plumage development of chicks that were seen well was also used as a guide to their probable age.

No birds were sitting tight on 15<sup>th</sup> May but seven sites were marked as sitting tight (including 4 with eggs seen) on the next check on 18<sup>th</sup> May. Of the total of 104 sites qualifying as having laid, 46.2 % had been recorded as such by 26<sup>th</sup> May and 66.3% by 30<sup>th</sup> May, suggesting a median laying date of 27<sup>th</sup> May, two weeks later than at Sumburgh Head. Of the 104 sites, an egg was seen at 77 (74%, c.f. 93% in 2015) and a chick was seen at 66 (64%, c.f. 53% in 2015). The number of adults attending the plot in relation to the number of assumed breeding pairs was considerably higher than at Sumburgh Head; on five mornings from 6<sup>th</sup> – 19<sup>th</sup> June in wind conditions of Force 4 or less *k*-values ranged from 0.54–0.68 (mean  $0.58 \pm 0.06$  SD), equivalent to 147–187 (mean  $173 \pm 15.5$  SD) per breeding pair.

Although the loss of very young chicks would be hard to detect due to viewing distance and the infrequency of checks, survival to possible fledging age of chicks seen at Burravoe has been high in the five years of monitoring, and the estimated breeding success in 2016 of 0.60 fledged per (assumed) laying pair was above the mean of 0.50 for the previous four years.

Of 29 chick feeds noted casually from 27<sup>th</sup> June – 20<sup>th</sup> July, 16 (55%) were gadids (3 large, 12 medium, 1 small: all but one believed to be Saithe), 12 (41%) were sandeels (2 large, 10 medium), and one was a medium clupeid.

**Table 1.16.** Common Guillemot breeding success monitoring at Burravoe, 2012–16. Adults sitting tight (ST) on two or more consecutive checks (a) were assumed to be incubating. Those sitting tight on just one, or on two or more non-consecutive checks (b) were assumed not to have laid an egg.

	<b>2012</b>	<b>2013</b>	<b>2014</b>	<b>2015</b>	<b>2016</b>
Date range visited	8/5–27/7	2/5–8/8	12/5–6/8	5/5–10/8	9/5–29/7
Checks (mean interval in days)	26 (3.2)	30 (3.4)	27 (3.2)	27 (3.6)	27 (3.0)
Date first egg seen / assumed incubation	8/5	16/5	12/5	5/5	18/5
<b>ST 2+ checks, assumed laid (a)</b>	<b>115</b>	<b>75</b>	<b>90</b>	<b>97</b>	<b>104</b>
ST 1 check only from first egg to 30/6 (b)	11	17	19	9	14
Other regularly attended sites (c)	3	38	34	29	15
% laid (a/a+b+c)	89.1%	57.7%	62.9%	71.9%	78.2%
Sites where chicks were seen	62	30	57	51	66
Minimum % hatched	53.9%	40.0%	63.3%	52.6%	63.5%
Date first assumed fledged	30/6–2/7	8–11/7	30/6–3/7	29/6–3/7	8–11/7
Number assumed fledged (d)	59	27	55	49	62
<b>Success (d/a)</b>	<b>0.51</b>	<b>0.36</b>	<b>0.61</b>	<b>0.51</b>	<b>0.60</b>

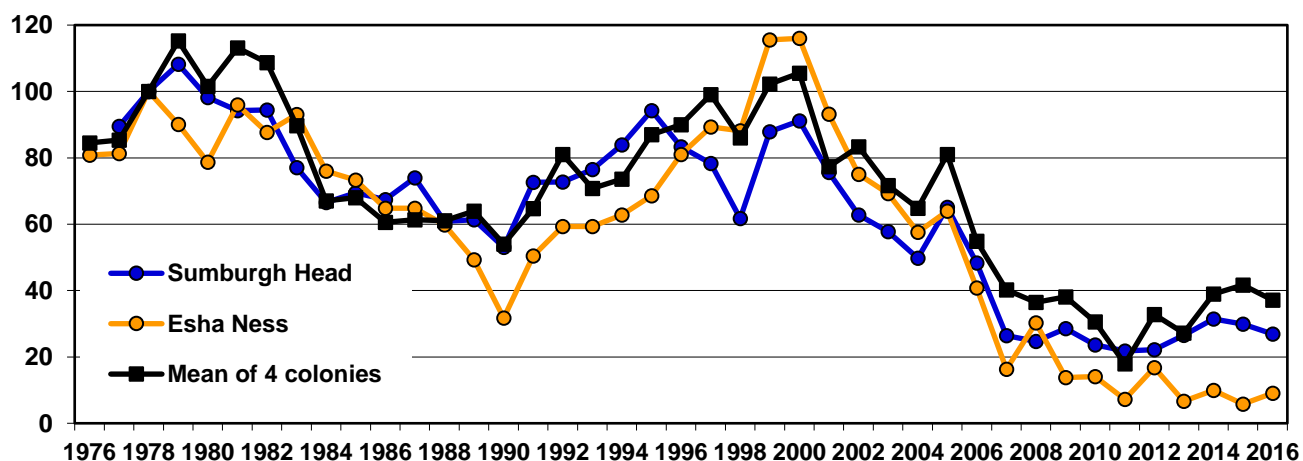
### 1.6a. Razorbill *Alca torda*: Population counts

The mean number of adults at the Sumburgh Head plots was slightly lower than in 2015, although counts were particularly variable and the highest count, on 18<sup>th</sup> June, was 73% higher than the lowest, on 8<sup>th</sup> June (**Table 1.17**). At the other three colonies monitored numbers are now so low that differences of just a few birds result in large year-to-year percentage changes. The mean population index at these colonies stood at 37.1 in 2016 compared to 100 when SOTEAG monitoring began in 1978 (**Figure 1.13**).

**Table 1.17.** Mean counts of individual Razorbills in study plots at four Shetland colonies, 2015–16. Statistics given are: number of counts, range, mean, standard deviation, coefficient of variation, percentage change since 2015, and population indices (1978 = 100).

Colony	Unit	Year	n	Range	Mean	SD	CV	% ch.	Index
Sumburgh	Birds	2015	5	71–99	86.6	10.83	0.13		29.9
Head		2016	5	59–102	78.0	16.66	0.21	-9.9	26.9
Troswick	Birds	2015	5	5–12	8.6	3.05	0.35		41.0
Ness		2016	5	9–15	11.0	2.45	0.22	+27.9	52.4
Esha Ness	Birds	2015	5	0–11	4.2	4.09	0.97		5.8
		2016	5	5–9	6.6	1.52	0.23	+57.1	9.1
Burravoe	Birds	2015	5	8–17	10.8	3.70	0.34		90.0
		2016	5	2–10	7.2	3.11	0.43	-33.3	60.0

**Figure 1.13.** Annual index (1978 = 100) of Razorbill numbers at Sumburgh Head and Esha Ness, 1976–2016, and the mean of indices at these two colonies plus Troswick Ness and Burravoe.



### 1.6b. Razorbill *Alca torda*: Breeding success at Sumburgh Head

This was monitored for the sixth successive year, using the same marked photographs and adding on new nest sites as they became apparent. The presence and number of attending adults at potential nest sites was recorded and pairs were assumed to have laid an egg if an adult was recorded as sitting tight (ST) on two consecutive checks (**Table 1.18**). An incubation period of 35 days, a minimum fledgling period of 15 days, and the state of chick plumage development were all used to help assess probable hatching periods, chick ages, and whether they could have fledged or not. The nest sites monitored were scattered around different areas of the Head where Razorbills could be seen reasonably closely using a telescope at a safe vantage point, and it would be spurious to clump them into ‘plots’.

Apart from 15<sup>th</sup> and 18<sup>th</sup>, the nest sites were monitored daily from 3<sup>rd</sup> – 20<sup>th</sup> May, and thereafter when other fieldwork allowed. The first bird was assumed to have laid by 5<sup>th</sup> May, the first egg was seen on 8<sup>th</sup> and by 9<sup>th</sup> May eight pairs were assumed to have laid. Breeding was proved at 69 sites while at a further 11 sites birds were sitting tight on two or more consecutive checks but no egg was seen. Chicks were seen at 57 sites, suggesting hatching success of 70% (broadly similar to the 74% from first eggs in the Guillemot success plot) and 52 chicks were judged to have survived to fledge giving breeding success of 0.64, the highest yet recorded at this colony. However, there was a marked difference in success between pairs on the east side of the Head (0.74, n = 61) and on the west side (0.35, n = 20), largely due to lower hatching success (chicks were seen 35% of nest sites compared to 82% on the east side).

Three chick feeds where the prey were seen clearly all involved single, small Saithe, while a female whose chick had fledged was seen standing at the site with a beak full of tiny larval fish.

**Table 1.18.** The number, status and outcome of Razorbill breeding sites monitored at Sumburgh Head, 2011–16. Adults sitting tight (ST) on two or more consecutive checks (a) were assumed to be incubating. Those recorded as sitting tight on just one check, or on two or more non-consecutive checks (c) were assumed not to have laid an egg.

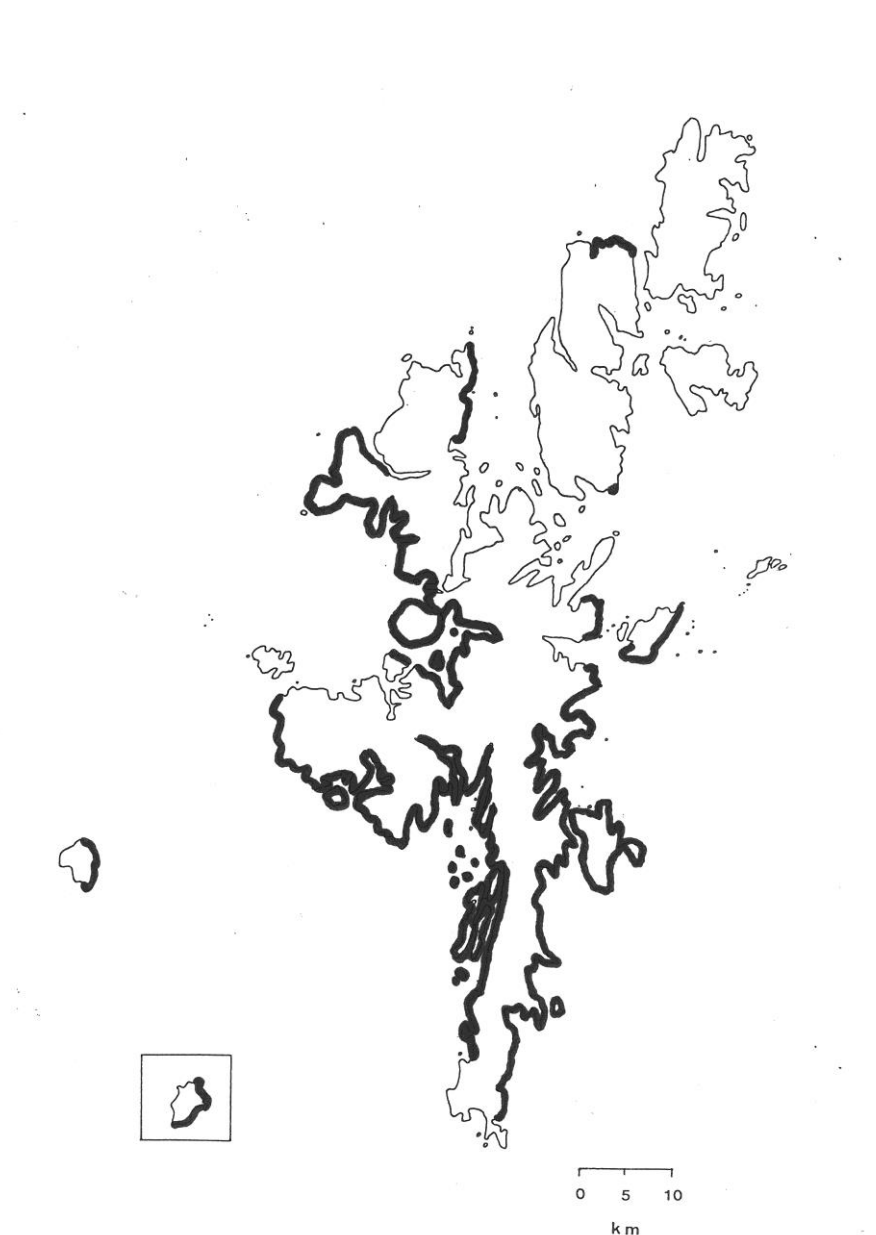
	2011	2012	2013	2014	2015	2016
Date range visited	4/5–11/7	3/5–26/7	3/5–6/8	7/5–26/7	6/5–6/8	3/5–17/8
Checks (mean interval in days)	22 (3.2)	42 (2.0)	41 (2.4)	26 (3.1)	38 (2.4)	54 (2.0)
First egg seen / assumed incubation	4/5	3/5	8/5	7/5	9/5	5/5
ST 2+ checks, no egg seen (a)	15	25	25	35	16	11
Egg / chick seen (b)	32	29	18	23	51	70
<b>Breeding pairs (a + b)</b>	<b>47</b>	<b>54</b>	<b>43</b>	<b>58</b>	<b>67</b>	<b>81</b>
ST 1 check only to 30/6 (c)	10	5	15	10	15	16
Other attended sites	6	7	14	19	14	13
Sites where chicks were seen	7	38	13	32	40	57
Date first assumed fledged	None	27–28/6	16/7	21–25/6	23–30/6	30/6–2/7
Chicks assumed fledged (d)	0	30	10	30	38	52
<b>Success: d/(a+b)</b>	<b>0.00</b>	<b>0.56</b>	<b>0.23</b>	<b>0.52</b>	<b>0.57</b>	<b>0.64</b>



## 2. Pre-breeding season census counts of Black Guillemots *Cephus grylle*

In 2015 a start was made to update the 1998–2002 *Seabird 2000* census figure for the Shetland population of Black Guillemots; most counts were made from land. In 2016, both the SOTEAG RIB and the SNH Zodiac were deployed to extend this coverage, while some counts from land were also undertaken (**Figure 2.1**). This was a collaboration between SOTEAG, Shetland Amenity Trust, SNH, RSPB and Shetland Bird Club (see Acknowledgements). Counts in 2015–16 are compared with those in 1999–2000 in **Tables 2.1 & 2.2**. Interpreting apparent changes in numbers should take account of: (i) the number of birds detected can be influenced by weather and sea conditions; (ii) weather forecasting (now from multiple sources) has improved greatly since the *Seabird 2000* census; (iii) counts along some coasts are likely to be more accurate if made from land, whereas the converse may be true for other coasts, but this difference is impossible to quantify; (iv) observer experience will have improved since *Seabird 2000*, both in terms of personal ‘fieldcraft’ and, because observers were issued with copies of distribution maps from 1998–2002, the number of birds that might be expected at a particular colony.

**Figure 2.1.** Coastline covered by surveys of pre-breeding season Black Guillemots in 2015 and 2016.



**Table 2.1.** Counts of adult Black Guillemots along adjacent sections of the west coast of Shetland in 1999–2000, and in 2015–16. Left justified = counted from the sea, right justified = counted from land, centred = sea & land combined. Counts not in bold may have been low because of adverse sea or weather conditions. The percentage difference between counts is given, with differences of > 20% in bold red.

<b>Southwest Mainland (south to north)</b>	<b>1999</b>	<b>2015/16</b>	<b>% diff.</b>	<b>Comment</b>
Peerie Voe of Spiggie to Maywick	261	307	+ 17.6	1999 wind, 2015 swell
Maywick to Scalloway, incl. East Burra	159	<b>232</b>	<b>+ 45.9</b>	1999 wind SE 4–6
South Havra, Little Havra, Holm of Maywick	161	<b>225</b>	<b>+ 39.8</b>	1999 wind SE 4–6
West Burra (largely the monitoring site)	<b>230</b>	<b>245</b>	+ 6.5	Both OK
<b>Total</b>	<b>811</b>	<b>1009</b>	<b>+ 24.4</b>	
<b>West Mainland (east to west)</b>	<b>1999/00</b>	<b>2015/16</b>	<b>% diff.</b>	<b>Comment</b>
Scalloway to White Ness & Scalloway islands	<b>84</b>	<b>86</b>	+ 2.4	Both OK
White Ness to Reawick & Weisdale Voe islands	<b>117</b>	<b>49</b>	<b>- 58.1</b>	Decrease on islands
Reawick to Skeld	<b>143</b>	<b>166</b>	+16.1	Both OK
Skelda Ness	154	<b>187</b>	<b>+21.4</b>	1999 Wind NE 4
Silwick to Culswick	<b>411</b>	<b>457</b>	+ 11.2	Both OK
Culswick to Gruting Voe	<b>99</b>	<b>127</b>	<b>+ 28.3</b>	Both OK
Vaila & Vaila Sound	<b>301</b>	<b>359</b>	+ 19.3	Both OK
Burrastow to Wats Ness	<b>118</b>	<b>113</b>	- 4.2	Both OK
Wats Ness & Mu Ness monitoring site	<b>314</b>	<b>287</b>	- 8.6	Both OK
Mu Ness to Huxter	255	<b>544</b>	<b>+ 113.3</b>	1999 fog, too quick?
<b>Total</b>	<b>1996</b>	<b>2375</b>	<b>+ 19.0</b>	
<b>St Magnus Bay (southeast to northwest)</b>	<b>1999/00</b>	<b>2015/16</b>	<b>% diff.</b>	<b>Comment</b>
East Vementry, Papa Little & Linga	<b>128</b>	<b>131</b>	+ 2.3	Both OK
Muckle Roe	<b>466</b>	<b>530</b>	+ 13.7	Both OK
Roe Sound to Ura Firth	<b>182</b>	<b>246</b>	<b>+ 35.2</b>	Both OK
Hillswick Ness monitoring site	<b>235</b>	<b>252</b>	+ 7.2	Both OK
Hillswick to Stenness	<b>145</b>	133	- 8.3	2015 moderate swell
<b>Total</b>	<b>1156</b>	<b>1292</b>	<b>+ 11.8</b>	
<b>Eshaness &amp; Tingon (south to north)</b>	<b>2000</b>	<b>2015</b>	<b>% diff.</b>	<b>Comment</b>
Stenness to Hamna Voe	96	77	- 19.8	Swell both years
Hamna Voe to Ronas Voe	<b>300</b>	244	- 18.7	2015 moderate swell
Ronas Voe monitoring site	<b>131</b>	<b>102</b>	<b>- 22.1</b>	Both OK
<b>Total</b>	<b>527</b>	<b>423</b>	<b>- 19.7</b>	
<b>Northwest Yell Sound (south to north)</b>	<b>1998</b>	<b>2015</b>	<b>% Diff.</b>	<b>Comment</b>
Lochend to Burravoe	<b>109</b>	<b>76</b>	<b>- 30%</b>	Both OK
Burravoe to Fethaland	<b>257</b>	<b>147</b>	<b>- 43%</b>	Both OK
<b>Total</b>	<b>366</b>	<b>223</b>	<b>- 39%</b>	

In **Southwest Mainland**, a substantial increase in numbers may have been largely due to sub-optimal conditions in 1999; numbers at the West Burra monitoring site had increased during this period but peaked in 2009–12 at 270–280 birds. In the **West Mainland**, the total for the Scalloway islands in 2016 was similar to that in 1999, but numbers were undoubtedly lower at the islands in Weisdale Voe, particularly at Hoy, Fore Holm and Kirk Holm (total of 17 adults c.f. 75 in 1999). The coast between Reawick and Gruting Voe was surveyed from the land in 2015 but from the sea in 1999–2000, and while counting from land may have contributed to the higher numbers recorded the consistency of this would suggest a genuine increase. This was supported by a similar increase at Vaila, counted from the sea in both 2000 and 2016. Numbers at Wats Ness and Mu Ness had fluctuated somewhat since *Seabird 2000*, having peaked in 2012 (351 birds). The remote coast from Mu Ness north to Huxter was counted by a single observer in 1999, rather quickly and in foggy conditions, whereas two observers walking in from each end and meeting half-way recorded substantially more birds in 2015, on the same morning as the Wats Ness and Mu Ness counts.

In southeast **St Magnus Bay**, numbers in 2016 were similar to 1999 at the small colonies on the east coast of Vementry and at Papa Little, but were higher at Muckle Roe than in 1999, the only previous survey of this rugged coast from the sea. There would appear to have been an even greater increase between 1999 and 2016 from Roe Sound north to Urafirth, particularly at the high cliffs around the Mill Geos (108 c.f. 187) but a count there from land of 171 birds in 1994 suggests the 1999 count was low, for reasons unknown. At Hillswick Ness, numbers increased in 2008 to fluctuate between 250 and 300 during 2008–16. On the exposed **Eshaness and Tingon** coasts, counts between Stenness and Hamnavoe were affected by heavy swell in 2000 and 2015, while swell on the same date in 2015 also affected the count from land at Tingon. However, the last four counts (2012–15) at the Ronas Voe monitoring site have been lower than those at the time of the *Seabird 2000* census. The only other recent counts on Shetland’s west coast were in **Northwest Yell Sound**, where numbers were 40% lower than in 1998.

**Table 2.2.** Counts of adult Black Guillemots along adjacent sections of the east coast of Shetland in 1999–2001, and in 2015–16. Conventions follow those in **Table 2.1**.

<b>Northeast Yell</b>	<b>2000</b>	<b>2015</b>	<b>% diff.</b>	<b>Comment</b>
Gloup Voe to Bay of Brough	212	139	- 34.4	Both OK
<b>Southeast Yell</b>	<b>2001</b>	<b>2015</b>	<b>% diff.</b>	<b>Comment</b>
Heoga Ness	29	45	+ 55.2	Both OK
<b>East Whalsay</b>	<b>1999</b>	<b>2016</b>	<b>% diff.</b>	<b>Comment</b>
Skaw to Symbister	252	262	+ 4.0	Both OK
<b>Northeast Mainland (north to south)</b>	<b>1999/00</b>	<b>2015/16</b>	<b>% diff.</b>	<b>Comment</b>
Lunning & Levaneap monitoring sites	408	268	- 34.3	Decline since 2012
Stava Ness	32	41	+ 28.1	Both OK
Kirkabister monitoring site	190	170	- 10.5	Both OK
Brettabister to Eswick south beach	159	167	+ 5.0	Both OK
Hoo Stack & Isles of Gletness	130	50	- 61.5	Both OK
Gletness to Lerwick	39	32	-17.9	Both OK
<b>Total</b>	<b>958</b>	<b>728</b>	<b>- 24.0</b>	
<b>Bressay &amp; Noss (north to south)</b>	<b>1999</b>	<b>2015/16</b>	<b>% diff.</b>	<b>Comment</b>
North Bressay & holms	165	150	- 9.1	Both OK
Noss	114	100	- 12.3	Both OK
South Bressay	340	352	+ 3.5	Both OK
<b>Total</b>	<b>619</b>	<b>602</b>	<b>- 2.7</b>	
<b>Southeast Mainland (north to south)</b>	<b>1999</b>	<b>2015/16</b>	<b>% diff.</b>	<b>Comment</b>
Lerwick to Okraquoy	237	358	+ 51%	Both OK
Aithsetter monitoring site	87	112	+ 29%	Both OK
Mousa monitoring site	207	106	- 49%	Steep decline since 2010
Helli Ness to Levenwick	384	321	- 16%	Decrease at No Ness
Levenwick to Boddam	249	246	- 1%	Both OK
Boddam to Virkie monitoring site	117	119	+ 2%	Both OK
<b>Total</b>	<b>1281</b>	<b>1262</b>	<b>- 2%</b>	

Two small sections of the **Yell** coast surveyed in 2015 produced differing results, an apparent decrease in the northeast and an increase in the southeast (**Table 2.2**). Numbers along the east coast of **Whalsay**, surveyed from land in a single morning in 2016 by three observers, were very similar to those recorded from a Zodiac in 1999. In **Northeast Mainland**, numbers at the Levaneap monitoring site have been in decline since 2012 for unknown reasons, while those at the Kirkabister monitoring site have fluctuated between 150–180 birds since 2008. Suitable cliff habitat becomes rather limited to the south of this, but numbers along the Mainland coast from Brettabister to Eswick were similar in 1999 and 2016. However, there were markedly fewer around the Isles of Gletness, which were visited just weeks before the 2016 count and found to be infested by rats (rats were reported from these isles in the early 1980s but whether their presence has been intermittent is uncertain).

Total numbers around **Bressay and Noss** were rather similar in 1999 and 2015–16. In **Southeast Mainland**, numbers in 2015 were considerably higher than in 1999 at The Knab (74 c.f. 20), at the south entrance to Bressay Sound, and were generally higher all along the coast south to Okraquoy. Whether counting from the land in 2015 rather than from a Zodiac in 1999 contributed to this apparent increase is uncertain, but numbers at the closely-monitored Aithsetter site, which has always been counted from the land, were 29% higher in 2015 compared to 1999. On Mousa, counts of 132 adults in 2015 and 106 in 2016 confirm a steep decline since a recent peak of 194 in 2010, with predation and/or disturbance by Otters believed to be a factor contributing to recent fluctuations in the breeding population of Black Guillemots on the island. On the west side of Mousa Sound numbers were markedly lower on the east cliffs of No Ness in 2015 (54) compared to 1999 (112), whereas there was little difference in total at colonies along the Mainland cliffs to the north of this (130 in 1999, 129 in 2015) or to the south (391 in 1999, 388 in 2015), and numbers at the Boddam to Virkie monitoring site were also very similar in the two years.

In summary, the census counts undertaken so far indicate that Shetland's Black Guillemot population is in a healthy state compared to 1999–2000. Some local decreases have occurred, some of which may be due to predation pressure by non-native mammals, while other decreases have no obvious explanation. Oil pollution during this period is unlikely to have been a factor, since only three of the 287 (1%) Black Guillemots found dead on beached bird surveys throughout Shetland during 1999–2015 were recorded as oiled.

### 3. Moulting Common Eiders *Somateria mollissima* in Yell Sound and Sullom Voe

A Shetland-wide census of moulting Common Eiders was completed in August 2015 and the next is scheduled for August 2018. In the years between these censuses, counts are limited to birds in Yell Sound and Sullom Voe, i.e. the Sullom Voe Harbour Oil Spill Plan (SVHOSP) area. This involves searching the areas around the extensive aquaculture sites in southern Yell Sound from land-based vantage points using a telescope, and surveying Sullom Voe and, in northern Yell Sound, the former moulting sites of Tinga Skerry, Little Holm and Muckle Holm by boat.

Southern Yell Sound was surveyed on 15<sup>th</sup> August when 78 Eiders (40 adult males, 38 females and/or juveniles) were found around aquaculture sites in Dales Voe and off Lunna Ness. In view of this low total compared to recent years (**Table 3.1**), a resurvey was conducted on the afternoon of 18<sup>th</sup> August when 86 birds (64 unsexed due to light conditions, 22 females or juveniles) were found, distributed similarly. Weather conditions were excellent on both dates and is unlikely that any flocks were overlooked.

The northern half of Sullom Voe (Eiders do not occur in the southern half of the voe at any time of year) and northern Yell Sound was surveyed on the morning of 18<sup>th</sup> August from the SOTEAG RIB, which proved extremely suitable for the task. Most (194) of the total of 210 birds in Sullom Voe (153 adult males, 57 females and/or juveniles) were scattered between the small holm of Ungam and Jetties 1–3. In Yell Sound there were none at Tinga Skerry or Muckle Holm, but two females and three juveniles were at Little Holm. The total of 301 Common Eiders in the SVHOSP area in August 2016 represented 7% of the 2015 census total of 4,610 birds for the whole of Shetland.

**Table 3.1.** Counts of moulting Common Eiders in Yell Sound and Sullom Voe, 2005–16 (nc = no count; totals with incomplete coverage in italics).

Area	2005	2006		2009	2010	2011	2012	2013	2014	2015	2016
Northern Yell Sound	nc	0		3	nc	nc	12	nc	0	8	5
Sullom Voe	11	0		4	nc	nc	72	118	59	160	210
Southern Yell Sound	190	109		666	771	386	499	494	151	240	86
<b>Total</b>	<b>201</b>	<b>109</b>		<b>673</b>	<b>771</b>	<b>386</b>	<b>583</b>	<b>612</b>	<b>210</b>	<b>408</b>	<b>301</b>

#### 4. Winter counts of seaduck and diving seabirds

##### 4.1. Hascosay, Bluemull and Colgrave Sounds (HBC), and South Unst.

A survey on 17<sup>th</sup> January was in perfect conditions, with little cloud, no swell and a very light westerly air dropping to flat calm. The main concentration of **Common Eider** (1,100 birds) was in the area between Burra Ness, Linga and towards Sound Gruney, in scattered flocks that were fairly easily counted, some feeding in open water but 500 were at salmon cages off Sand Wick, Yell; a further 184 were in small groups in Hascosay Sound. There were 105 **Long-tailed Duck** in the same area south of Linga, but the main concentration (530 birds) was in loose flocks just offshore from, or actually amongst the large cluster of salmon cages on the south side of Uyea. This is one of the largest mid-winter gatherings of this species in the UK and, unusually for Long-tailed Ducks, those birds feeding among salmon cages barely reacted to the close presence of our boat. The high count of **Goldeneye** will have been because most freshwater lochs had been frozen for several days.

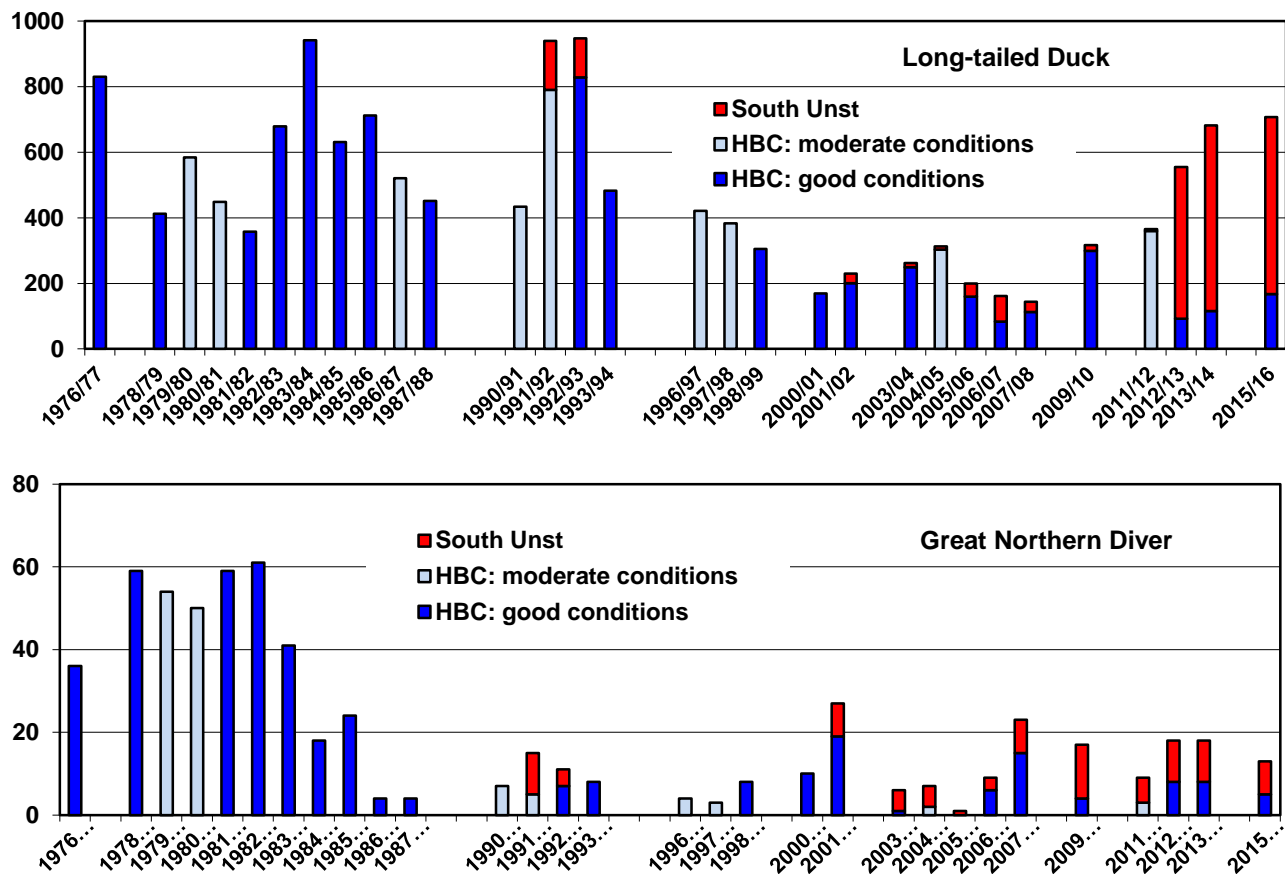
Only five **Great Northern Divers** were seen along the long-term HBC route, with a further eight off east Uyea and southeast Unst. With three observers and perfect conditions, few Great Northern Divers will have been missed and the species' continuing scarcity in the area after a decline in the mid 1980s remains unexplained (**Figure 4.1**). Two **White-billed Divers** were seen, one off Sound Gruney (almost certainly a regularly returning adult) and a very confiding individual between Burra Ness and Hascosay. Numbers of **Cormorants, Shags and Black Guillemots** were similar to recent winters (allowing for survey conditions for the latter), and few of the other auk species were seen.

The perfect sea conditions and good light allowed an extension of the survey into Basta Voe, only the second time in recent winters this has been covered (**Table 4.2**). Despite extensive mussel farming, no **Common Eiders** were seen. Basta Voe is the main site in the area for **Red-breasted Mergansers** but, surprisingly, no **Goldeneye** were seen. Basta Voe would also appear to be favoured by **Red-throated Divers** in winter, while five **Great Northern Divers** were seen in a tight group half-way up the voe.

**Table 4.1.** Counts of seaduck and diving seabirds in Hascosay, Bluemull and Colgrave Sounds, and off South Unst. Count conditions: \*\* = moderate to good, \*\*\* = good or excellent throughout.

Winter	2005/06	2006/07	2007/08	2009/10	2011/12	2012/13	2013/14	2015/16
Date	27/1	18/2	2/12	23/12	22/1	8/2	18/2	17/1
No. observers	4	3	3	4	2	3	3	3
Count Conditions	***	***	***	***	**	***	**	***
Common Eider	1001	1159	1241	1084	978	1458	1394	1319
King Eider	0	0	0	0	0	0	2	0
Long-tailed Duck	200	161	144	317	365	555	720	707
Common Scoter	2	1	0	3	1	2	4	2
Velvet Scoter	0	0	0	0	0	0	1	0
Goldeneye	14	4	7	25	11	12	0	51
Red-breasted Merganser	8	15	17	13	36	26	20	33
Red-throated Diver	5	51	12	16	20	21	12	0
Great Northern Diver	1	9	23	17	9	18	18	13
White-billed Diver	0	1	0	0	0	1	0	2
Cormorant	116	263	96	90	252	243	157	261
Shag	871	1243	1496	569	554	804	306	808
Common Guillemot	47	10	3	2	2	6	13	6
Razorbill	0	2	0	0	0	1	1	0
Black Guillemot	541	359	367	506	277	885	364	451
Little Auk	0	0	0	0	0	0	0	1
Puffin	0	0	0	0	1	0	0	1
<b>Total</b>	<b>2806</b>	<b>3278</b>	<b>3406</b>	<b>2642</b>	<b>2506</b>	<b>4032</b>	<b>2974</b>	<b>3655</b>

**Figure 4.1.** Counts of Long-tailed Duck and Great Northern Divers along the Hascosay, Bluemull and Colgrave Sounds (HBC) survey route, and off south Unst (added to the route in 1991/92 and 1992/93, and included on every survey from 2001/02). Until 1991/92 up to three surveys were made each winter and the highest count per winter is plotted; from 1992/93 only a single count was made in any winter.



**Table 4.2.** Counts of diving seabirds and seabirds in Basta Voe, Yell. Count conditions were good or excellent throughout on both dates.

Winter	2011/12	2015/16
Date	22/1	17/1
No. of observers	2	3
Common Eider	1	0
Long-tailed Duck	1	0
Red-breasted Merganser	33	47
Goosander	0	4
Red-throated Diver	7	6
Great Northern Diver	2	5
Cormorant	48	7
Shag	125	23
Common Guillemot	0	9
Black Guillemot	91	46
<b>Total</b>	<b>308</b>	<b>147</b>

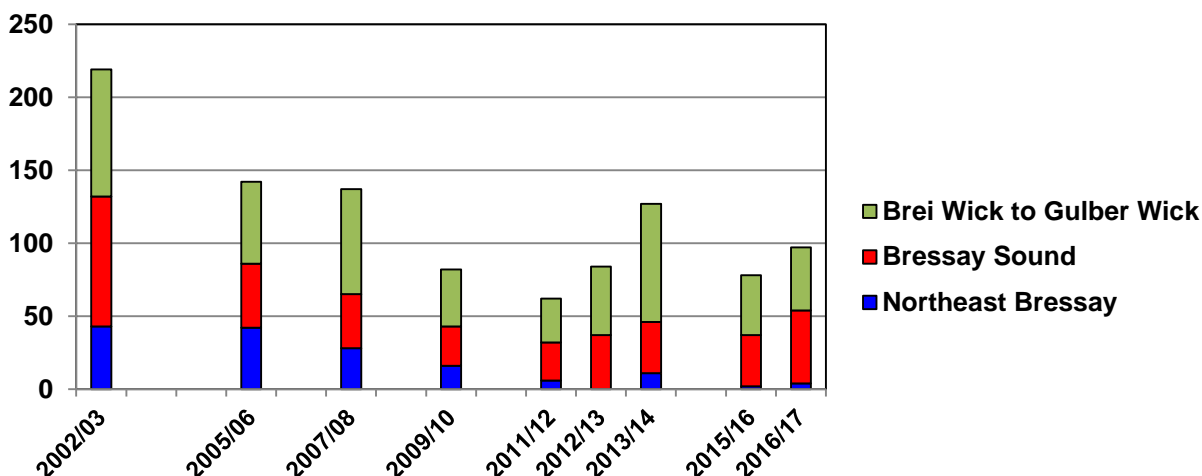
## 4.2. Bressay Sound and north Bressay

The area was surveyed in perfect conditions on 26<sup>th</sup> February and 13<sup>th</sup> December (**Table 4.3**). **Common Eiders** were mainly in Bressay Sound itself (126/144 in February, 87/109 in December), while most **Long-tailed Ducks** were in scattered groups throughout Bressay Sound and south to Gulber Wick; as numbers of this species have declined in the area it has become disproportionately scarce off northeast Bressay (**Figure 4.2**). Unlike these seaduck, **Great Northern Divers** avoid the busier areas of Lerwick Harbour with, in February, six in Breiwick, Voe of Sound and Gulber Wick (eight in December), and five off northeast Bressay in February and a record 17 there in December. **Slavonian Grebes** were all in Aith Voe, Bressay. In February, most **Common Guillemots** (10/12) were in winter plumage and therefore almost certainly immatures, while **Razorbills** were more equally split between summer (6) and winter plumage (7); all individuals of both species were in winter plumage in December. **Black Guillemot** numbers on both surveys were comparable with previous winters.

**Table 4.3.** Counts of seaduck and diving seabirds in Bressay Sound and North Bressay. Count conditions: \*\* = moderate to good, \*\*\* = good to excellent throughout.

Winter	2005/06	2007/08	2009/10	2011/12	2012/13	2013/14	2015/16	2016/17
Date	28/1	14/11	3/2	3/2	12/12	19/2	26/2	13/12
No. of observers	4	3	2	2	2	2	2	2
Count conditions	**	***	**	***	**	***	***	***
Common Eider	528	249	253	223	99	150	144	109
Long-tailed Duck	142	126	82	62	84	127	78	97
Common Scoter	0	0	1	4	1	3	2	3
Goldeneye	14	0	34	1	3	2	20	2
Red-breasted Merganser	43	41	38	44	23	16	30	28
Red-throated Diver	4	1	0	11	0	9	8	3
Great Northern Diver	5	10	2	9	9	17	11	26
Slavonian Grebe	0	0	3	2	0	0	4	3
Cormorant	5	7	15	3	1	5	3	4
Shag	414	432	374	234	359	150	221	357
Common Guillemot	58	7	3	9	11	20	12	6
Razorbill	12	10	4	18	0	7	13	11
Black Guillemot	271	394	381	358	302	326	283	279
Little Auk	0	3	0	19	0	0	0	2
Puffin	1	4	0	0	0	0	1	0
Total	1497	1284	1191	998	892	887	830	930

**Figure 4.2.** Numbers and distribution of Long-tailed Duck in Bressay Sound and North Bressay.





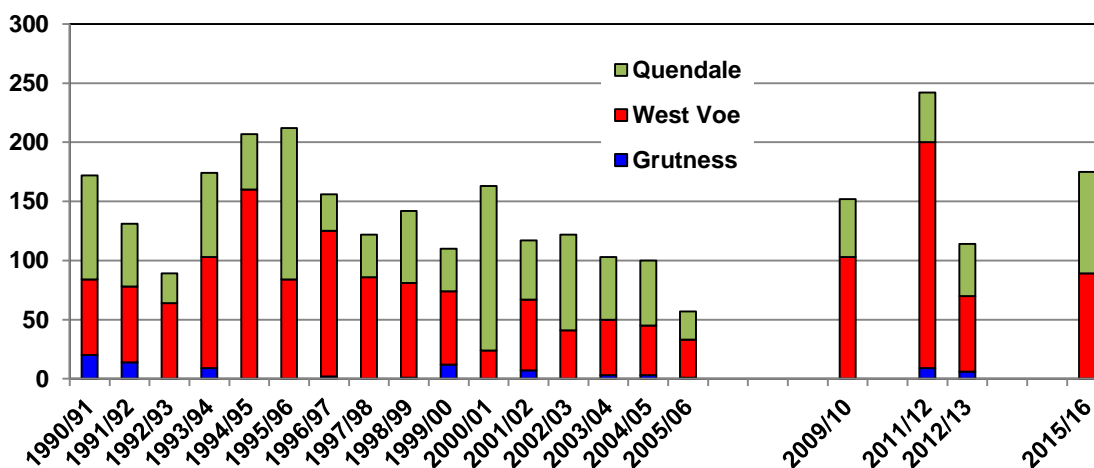
### 4.3. Pool of Virkie to Bay of Quendale

A count from land on 12<sup>th</sup> January was in perfect conditions, with no wind and thin high cloud, although a residual SSE swell meant the outer voes (especially Grutness) were rather disturbed. Few **Common Eiders** now winter in these sandy bays, although they remain a stronghold for **Long-tailed Ducks** (Figure 4.3). The 35 **Great Northern Divers** seen (1 in Grutness Voe, 11 in West Voe of Sumburgh, 23 in Bay of Quendale) was towards the upper range of midwinter counts for the area, despite most birds feeding actively and hence being underwater for long periods. Although there was near full attendance of **Common Guillemots** at the Sumburgh Head colony throughout the day, these adult birds do not normally feed in these bays during winter.

**Table 4.4.** Counts of seaduck and diving seabirds between Pool of Virkie and Bay of Quendale. Count conditions: \*\* = moderate to good, \*\*\* = good or excellent throughout.

Winter	2005/06		2007/08		2009/10		2011/12	2012/13	2015/16
Date	6/12	2/2	12/1	19/2	13/12	10/2	30/12	9/2	12/1
Count conditions	***	***	**	***	**	***	**	**	***
Common Eider	25	24	45	59	23	43	21	9	14
Long-tailed Duck	45	57	201	93	152	121	242	114	165
Common Scoter	0	0	0	0	1	0	7	1	2
Goldeneye	4	5	32	38	7	15	38	12	12
Red-breasted Merganser	2	0	0	1	0	0	1	0	3
Red-throated Diver	12	11	10	0	10	1	10	5	1
Black-throated Diver	0	0	0	0	0	0	0	0	1
Great Northern Diver	27	22	18	27	15	30	24	43	35
Cormorant	8	0	0	3	6	2	1	2	0
Shag	503	77	76	102	418	115	119	139	132
Common Guillemot	3	6	2	0	1	4	26	79	6
Razorbill	4	2	1	2	0	0	2	2	0
Black Guillemot	26	21	34	24	4	61	29	71	45
Little Auk	0	0	0	0	0	0	1	0	0
<b>Total</b>	<b>659</b>	<b>225</b>	<b>419</b>	<b>349</b>	<b>637</b>	<b>392</b>	<b>521</b>	<b>477</b>	<b>416</b>

**Figure 4.3.** Numbers and distribution of Long-tailed Ducks in the Bay of Quendale, West Voe of Sumburgh and Grutness Voe survey area. All counts were from land in a single day, by a range of observers, and for some winters the higher of two counts is plotted.



### 4.4. Burra, Trondra, South Havra, the Scalloway islands and Weisdale Voe

A survey on 20<sup>th</sup> January was in generally excellent conditions (apart from light snow showers in northern Clift Sound) until heading south from the Score Holms, when lowering overcast and a light SE breeze made **Black Guillemots** difficult to see, and with light rain from Cheynies to the finish. The numbers of birds and their distribution is best described by splitting the area at Scalloway Harbour, into Burra, Trondra and South Havra, and from Green Holm north through the Scalloway islands to Weisdale Voe (**Tables 4.5, 4.6**).

Around Burra and Trondra the main concentrations of **Common Eiders** were at mussel lines (216) and salmon cages (29) in Clift Sound, and in Scalloway Harbour (77; **Table 4.5**). Clift Sound is the main location for **Long-tailed Ducks** in the area, with 68 counted there, the lowest figure since boat surveys of this area began (**Figure 4.4**). The high count of **Goldeneye** will have been due to all freshwater being frozen, while numbers of **Red-breasted Mergansers** were rather low. The 23 **Great Northern Divers** seen, the highest count yet in the area, involved 10 around and north of South Havra, 12 in Clift Sound and one in Scalloway Harbour, but few **Slavonian Grebes** were recorded. There was a scatter of **Common Guillemots**, while five **Puffins** were also seen.

Among the Scalloway islands and in Weisdale Voe, the largest groups of **Common Eiders** were at salmon cages around Papa and Cheynies (134) and mussel lines north of Greena (35; **Table 4.6**). Few **Long-tailed Ducks** (**Figure 4.4**) and no **Red-breasted Mergansers** were seen. The excellent conditions on the run north towards Weisdale Voe will have contributed to the relatively high count of **Great Northern Divers**, which can be difficult to detect in the more open waters between Mainland and the outer Scalloway islands. A very confiding adult **White-billed Diver** between North Havra and Hoy was the first seen on a boat survey of this area. Seven **Slavonian Grebes** were in Weisdale Voe, five north of Greena and two off the tip of Russa Ness. As around Burra and Trondra, **Common Guillemots** were scattered throughout the area, about 50% presumed adults (summer plumage) and 50% immatures (winter plumage), and most appeared to be healthy. The total of 24 **Puffins** seen on the survey was highly unusual for January; it can be difficult to age Puffins in winter in the field but most appeared to be first-winter rather sickly birds.

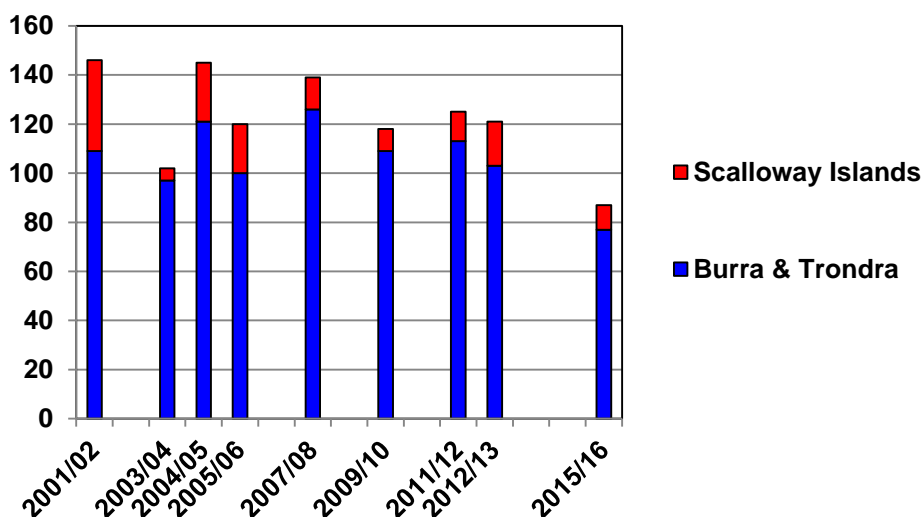
**Table 4.5.** Counts of diving seabirds and seaduck around Burra, Trondra and South Havra. Count conditions: \*\* = moderate to good, \*\*\* = excellent throughout. The 2012 survey did not cover the west coast of West Burra or South Havra.

Burra, Trondra, South Havra	2004/05	2005/06	2007/08	2009/10	2011/12	2012/13	2015/16
Date	22/2	26/1	14/2	8/1	27/1	24/1	20/1
No. of observers	3	4	3	3	3	3	2
Count conditions	***	***	***	***	***	**	***
Tufted Duck	0	0	0	22	0	11	0
Common Eider	465	542	565	615	367	576	380
Long-tailed Duck	121	100	126	109	113	103	77
Common Scoter	0	1	0	0	6	2	1
Velvet Scoter	0	0	0	1	1	1	0
Goldeneye	20	43	20	54	33	38	67
Red-breasted Merganser	43	30	52	48	117	54	39
Goosander	0	0	0	0	0	1	0
Red-throated Diver	29	6	28	2	22	6	14
Great Northern Diver	7	12	21	2	3	7	23
Little Grebe	0	0	0	0	1	0	1
Slavonian Grebe	2	0	0	5	20	7	4
Cormorant	142	45	62	49	21	57	28
Shag	500	412	332	471	324	315	406
Common Guillemot	29	66	23	2	2	3	57
Razorbill	5	3	1	0	1	6	0
Black Guillemot	217	185	275	282	153	200	307
Little Auk	0	0	0	0	4	0	0
Puffin	0	0	4	0	0	0	5
<b>Area total</b>	<b>1580</b>	<b>1445</b>	<b>1509</b>	<b>1608</b>	<b>1188</b>	<b>1433</b>	<b>1409</b>

**Table 4.6.** Counts of diving seabirds and seaduck around the Scalloway islands and Weisdale Voe. Count conditions: \*\* = moderate to good, \*\*\* = excellent throughout. The 2012 and 2013 surveys did not cover the outer entrances to Sand and Seli Voes.

Scalloway islands, Weisdale Voe	2004/05	2005/06	2007/08	2009/10	2011/12	2012/13	2015/16
Date	22/2	26/1	14/2	8/1	27/1	24/1	20/1
No. of observers	3	4	3	3	3	3	2
Count conditions	**	***	***	***	***	**	**
Tufted Duck	0	0	0	1	0	0	0
Common Eider	215	237	449	215	173	94	237
Long-tailed Duck	24	20	13	9	12	18	10
Common Scoter	0	0	0	2	0	0	0
Goldeneye	9	4	5	10	1	6	2
Red-breasted Merganser	8	4	19	16	8	28	0
Red-throated Diver	3	0	3	0	5	2	2
Great Northern Diver	13	19	17	24	38	24	26
Slavonian Grebe	6	5	4	14	11	13	7
Cormorant	153	97	68	194	23	62	44
Shag	255	448	221	433	318	286	437
Common Guillemot	32	180	32	4	5	0	99
Razorbill	1	13	5	0	2	4	2
Black Guillemot	138	298	129	308	173	208	133
Little Auk	0	0	0	0	14	0	4
Puffin	0	0	0	0	0	2	19
Area total	921	1325	965	1230	783	747	1023

**Figure 4.4.** The number and distribution of Long-tailed Ducks in the Burra, Trondra, South Havra, the Scalloway islands and Weisdale Voe survey area.



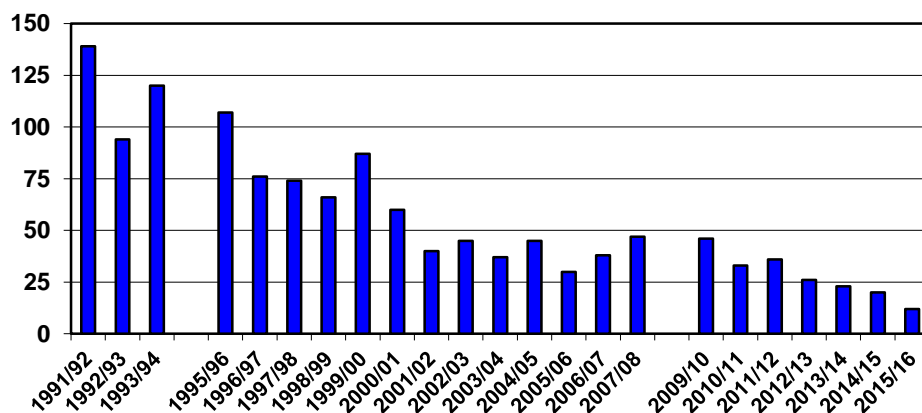
#### 4.5. Whiteness Voe to Skelda Voe, West Mainland

The area was surveyed from land on 12<sup>th</sup> January by Rory Tallack and Howard Towll (Shetland Amenity Trust) in perfect conditions, although there was extensive thin ice in Effirth and Bixter Voes, and The Firth. The area borders the Scalloway islands and Weisdale Voe survey area, and species such as **Common Eider** may move between the two areas, resulting in rather variable counts (**Table 4.7**). However, the long-term decline in numbers of **Long-tailed Duck** is real (**Figure 4.5**), as few have been recorded on boat surveys of the Scalloway islands (**Figure 4.5**). Numbers of **Red-breasted Mergansers** were more similar to those recorded in the 1990s than the higher counts of the early 2010s. Counts of **Great Northern Divers** have been rather variable in this area, possibly as some birds were feeding further offshore on some survey dates. The total of 23 **Slavonian Grebes** (nine in Whiteness Voe, six in Weisdale Voe, eight in Garderhouse Voe) was the lowest since regular counts of the area began, with the exception of five on the early date of 10<sup>th</sup> November 1995, while the 23 **Little Auks** and five **Puffins** seen were unusual for recent winters.

**Table 4.7.** Counts from land of diving seabirds and seaduck in the voes between Whiteness Voe and Skelda Voe. Count conditions were good to excellent throughout on each date.

Winter	2007/08	2009/10	2010/11	2011/12	2012/13	2013/14	2014/15	2015/16
Date	19/2	12/2	25/1	23/1	13/12	7/2	15/2	12/1
Common Eider	178	201	169	58	317	42	134	16
Long-tailed Duck	47	46	33	36	26	23	20	12
Common Scoter	0	4	3	5	0	2	0	1
Velvet Scoter	2	0	0	1	0	0	0	0
Goldeneye	16	35	11	21	18	28	15	2
Red-breasted Merganser	192	156	83	110	156	188	109	72
Goosander	0	2	1	3	0	1	0	0
Smew	0	1	0	0	0	0	0	0
Red-throated Diver	13	0	1	1	2	3	0	2
Black-throated Diver	0	0	0	0	0	1	0	0
Great Northern Diver	23	15	26	39	17	42	25	29
Slavonian Grebe	68	77	73	74	55	57	66	23
Cormorant	35	26	14	10	17	27	8	0
Shag	127	101	103	104	145	127	128	146
Common Guillemot	6	6	0	0	0	76	1	26
Razorbill	9	0	1	0	3	11	4	4
Black Guillemot	108	57	76	76	44	106	81	61
Little Auk	0	0	0	0	0	0	0	23
Puffin	0	0	0	0	0	1	1	5
<b>Total</b>	<b>824</b>	<b>727</b>	<b>587</b>	<b>528</b>	<b>800</b>	<b>735</b>	<b>592</b>	<b>422</b>

**Figure 4.5.** Counts from land of Long-tailed Duck in the voes between Whiteness Voe and Skelda Voe.



## 5. Beached Bird Surveys

### 5.1. Changes in coverage

The monthly beached bird survey is carried out by the authors and a team of long-term volunteers, and coverage has varied only slightly in the past 20 years. However, following a review of the monitoring programme in 2015 it was decided in 2016 to discontinue coverage of eight beaches (total of 2.95 km) that were either particularly unproductive, or difficult of access or to walk along. It was also decided to discontinue coverage of 13.7 km of shoreline in Sullom Voe, but retain the 1.6 km between the SVT construction jetty and the head of Garths Voe, and the 0.3 km Gluss Ayre on the west side of the voe. Thus, the total shoreline surveyed per month was reduced from 49.56 km (December 2015) to 32.91 km (January 2016). Because the discontinued beaches had contributed disproportionately few corpses, especially in Sullom Voe, this will have consequences for comparing results in 2016 and beyond with earlier data and we investigated the effect of this for 2014 and 2015 by removing these beaches from the results for those years (**Table 5.1**). There was only a minor reduction in the number of corpses found and little change in the percentage oiled, but a 41–42% increase in the total number per km and a 37–50% increase in the number of oiled corpses per km. Consideration will have to be given as to how the data can be managed so that these parameters are described for the history of the beached bird survey.

**Table 5.1.** Beached bird survey parameters in 2014 and 2015 for: (i) full coverage; (ii) beaches retained in the survey in 2016; (iii) the percentage difference for each parameter.

Parameter	2014 (i); (ii); (iii)	2015 (i); (ii); (iii)
Total km surveyed	587.5; 388.9; - <b>34%</b>	585.2; 391.5; - <b>33%</b>
Seabird corpses found	1,152; 1,078; - <b>6%</b>	691; 657; - <b>5%</b>
Oiled seabirds found	11; 10; - <b>9%</b>	27; 27; <b>0%</b>
Total corpses per km	1.961; 2.772; + <b>41%</b>	1.181; 1.678; + <b>42%</b>
Oiled corpses per km	0.019; 0.026; + <b>37%</b>	0.046; 0.069; + <b>50%</b>
Percentage of corpses oiled	0.955; 0.928; - <b>3%</b>	3.907; 4.109; + <b>1%</b>

**Table 5.2.** Summary details for the Shetland Beached Bird Survey. \*The reduction in coverage in 2016 means these figures are not directly comparable with earlier years.

Year	Km.	Corpses	Oiled	Total/km	% Oiled	Oiled/km.
2007	559.40	1,069	36	1.911	3.37	0.064
2008	577.80	1,159	90	2.006	7.77	0.156
2009	553.90	942	40	1.701	4.25	0.072
2010	551.30	857	46	1.555	5.37	0.083
2011	577.80	935	23	1.618	2.46	0.040
2012	579.20	1031	21	1.780	2.04	0.036
2013	581.12	811	49	1.396	6.04	0.084
2014	587.52	1,152	11	1.961	0.96	0.019
2015	585.17	691	27	1.181	3.91	0.046
<b>2016</b>	<b>389.42</b>	<b>752</b>	<b>35</b>	<b>*1.931</b>	<b>4.65</b>	<b>*0.090</b>
<b>5-Year Annual Means: 1979–1983</b>				4.064	9.98	0.408
1984–1988				3.933	7.86	0.311
1989–1993				3.990	7.19	0.285
1994–1998				4.307	9.50	0.409
1999–2003				3.171	2.39	0.073
2004–2008				2.163	2.97	0.061
2009–2013				1.610	4.04	0.063
<b>2014–2016</b>				<b>*1.691</b>	<b>3.17</b>	<b>*0.052</b>

## 5.2. Incidence of oiling

**January to April:** Apart from two Common Guillemots at Meal, Burra in March and a Fulmar at Culswick, west Mainland in April, all other 13 oiled seabirds (9 Fulmars, 1 Herring Gull, 1 Kittiwake, 2 Common Guillemots) found in late winter and early spring were on beaches in northwest Mainland, north Yell and north Unst (a Common Guillemot at Fair Isle was not found on a standard BBS). A Fulmar at Eshaness on the January survey had been lightly oiled with East Shetland Basin crude (**Table 5.3**). On the February survey, small patches of black oil were found on a tideline of several weeks earlier at Ronas Voe along with two oiled Fulmars (one lightly oiled, one 100% oiled) and a Common Guillemot (100% with fuel oil); all were long-dead. No other beached oil was found on that survey (and this was the only beached oil recorded all year), but a Fulmar found on the same day at Sandvøe at the north tip of Mainland was contaminated with a different fuel oil to the Ronas Voe Guillemot. Three samples from widely scattered locations on the March and April surveys were all fuel oil refined from Nigerian crude.

**May to August:** A lightly oiled, long-dead Common Guillemot was found at Gluss Ayre in Sullom Voe in June, but all other 17 oiled seabirds (13 Fulmars, 2 Gannets, 1 Herring Gull, 1 Great Black-backed Gull) found in summer were on the west coast of Shetland, most (14) again in northwest Mainland and north Yell. Apart from a moderately oiled Fulmar contaminated with fuel oil that had been refined from Russian crude and was therefore from a different discharge than the previous three samples (**Table 5.3**), all were recorded as having been lightly oiled.

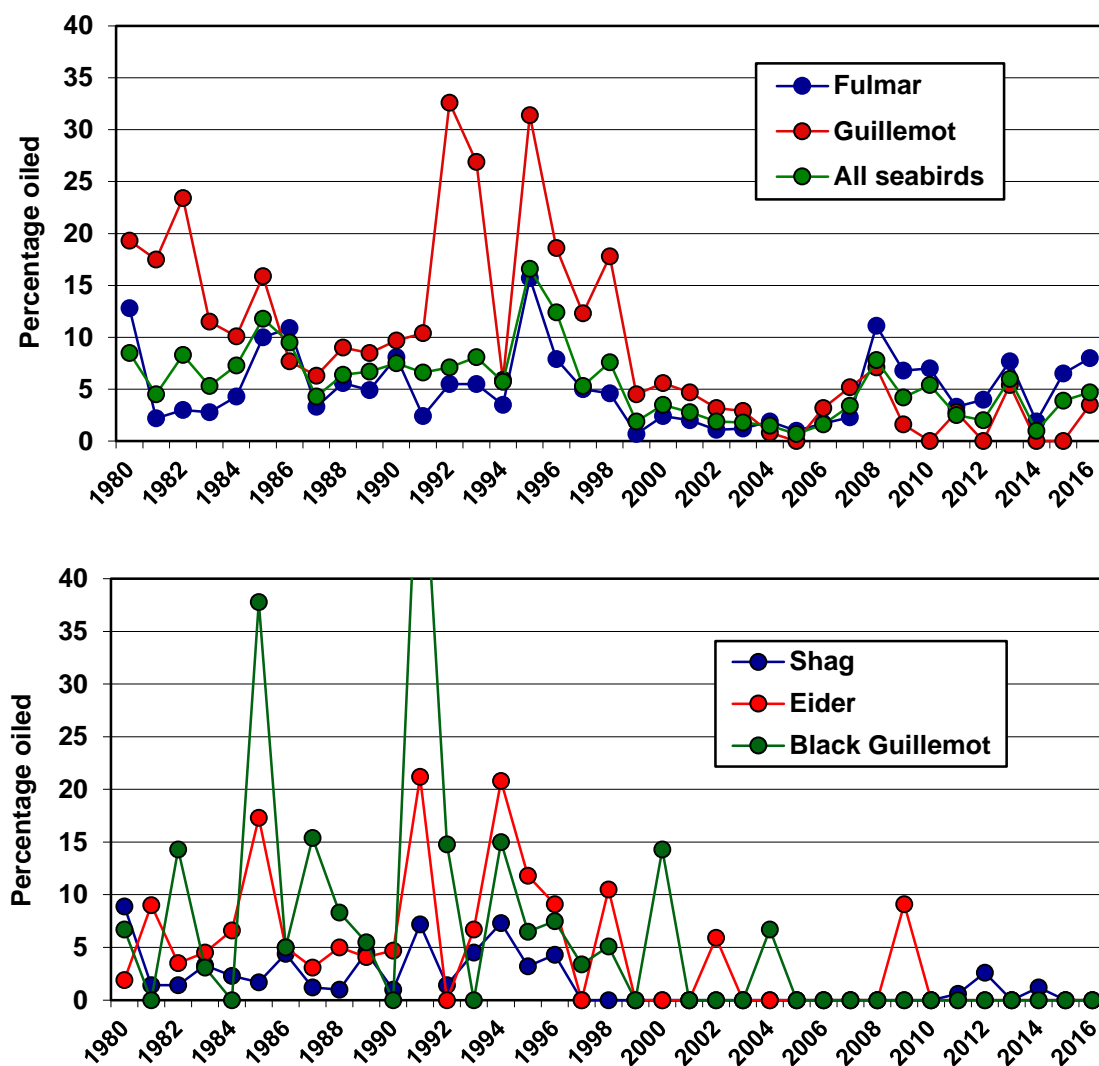
**September to December:** No oil or oiled birds were found in September, and there was no trace at the end of October of the spill on 2<sup>nd</sup> October of 95 tonnes of crude in the Clair Field to the northwest of Shetland which occurred during, and was followed by, persistent SSE winds. A few soft oil pellets found in northwest Mainland at the end of November and again in December proved to be fuel oil from the same source, while a Fulmar at Sand in the west Mainland in late December was contaminated with very heavily weathered unrefined crude of Middle Eastern origin.

**Table 5.3.** Results of analyses of oil samples collected in 2016. L = lightly oiled (< 10%); M = moderately oiled (10–25%); H = heavily oiled (> 25%). \*There were differences between samples 250 & 251; \*\*there was a positive match between samples 256 & 258.

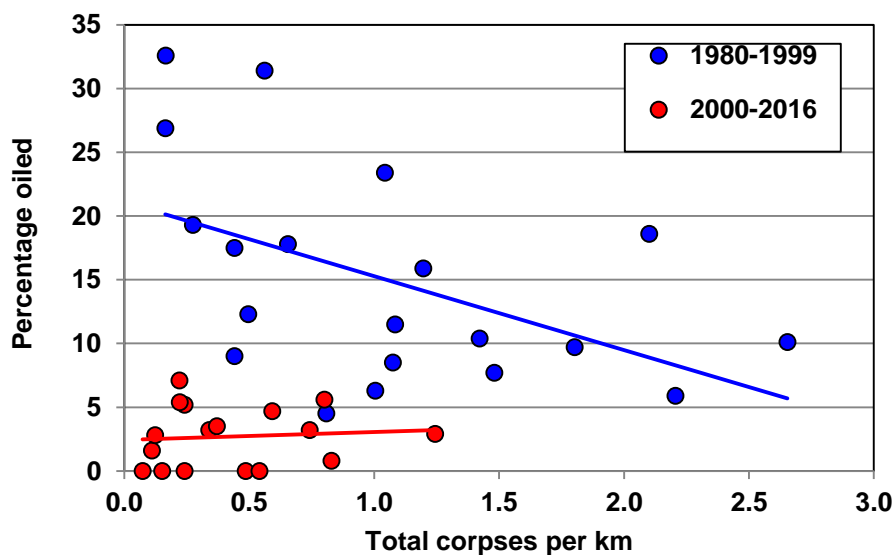
No.	Date	Location	Sample	Type	Possible type; source
248	24/01	Breivick, Eshaness	Fulmar (L)	Crude	East of Shetland Basin; tank washing or illegal discharge
249	10/02	South Haven, Fair Isle	Guillemot (M)	Fuel	Illegal bilge discharge or accidental release
250	01/03	Sandvøe, North Roe	Fulmar (L)	Fuel*	Illegal bilge discharge or accidental release
251	01/03	The Blade, Ronas Voe	Guillemot (H)	Fuel*	Illegal bilge discharge or accidental release
252	24/03	Meal, West Burra	Guillemot (L)	Fuel	Refined with Nigerian crude oil feedstock; illegal bilge discharge or accidental release
253	20/04	The Blade, Ronas Voe	Fulmar (H)	Fuel	Refined with Nigerian crude oil feedstock; illegal bilge discharge or accidental release
254	21/04	Culswick, W Mainland	Fulmar (M)	Fuel	Refined with Nigerian crude oil feedstock; illegal bilge discharge or accidental release
255	23/05	Sandwick, Eshaness	Fulmar (M)	Fuel	Refined with Russian crude oil feedstock; illegal bilge discharge or accidental release
256	23/11	Sandwick, Eshaness	Soft tar ball	**Fuel	Refined with Russian crude oil feedstock; illegal bilge discharge or accidental release
257	28/12	Sand, W Mainland	Fulmar (M)	Crude	Very heavily weathered Middle Eastern crude; tank washing or illegal discharge
258	29/12	Urafirth, NW Mainland	Soft tar ball	**Fuel	Refined with Russian crude oil feedstock; illegal bilge discharge or accidental release

**Long-term changes in percentage oiled:** The oiling rate of seabirds found has declined since the 1980s and 1990s (**Table 5.2**), but this has differed between species. Disregarding 1979 when many long-dead victims of the *Esso Bernicia* and other oil spills were recorded, the oil rate for Fulmar in 1980–89 averaged 6.0% compared to 5.9% in 2007–16, whereas the respective figures for Common Guillemot were 12.9% and 2.6% with, remarkably, no oiled birds found in four of the latter years (**Figure 5.1**). The oil rate for Common Guillemot was particularly erratic in the 1980s and 1990s but this can be largely explained by occasional large winter ‘wrecks’ of birds that died of starvation, which ‘diluted’ the oil rate in some years (**Figure 5.2**). The last such ‘wreck’ was in early 2003, and for years with less than one Guillemot corpse recorded per km there is virtually no overlap in the oiling rate between the periods 1980–99 and 2000–16. Oiling rates for coastal species (Shag, Eider and Black Guillemot) were rather erratic during the 1980s and 1990s, as particular incidents impacted inshore waters (e.g. September 1985 in northwest Mainland; March 1991 in southeast Mainland). Since 2000, however, most years have seen oiling rates of zero for all three species.

**Figure 5.1.** Annual percentage oiled for: (upper) all seabird species and for Fulmar and Common Guillemot; (lower) Shag, Common Eider, and Black Guillemot (N.B. 1991 value of 57.9% is off the y-axis scale).



**Figure 5.2.** The annual percentage oiled for Common Guillemots plotted against the total number found per km surveyed (the data point for 2016 is 0.370 per km and 3.5%).





### 5.3. Non-oiled mortality

**January to April:** Late winter and early spring is normally the time of peak mortality for Shags, but few were found dead (nine first-winter/immatures, four adults, one unaged). Given the number of Common Guillemots and Puffins seen around Burra and the Scalloway islands on 20<sup>th</sup> January (**Tables 4.5, 4.6**) it was unsurprising that moderate numbers were found on beaches at the end of the month (**Table 5.4**). Guillemots were mostly first-winter birds in January, but the proportion of older birds increased by March/April (**Table 5.5**). Of the 17 Puffins found, 10 were first-winters, two were adults (February and April), and five were unaged (wings only), while the single Razorbill was also unaged. The relatively small numbers and the age-classes involved would suggest mortality around Shetland in early 2016 was trivial in population terms for these three species. No other seabird species was found in unusually high numbers.

**May to August:** The summer months were notable only for the low number of seabird corpses found. This must largely reflect declining breeding populations rather than the reduction in coverage in 2016, e.g. only seven Kittiwakes were found in 2016 compared to 76 in summer 2000, 123 in summer 1990, and 423 in summer 1980. The corresponding figures for Gannet, the breeding population of which has increased over this period, were 35 in 2016, 54 in 2000, 18 in 1990 and 32 in 1980.

**Table 5.4.** Seabirds and seaduck found on beached bird surveys in 2016. For each species the first figure given each month is the total found, the second is the number that were oiled (in bold).

**Other species:** Whooper Swan 1, Greylag 19, Grey Heron 1, Oystercatcher 8, Curlew 1, Rock Dove 6, Hooded Crow 2, Raven 6, Redwing 1.

**Net/rope/hook tangled:** Fulmar 3 (2 monofilament net, 1 monofilament line), Gannet 2 (1 net, 1 rope).

SPECIES	J	F	M	A	M	J	J	A	S	O	N	D	SUM
Common Eider		1		1	2		1				1		6
Long-tailed Duck										6	1		7
<b>Fulmar</b>	<b>11/2</b>	<b>16/4</b>	<b>17/1</b>	<b>28/3</b>	<b>63/11</b>	<b>32/1</b>	47	<b>41/1</b>	23	9	7	<b>6/1</b>	<b>299/24</b>
<b>Gannet</b>	8	1		4	<b>7/1</b>	8	12	<b>8/1</b>	7	10	3		<b>68/2</b>
Slavonian Grebe										1			1
Cormorant	1	1		2			1			2		1	8
Shag	2	1	2	9	6	1	5		3			8	37
Great Skua					1				1				2
Black-headed Gull						1		1					2
Common Gull	4	1		2	1	6	3	2	5	1			25
Lesser Bl.-backed Gull						1							1
<b>Herring Gull</b>	6	<b>9/1</b>	1	1	8	<b>8/1</b>	3	5	1	1	1	1	<b>45/2</b>
Herring / LBB Gull								1					1
Iceland Gull					1								1
Glaucous Gull												1	1
<b>Great Bl.-back. Gull</b>	4	1	2	3	<b>5/1</b>	1	5	2	1	2	2	2	<b>30/1</b>
Gull sp.							1						1
<b>Kittiwake</b>		1		<b>1/1</b>	2	1	2	2				2	<b>11/1</b>
Arctic Tern						1	7	1					9
<b>Common Guillemot</b>	23	<b>42/2</b>	<b>35/2</b>	9	<b>9/1</b>	2	13	4	3	2	1	1	<b>144/5</b>
Razorbill				1	1	2	5			3	2		14
Black Guillemot	1		1		3	1	1	2	1		1		11
Puffin	10	4	1	2	1	4	4	1					27
<b>Total</b>	<b>70</b>	<b>78</b>	<b>59</b>	<b>63</b>	<b>110</b>	<b>69</b>	<b>110</b>	<b>70</b>	<b>45</b>	<b>37</b>	<b>19</b>	<b>22</b>	<b>752</b>
<b>Oiled</b>	<b>2</b>	<b>7</b>	<b>3</b>	<b>4</b>	<b>14</b>	<b>2</b>	<b>0</b>	<b>2</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>1</b>	<b>35</b>
Km. surveyed	32.9	32.9	32.9	32.9	31.0	31.4	31.9	32.9	32.9	32.9	32.8	31.9	389.4
Corpses / km.	2.13	2.37	1.79	1.91	3.55	2.20	3.45	2.13	1.37	1.12	0.58	0.69	1.93
<b>% oiled</b>	<b>2.86</b>	<b>8.97</b>	<b>5.1</b>	<b>6.3</b>	<b>12.7</b>	<b>2.9</b>	<b>0</b>	<b>2.9</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>4.6</b>	<b>4.7</b>
<b>Oiled / km.</b>	<b>0.06</b>	<b>0.21</b>	<b>0.09</b>	<b>0.12</b>	<b>0.45</b>	<b>0.06</b>	<b>0</b>	<b>0.06</b>	<b>0</b>	<b>0</b>	<b>0</b>	<b>0.03</b>	<b>0.09</b>
Oiled after death	0	0	0	0	0	0	0	0	0	0	0	0	0
Net/rope/hook tangled	0	1	1	0	1	1	0	0	1	0	0	0	5
Other species	1	1	1	2	9	4	5	5	4	8	1	4	45

**September to December:** The finding of intact corpses of a Slavonian Grebe and five first-winter Long-tailed Ducks at Fair Isle on the October survey was most unusual, in that the former species has been only rarely recorded dead elsewhere in Shetland, and such a geographic and temporal cluster of the latter species is unprecedented in the history of the BBS in Shetland. The inclusion in 2012 of three small beaches on the east coast of Fair Isle was a welcome addition to coverage. Lying in the middle of the Fair Isle Channel shipping lane, the island provides the only shelter for migrant waterfowl between Shetland and Orkney. However, Fair Isle's rocky coastline has little feeding habitat for either species and FIBO records indicate a history of migrant individuals lingering there and eventually being found dead. Little else of note was found in autumn and early winter, apart from a further 20 Gannets (9 adults, 11 first-winter) in September to November. In December, most beaches were surveyed during 27<sup>th</sup> – 31<sup>st</sup> following severe north-westerly gales on 24<sup>th</sup> and 26<sup>th</sup> but apart from eight Shags (2 adults, 4 immatures, 2 unaged) there was little evidence of storm-related mortality.

**Table 5.5.** Age composition of Common Guillemots found on the 2016 beached bird survey. No white tips to the greater underwing coverts means birds were older than their first year, white tips means they were in their first winter year. Percentages given are of the total of aged corpses only.

<b>Month</b>	<b>January</b>		<b>February</b>		<b>March</b>		<b>April</b>		<b>May</b>		<b>June</b>	
<b>Guillemot</b>	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%
No white tips	3	14	12	32	17	50	4	44	4	50	1	50
White tips	19	86	26	68	17	50	5	56	4	50	1	50
Unaged	1		4		1		0		1		0	
<b>Total</b>	<b>23</b>		<b>42</b>		<b>35</b>		<b>9</b>		<b>9</b>		<b>2</b>	
<b>Month</b>	<b>July</b>		<b>August</b>		<b>September</b>		<b>October</b>		<b>November</b>		<b>December</b>	
<b>Guillemot</b>	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%
No white tips	9	90	2	67	1	33	1	50	0		0	
White tips	1	10	1	33	2	67	1	50	1	100	1	100
Unaged	3		1		0		0		0		0	
<b>Total</b>	<b>13</b>		<b>4</b>		<b>3</b>		<b>2</b>		<b>1</b>		<b>1</b>	

## 6. Publications and presentations

Camphuysen, K. & **Heubeck, M.** 2016. Beached bird surveys in the North Sea as an instrument to measure chronic oil pollution. In: Carpenter, A. (ed.) *Oil Pollution in the North Sea*: 193-208. Springer, Heidelberg/New York.

**Heubeck, M. & Mellor.** 2016. *The SMP [Seabird Monitoring Programme] 30 years on: taking stock, and planning for the future*. Oral presentation at 13<sup>th</sup> International Seabird Group Conference, Edinburgh 6<sup>th</sup>–9<sup>th</sup> September 2016.

**Heubeck, M. & Mellor.** 2016. *Thirty-eight years of monitoring show a large-scale oil development has had little long-term impact on local seabird populations*. Poster presentation at 13<sup>th</sup> International Seabird Group Conference, Edinburgh 6<sup>th</sup>–9<sup>th</sup> September 2016.

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**Winter counts of diving seabirds and seaduck:** Phil Harris, Paul Harvey, Roger Riddington, Rory Tallack, Howard Towll, George Williamson, Jonathan Wills.

**Pre-breeding census counts of Black Guillemots:** Paul Harvey, Rory Tallack, Howard Towll (Shetland Amenity Trust); Juan Brown, Andy Denton, Craig Nisbet, Afra Skene, Jonathan Swale, Glen Tyler (SNH); Patrick Cook, Martha Devine, Pete Ellis, Helen Moncrieff, Nathalie Pion, Malcolm Smith, Jenny Sutherland (RSPB); Gary Bell, Phil Harris, Rebecca Nason, Roger Riddington (Shetland Bird Club); George Williamson.

**June census counts of cliff-nesting seabirds:** Paul Harvey, Roger Riddington, Rory Tallack.

**Common Guillemot chick weights:** Pete Ellis, Newton Harper, Phil Harris, George Petrie, Nathalie Pion, Roger Riddington, Glen Tyler.

**The Ornithological Monitoring Programme is funded by the Sullom Voe Association Limited.**

## Appendix 1. Seabird monitoring on Foula in 2016, conducted by Sheila Gear (Foula Ranger Service).

**Common Eider.** The first chicks were seen on 13<sup>th</sup> June and the annual count along the east coast was made on 24<sup>th</sup> July in calm, cloudy but bright conditions. After an abnormally low count in 2015, the number of adults was more similar to those in 2013–14 while the number of chicks seen was the highest since 2012.

	27/7/07	26/7/08	27/7/09	24/7/10	26/7/11	27/7/12	25/7/13	27/7/14	25/7/15	24/7/16
Males	73	94	110	48	74	108	94	81	33	81
Females	60	70	89	66	51	50	71	87	52	68
<b>Adults</b>	<b>133</b>	<b>164</b>	<b>199</b>	<b>114</b>	<b>125</b>	<b>158</b>	<b>165</b>	<b>168</b>	<b>85</b>	<b>149</b>
Chicks	27	25	53*	19	26	81	27	49	21	70
<b>Total</b>	<b>160</b>	<b>189</b>	<b>252</b>	<b>133</b>	<b>151</b>	<b>239</b>	<b>192</b>	<b>217</b>	<b>106</b>	<b>219</b>
Brood/1	11	8	10	8	7	7	15	5	3	14
Brood/2	4	7	12	3	6	12	3	11	2	7
Brood/3	1	1	4	0	1	8	2	6	2	7
Brood/4	0	0	1	0	1	4	0	1	2	4
Brood/5	1	0	0	1	0	2	0	0	0	1
<b>Mean Br.</b>	<b>1.59</b>	<b>1.56</b>	<b>1.85</b>	<b>1.58</b>	<b>1.73</b>	<b>2.45</b>	<b>1.35</b>	<b>2.13</b>	<b>2.33</b>	<b>2.12</b>

**Red-throated Diver.** Breeding pools were checked on eight dates from 28<sup>th</sup> April – 4<sup>th</sup> September. Drought and low water levels during the first half of the summer may have reduced breeding success. Breeding was proved at 13 sites, there was a pair displaying and an empty scrape at a new site on 4<sup>th</sup> June, and two adults but no evidence of nesting at a further site on 16<sup>th</sup> May. Greylag geese were again observed fighting with breeding divers. Only one brood of two was recorded, one of which grew more slowly than its sibling and was still present with a parent on 4<sup>th</sup> September (large and assumed to have fledged).

<b>Foula Red-throated Divers</b>	<b>2007</b>	<b>2008</b>	<b>2009</b>	<b>2010</b>	<b>2011</b>	<b>2012</b>	<b>2013</b>	<b>2014</b>	<b>2015</b>	<b>2016</b>
Sites occupied at least once	11	10	12	10	13	12	13	13	12	15
Breeding attempts	7	8	11	9	11	8	12	12	12	13
Sites where chicks hatched	6	6	7	5	7	6	7	11	11	11
Minimum number of chicks	7	6	10	5	9	8	9	17	12	12
Chicks presumed fledged	7	4	9	4	5	5	4	15	10	6
<b>Breeding success</b>	<b>1.00</b>	<b>0.50</b>	<b>0.82</b>	<b>0.44</b>	<b>0.45</b>	<b>0.63</b>	<b>0.33</b>	<b>1.25</b>	<b>0.83</b>	<b>0.46</b>

**Northern Fulmar.** Four of the monitoring sites were picked at random, AOS were scored on 29<sup>th</sup> May, 31<sup>st</sup> May and 3<sup>rd</sup> June, and chicks were counted on 18<sup>th</sup> August.

<b>Plot</b>	<b>Total AOS</b>	<b>AOS on all 3 checks (%)</b>	<b>Chicks at all-3-check sites + 'extra' sites</b>	<b>Success</b>
3	83	54 (65.1%)	25 + 4	29/58 = 0.50
5	49	37 (75.5%)	19 + 4	23/41 = 0.56
6	37	25 (67.6%)	14 + 1	15/26 = 0.58
8	31	21 (67.7%)	12 + 1	13/22 = 0.59
Sum	200	137 (68.5%)	70 + 10	80/147 = 0.45
<b>Mean ± SE of 4 plots</b>				<b>0.56 ± 0.02</b>

Breeding success was higher than in 2015, but slightly below that recorded in 2012–14. NB: Data from 2007–10 have been recalculated to standardise the methodology to that employed subsequently and elsewhere in Shetland, and figures differ from those reported previously

<b>Fulmar</b>	<b>2007</b>	<b>2008</b>	<b>2009</b>	<b>2010</b>	<b>2011</b>	<b>2012</b>	<b>2013</b>	<b>2014</b>	<b>2015</b>	<b>2016</b>
Qualifying AOS	162	127	111	140	119	196	135	113	123	137
'Extra' AOS	9	20	9	5	0	0	0	33	16	10
Chicks in August	74	77	51	88	57	125	96	97	45	80
<b>Mean success</b>	<b>0.43</b>	<b>0.55</b>	<b>0.45</b>	<b>0.62</b>	<b>0.48</b>	<b>0.64</b>	<b>0.73</b>	<b>0.67</b>	<b>0.33</b>	<b>0.56</b>

**European Shag.** Plots were checked on 11 dates, from 22<sup>nd</sup> April – 9<sup>th</sup> August. Numbers continue to decline and many former nesting areas remain deserted. Two nest sites were lost due to a rock fall, and at two other nests one chick was found dead and another appeared to have been predated. Some chicks appeared to have moved around, perhaps in response to heavy rain in late summer flooding their nests, but 19 were believed to have fledged from 26 breeding attempts, giving breeding success of only 0.73.

Shag	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
Trace nest only	3	3	2	1	0	4	3	0	1	1
Empty nest only	1	10	2	1	1	3	4	0	1	0
Incubating nests	24	27	44	41	27	10	4	35	29	26
% Incubating	85.7	67.5	91.7	95.3	96.4	58.8	36.4	100	93.5	96.3
Young fledged	25	7	55	56	20	5	3	66	23	19
<b>Fledged / inc.</b>	<b>1.04</b>	<b>0.26</b>	<b>1.25</b>	<b>1.37</b>	<b>0.74</b>	<b>0.50</b>	<b>0.75</b>	<b>1.89</b>	<b>0.79</b>	<b>0.73</b>

**Arctic Skua.** The first was seen ashore on 26<sup>th</sup> April but most birds returned late and did not lay until June. Of 27 apparently occupied territories (AOT), two held only a single bird and only 17 pairs were known to have laid; most birds in the other AOT were only seen in the first half of June and then disappeared. Most pairs failed during incubation or at hatching, seven chicks survived long enough to be ringed but only four of these survived to fledge.

Arctic Skua	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016
First seen on land	26/4	21/4	24/4	26/4	22/4		3/5	29/4	26/4	26/4
AOT	71	41	63	50	41	37	35	24	28	27
Pairs laid	42	10	49	39	32	27	26	21	26	17
Mean clutch	1.69	1.71	1.43	1.73	1.63	1.58	1.77	1.70	1.62	1.47
Fledged	0	0	22	(1)	0	4	0	18	17	4
Success/AOT	0	0	0.35	0.00	0	0.11	0	0.75	0.61	0.15

**Great Skua.** Numbers of AOT in the Bitten monitoring plot increased. Predation of chicks was high and continued after chicks were large enough to ring, resulting in the 7<sup>th</sup> successive year of low breeding success.

Great Skua	2008	2009	2010	2011	2012	2013	2014	2015	2016
First seen on land	4/4	10/4	6/4	2/4	28/3	10/4	10/4	3/4	2/4
AOT monitored	62	45	48	53	38	41	48	42	54
Mean clutch	-	1.94	1.87	1.74	1.76	1.54	1.88	1.62	1.77
Fledged (*see below)	70	65	11	14	8	3	8	3	14
Success/AOT	1.13	1.44	0.23	0.26	0.21	0.07	0.17	0.07	0.26

\*2008: 57 live chicks (marked) and 9 dead on 28/7; most chicks flying on 9/8 but a further 13 live and 4 dead unmarked found, so assume 70 fledged.

\*2009: 66 chicks marked on 24–25/7; fledglings not counted but one marked chick found dead 21/8.

\*2010: 40 chicks ringed on 21 & 26/7; 9 fledged, 2 unfledged and 35 dead on 8/8.

\*2011: 38 chicks ringed on 21 & 28/7, 3 of which predated; 11 fledged and 3 unfledged (adults defending well so assume fledged) on 14/8.

\*2012: 17 chicks ringed on 24 & 27/7; 8 fledged and 4 unfledged (these assumed didn't fledge) on 12/8.

\*2013: 16 chicks ringed between 21/7 & 8/8; 3 fledglings on 19/8.

\*2014: 14 chicks ringed on 21–22/7; 8 fledglings (including one un-ringed) on 12/8.

\*2015: 13 chicks ringed on 19 & 22/7 (2 of which predated); 3 fledglings on 15/8.

\*2016: 20 chicks ringed in late July; 14 survived to fledge.

**Common Gull.** Only three pairs of Common Gulls nested at the Groups Quarry; they failed early on, relaid and failed again.

**Herring Gull.** Nine pairs nested at the Swaa fledging five young. One pairs of Lesser Black-backed Gulls was present but no nest was seen.

**Black-legged Kittiwake.** The whole-island count from the sea was made on 25<sup>th</sup> June, and the total number of apparently occupied nests (AON) was similar to that in 2015.

<b>Black-legged Kittiwake</b>	<b>2007</b>	<b>2008</b>	<b>2009</b>	<b>2010</b>	<b>2011</b>	<b>2012</b>	<b>2013</b>	<b>2014</b>	<b>2015</b>	<b>2016</b>
Census count (AON)	997	-	509	582	480	378	327	361	277	272
% change per year	-6.4		-28.5	+14.3	-17.5	-21.3	-13.5	+10.4	-23.3	-1.8

At In Under da Stee material was still coming down from a rock fall high above the site so only five checks were made (15<sup>th</sup> May – 18<sup>th</sup> August); one chick was assumed to have fledged. At Hodden (7 checks, 27<sup>th</sup> May – 18<sup>th</sup> August) nine chicks fledged from 20 nests, giving a mean productivity at the two sites of 0.48.

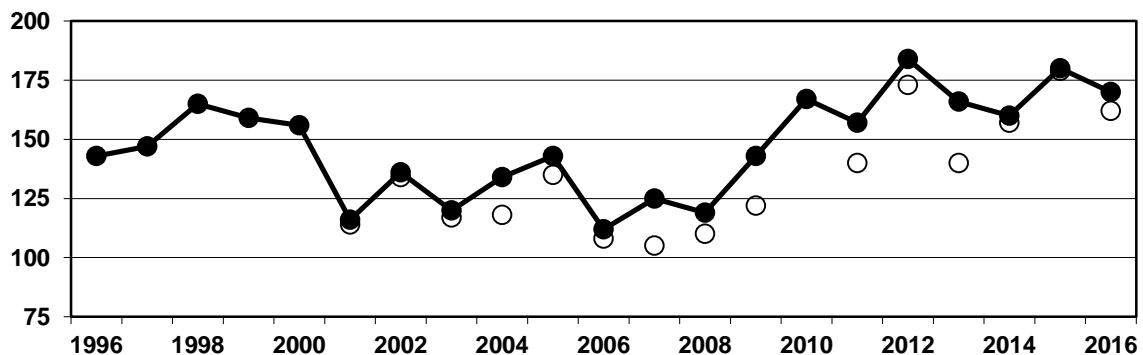
<b>In Under da Stee</b>	<b>2007</b>	<b>2008</b>	<b>2009</b>	<b>2010</b>	<b>2011</b>	<b>2012</b>	<b>2013</b>	<b>2014</b>	<b>2015</b>	<b>2016</b>
Completed nests	91	13	70	52	50	44	32	20	2	2
Fledged	1	0	23	3	0	0	0	0	1	1
Success	<b>0.01</b>	0	0.33	0.06	0	0	0	0	0.50	0.50
<b>Hodden</b>	<b>2008</b>	<b>2009</b>	<b>2010</b>	<b>2011</b>	<b>2012</b>	<b>2013</b>	<b>2014</b>	<b>2015</b>	<b>2016</b>	
Completed nests		2	46	31	22	20	18	18	21	20
Fledged		0	22	0	2	0	0	15	4	9
Success		0	0.48	0	0.09	0	0	0.83	0.19	0.45
<b>Mean success</b>		<b>0</b>	<b>0.41</b>	<b>0.03</b>	<b>0.05</b>	<b>0</b>	<b>0</b>	<b>0.42</b>	<b>0.35</b>	<b>0.48</b>

**Arctic Tern.** Birds returned in mid May, with 41 counted on the Hame Clettins on 15<sup>th</sup> May. Through June the flock built up to c.200 birds and by 23<sup>rd</sup> June c.100 pairs were attempting to breed on the east side of the airstrip, and those around the windsock were incubating. By 9<sup>th</sup> July most of these had failed and only six chicks survived to fledge. In addition, one pair defended a territory at Hiorawick but no nest was found.

**Black Guillemot.** The stretch of coast monitored extends from Selchie Geo (HT952412) in the northwest of the island down along the entire east coast to Husawick (HT961370) in the southwest and is covered by two observers. On both dates, conditions were somewhat difficult for counting, most birds were ashore in the north sector and most were on the sea in the south; numbers were only slightly lower than in 2015.

<b>Area counted</b>	<b>Date &amp; time</b>	<b>Weather &amp; tide</b>	<b>Count</b>
East coast	22/4: 6.00–8.30am	Wind N 3, cloudy, swell & heavy chop, heavy shore break, tide flowing	170 adults
East coast	24/4: 7.30–9.35am	Wind NW 4, cloudy & rain, swell & chop, heavy shore break in north, calmer in south, tide flowing	162 adults

**Figure 1.** Counts of adult Black Guillemots along the east coast of Foula, 1996–2016. Open symbols indicate the lower count when two were made in a year (symbols overlap in 2015).



**Atlantic Puffin.** Counts of Puffins around the entire island were conducted on the evenings of 28<sup>th</sup> April and 6<sup>th</sup> May by a team comprising Sheila Gear, Jim Gear, Penny Gear, Fran Dyson Sutton, Geoff Atherton and Donna Atherton. The total numbers counted and estimated were similar on both evenings.

Date and times	Weather	Puffins counted	Estimates for areas out of sight	Possible total number of Puffins
28 <sup>th</sup> April 2016 19.00–21.30	Wind SE 4, partial cloud	5,055	1,296	6,351
6 <sup>th</sup> May 2016 19.00–21.50	Wind SW 3–4, partial cloud	4,690	1,457	6,147

Non-breeders arrived on 30<sup>th</sup> June. An RSPB team fitted GPS trackers to breeding Puffins in July to discover where they were feeding. Preliminary results indicated that some were making short flights near the island while others were making lengthy flights all the way to the north coasts of Orkney. Conditions for Puffins appeared to deteriorate in mid July and few pairs appeared to have raised a chick.

**Heubeck & Mellor comment:** On the morning of 26<sup>th</sup> June hundreds of Puffins and Razorbills were feeding very close inshore along the coast between Vaila and Wats Ness. Both species were seen surfacing with fish (sandeels and gadids) and those that took off carrying fish flew directly towards Foula, 25 km to the southwest.

## Appendix 2. Seabird ringing in Shetland in 2016.

Ringing of seabirds breeding in Shetland has provided valuable information on their non-breeding distribution and causes of mortality, both within Shetland and elsewhere in their ranges. SOTEAG has supported this activity since 1980 by reimbursing the cost of rings, initially for selected species (prioritising those whose populations were judged most vulnerable to oil pollution) but from 2010 for all species of seabird. The number of seabirds ringed each year fluctuates according to breeding success and the number of chicks available to be ringed, but has also declined as breeding numbers of many species have declined, accessible colonies have become fewer, and as fewer groups and individual ringers have been active.

The total of 2,850 seabirds ringed at breeding colonies in 2016 was considerably higher than in 2015 (803), due to increased effort and more successful breeding seasons for certain species resulting in more chicks being available for ringing. The main differences were in Northern Fulmar (151 c.f. 84 in 2015), Great Skua (842 c.f. 261), Arctic Tern (373 c.f. 10), Common Guillemot (970 c.f. 21) and Atlantic Puffin (193 c.f. 92). In 2016 SOTEAG provided Shetland Ringing Group with a grant to purchase new ropes and helmets in order to access breeding colonies more safely.

**Recommendation:** That SOTEAG offers reimbursement of ring costs for all species listed in Table 1, with (as per existing policy) the exception of tape-lured non-breeding storm petrels. This amounts to a total of £601.85, comprising: Fair Isle Bird Observatory (£385.65); Shetland Ringing Group (£206.70); University of Glasgow (£9.50).

**Table 1.** Seabirds ringed in Shetland in 2016. FI = Fair Isle Bird Observatory; SRG = Shetland Ringing Group; FO = Foula, using University of Glasgow rings. \*The cost of Red-throated Diver rings is covered by a separate grant to SRG, and the British Trust for Ornithology (BTO) does not charge for rings used on Common Guillemots and Razorbills. The unit cost of rings that is charged by the BTO reflects a combination of manufacturing cost and the cost of processing details of recoveries of dead birds or controls (retrapping) of live birds. Thus, ringing costs can differ for closely related species of similar size.

Species	Chicks			Adults breeding		Adults non-breeding		Total	Unit cost £	Total cost £
	FI	SRG	FO	FI	SRG	FI	SRG			
Red-throated Diver*		16						<b>16</b>	0.2550	<b>4.08</b>
Northern Fulmar	145			6				<b>151</b>	0.2300	<b>34.73</b>
European Storm Petrel		37		9	2	2113	363	<b>2524</b>	0.4450	<b>1123.18</b>
Leach's Storm Petrel						3	2	<b>5</b>	0.0900	<b>0.45</b>
European Shag	23	9		3	2			<b>37</b>	0.2550	<b>9.44</b>
Great Skua	565	256	20	1				<b>842</b>	0.3875	<b>326.28</b>
Arctic Skua	37	3	7					<b>47</b>	0.2500	<b>11.75</b>
Common Gull	11	22						<b>33</b>	0.2500	<b>8.25</b>
Lesser Black-backed Gull	4							<b>4</b>	1.0650	<b>4.26</b>
Herring Gull	53	19					3	<b>75</b>	1.0650	<b>79.88</b>
Great Black-backed Gull		6				1	3	<b>10</b>	0.3875	<b>3.88</b>
Common Tern		7						<b>7</b>	0.1275	<b>0.89</b>
Arctic Tern	46	327						<b>373</b>	0.1275	<b>47.56</b>
Common Guillemot*	28	930		2	10			<b>970</b>	Free	
Razorbill*	33	7		5	1			<b>46</b>	Free	
Black Guillemot	5							<b>5</b>	0.2500	<b>1.25</b>
Atlantic Puffin	89			74	30			<b>193</b>	0.2500	<b>48.25</b>
<b>Total (a)</b>	<b>1039</b>	<b>1639</b>	<b>27</b>	<b>100</b>	<b>45</b>	<b>2117</b>	<b>371</b>	<b>5338</b>		<b>1704.11</b>
<b>Total (b)</b>	<b>2705</b>			<b>145</b>		<b>2488</b>				



### Appendix 3. Census counts of cliff-nesting seabirds in June 2015 and 2016.

Counts of sections of the southeast Mainland were undertaken by SOTEAG in 2015 using the SNH Zodiac, while more extensive coverage of the west coast of Mainland and off-lying islands was undertaken in 2016 using the SOTEAG RIB, both with assistance from Shetland Amenity Trust staff and Shetland Bird Club members. An SNH team completed census counts at Foula in 2015, and made counts of cliff-nesting seabirds around Fetlar and at Hermaness in 2016. No analysis of data has yet been made.

**Figure 1.** Coverage of the Shetland coast achieved in 2015 and 2016 by SOTEAG (black) and SNH (red).

