



Key-site monitoring in Norway 2015, including Svalbard and Jan Mayen

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The 2015 breeding season was very varied with large differences in both population changes and breeding success between species and regions. Again, pelagic-feeding seabirds fared the worst, but also the coastal species experienced a bad season at many key sites (Table 1, Figure 1).

Breeding success

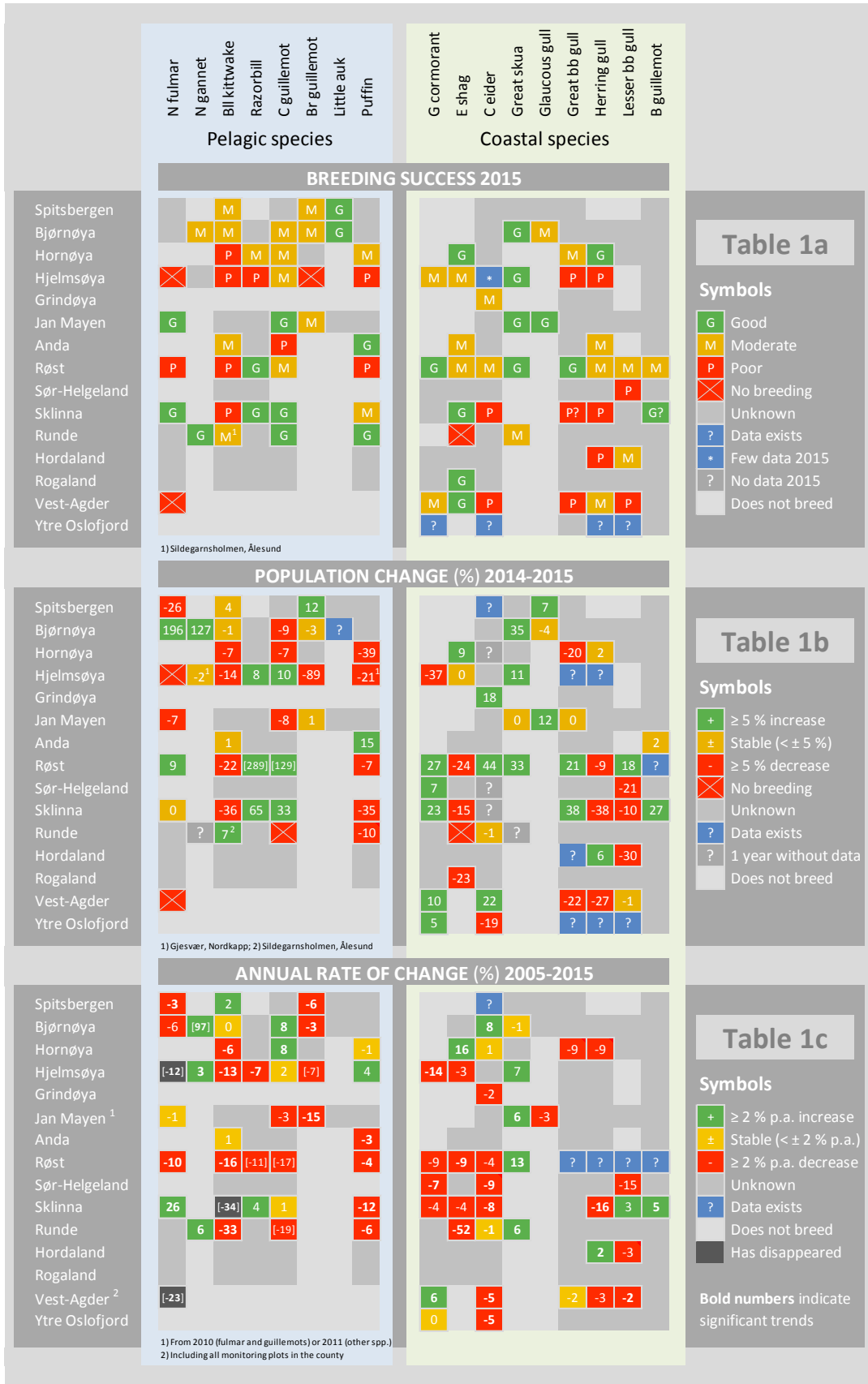
Sadly, the long succession of poor breeding seasons for Norwegian seabirds continued into 2015. For pelagic seabirds that have suffered over many years, 2015 was almost identical to the previous season. Less than one third of the species bred successfully, and an equal proportion failed almost completely. The most striking change was the failure among puffins on Hjelmsøya after a successful season in 2014, and the few fulmars on Sklinna actually produced chicks in 2015. As in many colonies along the mainland coast, the common guillemots have disappeared from open shelves on Runde, but those that breed hidden in crevices and suchlike had what seemed to be a good season. The same was true on Sklinna where chick production was the highest since monitoring started in 2008. At Røst, kittiwake (0.12 chicks/pair) and puffin (complete failure) breeding success was disastrous for the 9th year running. This is now the longest running series of breeding failures for any Norwegian colony, having exceeded the failure among puffins at the same site in 1975-1982. The kittiwakes on the buildings in the settlement of Røst were slightly more successful, but with only 0.31 chicks/pair. For the coastal species, the picture was far worse than in previous seasons, and approached that of the pelagic birds. More than ¼ of the populations had a poor year, and a further 40% could only boast a moderate production. In comparison, 58% had a good year in 2014. The biggest contrast was the success of the great skuas on Bjørnøya and the near failure of eiders at Sklinna. Shags were absent at Runde for the second year running, whereas at Sklinna they had a good season, albeit after two waves of egg laying, one in early May and one in early June.

In a geographic perspective, it seems that the breeding success of pelagic species dropped towards the north, while the pattern for coastal species was the reverse. The breeding success of Svalbard birds was an all-time low with only the great skua (top of the food chain) and little auk (feeding at the bottom of the chain) having a good season. The gannets on Bjørnøya had only a moderate success, but this can be expected in this little and newly established colony.

The gulls had an especially bad season in 2015. With the exception of herring gulls on Hornøya and great black-backed gulls on Røst, their breeding success was moderate to bad in all the monitored colonies. For the other coastal species, breeding success varied. Especially for shags, cormorants and eiders this was a clear change from 2014, when these three species did very well at most sites. Among the auks, breeding success also varied in 2015, with no clear spatial pattern.

Table 1

Schematic summary of breeding success (1a) and change in breeding numbers (1b) for focal seabird species at the regular SEAPOP monitoring sites in 2015, and their mean population trend over the last ten years (1c).



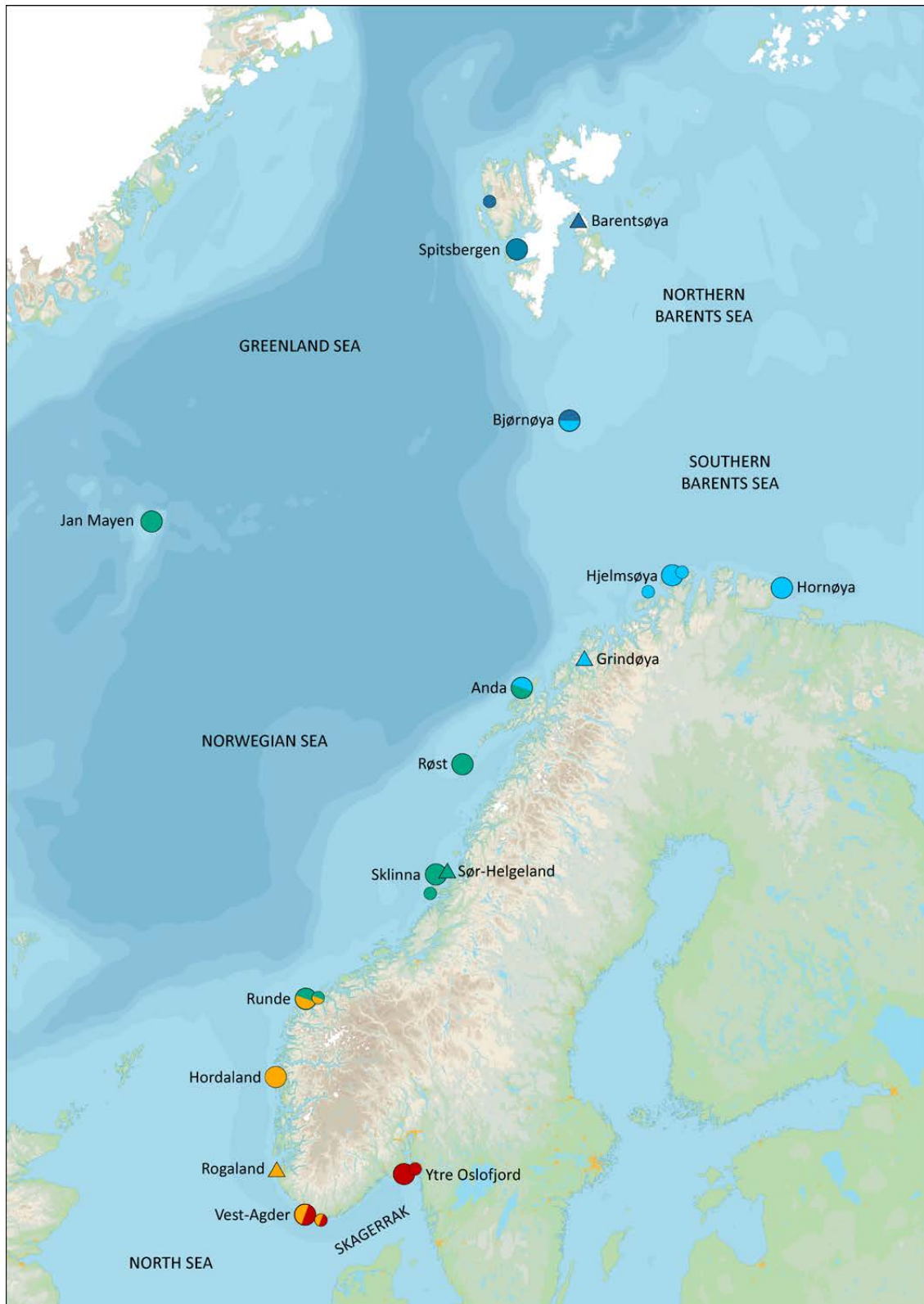


Figure 1

SEAPOP key-sites, as of 2015. Symbol colours indicate which seas they represent: the northern (dark blue) and southern (pale blue) Barents Sea, the Norwegian Sea (green), the North Sea (orange) and the Skagerrak (red). Split colours indicate sites associated with two seas. Large circles indicate the main localities, with some work carried out on nearby sub-localities (small circles). Triangles indicate single-species key-sites for ivory gull (Barentsøya), common eider (Grindøya), lesser black-backed gull (Sør-Helgeland) and shag (Rogaland).

Although we have modelled the dynamics of only a few populations, there is no doubt that the widespread and repeated breeding failures documented by SEAPOP over the last ten years have, and will continue to have, a negative effect on the populations of Norwegian seabirds. These problems have long been most noticeable in the Norwegian Sea, but there is now clear evidence that they are spreading to the other stretches of coastline. Seen in the light of the steep declines in many populations (see below), it is essential that we find the cause(s) of this worrying development. The most obvious explanations are certainly not common for all the populations, but some of the ultimate causes might apply to many.

Population changes

The decline in numbers of Norwegian seabirds continued into 2015. Puffin populations dropped in all but one (Anda, where numbers slowly increase) of the monitored colonies, with the largest declines in the far north and far south of the mainland. The Barents Sea common guillemot population has been increasing since the collapse in 1986-87, especially at Bjørnøya and Hornøya. This trend was broken in 2014 and 2015 with the first declines for 25 years in the monitoring plots, but the colony at Hornøya is expanding into new areas such that the total population there is probably still increasing. The Brünnich's guillemot population increased slightly at Spitsbergen, remained more or less stable at Bjørnøya and Jan Mayen, but dropped heavily at Hjelmsøya. Numbers at Hjelmsøya are now very low, and the population will probably soon disappear, as the one at Røst did 30 years ago.

Kittiwakes had a mediocre to bad year in 2015 in most of the colonies, with the most positive development in Ålesund where numbers increased by 7%. Further north there was either little to no change since 2014, or a decline as at Hornøya, Røst and Sklinna. Overall, however, the long-term decline continues as before, with few positive signals evident. Fulmars also have a worrying trend, despite a small increase at Bjørnøya and Røst. Declines were evident at the other sites where it is monitored, and the colonies at Hjelmsøya and in Vest-Agder were empty. Except for Sklinna, where numbers have increased and Jan Mayen where they are stable, the ten-year trend is negative at a rate of 3-10% p.a. at the three remaining colonies (including the largest ones at Svalbard).

The gannets and great skuas were the only bright spots in 2015. The gannet colony at Bjørnøya continues to increase since its establishment in 2011, as it also does at Runde. At Gjesvær, it seems to have stabilised around 1400 pairs, although the long-term trend is more positive. Numbers of great skuas have increased on Bjørnøya and all the mainland colonies, but changed little since 2014 at Jan Mayen. The long-term trend is also positive for this species that has now spread throughout the Barents Sea region.

For the coastal species, 2015 was very variable. In the north, great cormorants declined at Hjelmsøya but increased since 2014 at all other sites further south. Over a ten-year period, however, numbers are declining on all colonies of the nominate subspecies, while the continental subspecies continues to increase in Vest-Agder and the outer Oslofjord. For shags, however, the picture is grim, despite continued growth at Hornøya (9% since 2014) and no change at Hjelmsøya. At the other sites, the

population declined steeply, and the colony at Runde was again empty. Over a ten-year period, shag numbers have dropped, except at Hornøya where they increase.

The large gulls also had a depressing season in 2015. The great black-backed, herring and lesser black-backed gull numbers declined at many key sites, except at Sklinna (GBB) and Røst (GBB and LBB). Further north and west, the glaucous gull maintained numbers at Spitsbergen and Jan Mayen, but the already greatly reduced population at Bjørnøya dropped slightly. For the two most coastal species, the eider and black guillemot, the picture is varied. Apparent changes in numbers of eiders must, however, be treated with extra care as the count unit is number of males present in the breeding area, a number that can easily change in relation to breeding phenology. Over the long term, the breeding populations at all sites (or in nearby areas) are declining. Numbers of black guillemots, on the other hand, increased clearly at Sklinna, both since 2014 and over the last decade.

Adult survival

Seabirds have a long life expectancy and a low reproductive potential. This is a good adaptation to the unstable marine environment, but makes populations very sensitive to changes in survival rates. A small decrease in survival rates can lead to a serious decline in a population, a population that may already be suffering from a reduction in breeding success. As such, the monitoring of annual survival rates is essential to help understand the causes of population changes. Much effort is thus made by SEAPOP to monitor a sample of the key species through annual observations of individually colour-ringed birds.

In general, the survival of Norwegian seabirds is on the decline, with the exception of shags and eiders. On the mainland, adult survival rates of all the kittiwake populations monitored in SEAPOP have declined, with values of 70.5, 75.4 and 64.6% between 2013 and 2014 at Røst, Anda and Hornøya respectively being the lowest ever recorded. The absolute lowest was at Sør-Gjeslingan with 54.7%. Much lower rates than normal were also registered on Spitsbergen, while there was no change on Bjørnøya since the previous season. These low survival rates are extra dramatic in a species that is already rapidly declining in this part of the world, and it is essential that we find the cause(s).

There were no evident changes in survival rates of puffins at Røst and Hjelmsøya, while they dropped at Hornøya and Anda in relation to the previous season. The rate at Anda (78.7%) was the second lowest since monitoring started in 2006), while at Hornøya only 63.1% survived between 2013 and 2014, the lowest ever recorded since 1990.

Common guillemots maintained a stable survival rate at Sklinna and Hornøya, but a steep drop to only 42.7% was recorded at Hjelmsøya. The latter may be a result of disturbance by mink. Common guillemot survival rates also dropped at Jan Mayen. There were no changes in survival rates of Brünnich's guillemots at Diabasodden in Spitsbergen, but declines were registered at Ossian Sarsfjellet and at Jan Mayen, and a slight increase at Bjørnøya. Little auk survival also dropped on Spitsbergen, especially in the colony at Feiringfjellet.

Happily, shag survival rates increased at Sklinna, Røst and Hornøya. Among the gulls, however, the results varied considerably. There was little or no change among herring gulls and lesser black-backed gulls in Mandal, among herring and great black-backed gulls at Hornøya and among LBBs in

Sør-Helgeland compared to the previous season. It increased among herring gulls and LBBs at Rauna, and among the former at Lyngøy, Hordaland but decreased among LBBs at Lyngøy. For glaucous gulls, survival decreased on both Spitsbergen and Bjørnøya, as it also did among great skuas on Bjørnøya.

At Sklinna, the survival rate of black guillemots increased slightly compared to 2012-2013, while it decreased at Røst. Razorbill survival is monitored at Hornøya only, and here there was a large decline in relation to the previous season. Eider survival is also monitored in one colony only, on Grindøya near Tromsø, but with >30 years of data this is the longest data series on adult survival of any Norwegian seabird. Here there was an increase compared to 2012-2013.

Yearly changes in adult survival rates reflect the environmental conditions that the birds experience over the year. Such conditions change greatly from year to year, and changes in survival rates are good proxies of these conditions. Return rates of marked individuals can also influence estimates of survival rates. Any emigration of adult individuals from a colony may thus result in a lower estimate of adult survival rate. This may be an explanation for the recent extreme low value for kittiwakes at Sør-Gjeslingan, from where many birds have probably moved to Rørvik as a result of high predation pressure at Sør-Gjeslingan.



Colour-ringed common guillemots on breeding ledges at Hornøya. The adult survival rate for this species differed greatly among the four key sites where this parameter is monitored. © Rob Barrett

APPENDIX – Key parameters from all key-sites in 2015

Key to Tables A1-A13

Key population parameters (SE, n) of seabirds breeding on the key-sites indicated above each table. The start year of most data series are listed in Table 3.1.1 of Anker-Nilssen et al. (2008). Population change (expressed as percentage) is the numeric change in size of the breeding population registered between 2014 and 2015 on the basis of plot counts (p) or total censuses (t). In all cases the listed survival estimate was derived from the basic CJS model(s) that fitted the data set best (i.e. the one with the lowest AICc or QAICc value). If the analysis indicated survival varied between years the given estimate applies for the last estimable time step only (yrs=1), whereas it applies for the whole monitoring period indicated (yrs>1) if the analysis indicated a constant survival.

Ref.: Anker-Nilssen, T. (ed.), Barrett, R.T., Bustnes, J.O., Christensen-Dalsgaard, S., Erikstad, K.E., Fauchald, P., Lorentsen, S.-H., Steen, H., Strøm, H., Systad, G.H. & Tveraa, T. (2008) SEAPOP studies in the Barents and Norwegian Seas in 2007. **NINA Report 363**, 92 pp.

Table A1 Key population parameters (SE, n) of seabirds on **Spitsbergen** in 2015.

Species	Colony	Population change %	Annual adult survival		Reproductive performance	
			Period (yrs)	Estimate %	Sampling unit	Estimate%
Fulmar	Nøisdalen	- 25 ^p		No data		No data
Glaucous gull	Kongsfjorden	+ 7 ^p	2013-14 (1)	79.4 (8.9, 75)	Hatching success	84.3 (n=51)
Kittiwake	Ossian Sars	- 11 ^p		No data		No data
	Grumantbyen	No data	2013-14 (1)	69.0 (5.1, 178)	Chicks >15d/nest ¹	45.1 (n=51)
	Fuglehuken	+ 9 ^p		No data		No data
Brünnich's guillemot	Ossian Sars	+ 16 ^p	2013-14 (1)	81.1 (5.6, 212)	Chicks >15d/egg	79.6 (n=54)
	Diabasodden	+ 8 ^t	2005-15 (10)	91.1 (1.3, 434)	Chicks >15d/egg	60.9 (n=64)
Little auk	Fuglehuken	+ 11 ^p		No data		No data
	Bjørndalen	No data	2013-14 (1)	85.3 (4.5, 551)	Chicks >15d/egg	70.8 (n=24)
	Feiringfjellet	No data	2013-14 (1)	58.6 (6.8, 709)		No data

1) Nests with at least 1 chick surviving to 15 days of age.

Table A2 Key population parameters (SE, n) of seabirds on **Bjørnøya** in 2015.

Species	Population change %	Annual adult survival		Reproductive performance	
		Period (yrs)	Estimate %	Sampling unit	Estimate
Fulmar	+ 196 ^p		No data		
Gannet	+ 127 ^{p1}		No data	Large chicks/nets	0.58 (0.12, 17)
Great skua	+ 35 ^p	2005-2015 (10)	94.5 (0.8, 229)	Large chicks/nest	1.08 (0.22, 34)
Glaucous gull	0 ^p	2009-2015 (6)	72.4 (3.2, 113)	Large chicks/nest	1.22 (0.09, 27)
Kittiwake	- 1 ^p	2005-2015 (10)	87.0 (1.0, 345)	Large chicks/nest	0.49 (0.02, 747)
Common guillemot	- 9 ^p	Results not yet available		Fledging success ²	0.59 (0.05, 111)
Brünnich's guillemot	- 3 ^p	2013-2014 (1)	95.5 (4.4, 342)	Fledging success ²	0.46 (0.07, 55)
Little auk	^{p3}	2013-2014 (1)	85.1 (3.0, 849)	Fledging success	0.88 (0.05, 51)

1) At least 62 individuals recorded, 25 nests built; 2) Measured at the age of 20 days; 3) Pilot project data under analysis.

Table A3 Key population parameters (SE, n) of seabirds on *Hornøya* in 2015.

Species	Population change %	Annual adult survival		Reproductive performance	
		Period (yrs)	Estimate %	Sampling unit	Estimate
Shag	+ 9 ^p	2004-2015 (11)	85.6 (1.6, 249)	<i>No data</i>	
Herring gull	+ 2 ^p	2006-2015 (9)	83.9 (2.7, 104)	Clutch size	2.91 (0.05, 32)
				Fledging success ¹	0.70 (0.05, 74)
Great black-backed gull	- 20 ^p	2001-2015 (14)	81.5 (1.5, 212)	Clutch size	2.62 (0.12, 29)
				Fledging success ¹	0.75 (0.06, 53)
Kittiwake	- 7 ^p	2013-2014 (1)	64.6 (4.0, 1360)	Clutch size	2.04 (0.08, 27)
				Large chicks/nest ¹	0.10 (0.03, 57)
Common guillemot	- 7 ^p	1988-2015 (27)	96.2 (0.4, 234)	Fledging success ¹	0.55 (0.09, 29)
Razorbill	<i>No data</i>	2013-2014 (1)	76.8 (4.6, 280)	Fledging success ¹	0.42 (0.09, 31)
Puffin	- 39 ^p	2013-2014 (1)	63.1 (6.7, 829)	Fledging success ¹	0.22 (0.09, 22)

1) Medium-sized chicks/egg laid.

Table A4 Key population parameters (SE, n) of seabirds on *Hjelmsøya* in 2015.

Species	Population change %	Annual adult survival		Reproductive performance	
		Period (yrs)	Estimate %	Sampling unit	Estimate
Great cormorant	- 37 ^t	<i>No data</i>		<i>No data</i>	
Shag	0 ^p	<i>No data</i>		Clutch size ¹	1.86 (0.07, 154)
				Clutch size ²	2.42 (0.07, 118)
Gannet	- 2 ^t	<i>No data</i>		<i>No data</i>	
Common eider	^{t3}	<i>No data</i>		<i>No data</i>	
Great skua	+ 11 ^t	<i>No data</i>		Clutch size	1.73 (0.19, 11)
				Large chicks/nest	1.40 (0.16, 10)
Arctic skua	- 69 ^t	<i>No data</i>		<i>No data</i>	
Common gull	- 1 ^t	<i>No data</i>		Clutch size ¹	1.96 (0.24, 28)
Herring gull	^{p3}	<i>No data</i>		Clutch size ¹	2.12 (0.16, 33)
				Large chicks/nest ¹	0.15 (0.08, 40)
Great black-backed gull	^{p3}	<i>No data</i>		Clutch size ¹	2.31 (0.16, 26)
				Large chicks/nest ¹	0.12 (0.11, 17)
Kittiwake	- 14 ^p	2013-2014 (1)	70.6 (5.7, 315)	Clutch size ¹	0.91 (0.09, 80)
				Clutch size ²	1.52 (0.07, 48)
				Large chicks/nest	0.01 (0.01, 229)
Common guillemot					
Open ledges (inds.)	- 31 ^p	<i>No data</i>		Fledging success ⁴	0.00
Crevices not predated (eggs)	+ 10 ^p	2013-2014 (1)	42.7 (6.8, 143)	Fledging success ⁵	0.46 (n=37)
Crevices predated (eggs)				Fledging success ⁵	0.18 (n=56)
Brünnich's guillemot	- 89 ^p	<i>No data</i>		Fledging success ⁴	0.00
Razorbill					
Open ledges (inds.)	- 4 ^p	<i>Too small sample</i>		<i>No data</i>	
Crevices not predated (eggs)	+ 8 ^p			Fledging success ⁵	0.58 (n=26)
Crevices predated (eggs)				Fledging success ⁵	0.00 (n=18)
Puffin					
Gjesværstappan	- 21 ^{p6}	<i>No data</i>		Fledging success ⁵	0.09 (n=117)
Hjelmsøya	- 3 ^{p7}	2007-2015 (1)	90.3 (2.5, 156)	Fledging success ⁵	0.34 (n=29)

1) Including empty nests; 2) Excluding empty nests; 3) Results not yet available; 4) No eggs produced, or eggs predated immediately after laying; 5) Medium-sized chicks/egg laid. 6) 250 plots; 7) 25 plots.

Table A5 Key population parameters (SE, n) of seabirds on **Jan Mayen** in 2015.

Species	Population change %	Annual adult survival		Reproductive performance	
		Period (yrs)	Estimate %	Sampling unit	Estimate
Fulmar	- 7 ^p	<i>No data</i>		Chicks/nest ¹	0.75 (0.05, 73)
Common guillemot	- 9 ^p	2011-15 (4)	87.4 (3.7, 64)	Breeding success ²	0.85 (0.08, 20)
Brünnich's guillemot	1 ^p	2013-14 (1)	75.6 (5.0, 117)	Breeding success ²	0.50 (0.06, 60)
Great skua	0 ^p	<i>No data</i>		Large chicks/nest ³	0.77 (0.11, 31)
Glaucous gull	12 ^p	<i>No data</i>		Large chicks/nest ³	0.71 (0.18, 28)
Great black-backed gull	0 ^p	<i>No data</i>		Large chicks/nest ³	0.00 (n=2)
Lesser black-backed gull	0 ^p	<i>No data</i>		<i>No data</i>	

1) Recorded early in the chick-rearing period when most chicks were still small/medium sized. Due to late start of fieldwork, the number of initially active nests was probably underestimated, hence reproductive performance is probably overestimated; **2)** Number of chicks ≥ 15 days old divided by number of breeding pairs; **3)** Number of chicks large enough for ringing divided by number of active nests.

Table A6 Key population parameters (SE, n) of common eider on **Grindøya** in 2015.

Species	Population change %	Annual adult survival		Reproductive performance	
		Period (yrs)	Estimate %	Sampling unit	Estimate
Common eider	- 2 ^{t1} + 59 ^{t2}	2013-2014 (1)	65.6 (18.5, 1389)	Clutch size	4.57 (0.11, 82)

1) No. of males in a larger breeding area; **2)** Nest counts.

Table A7 Key population parameters (SE, n) of seabirds on **Anda** in 2015.

Species	Population change %	Annual adult survival		Reproductive performance	
		Period (yrs)	Estimate %	Sampling unit	Estimate
Shag	- 10 ^t			Clutch size ¹	1.50 (0.31, 16)
				Clutch size ²	2.40 (0.16, 10)
Herring gull	+ 27 ^t			Clutch size ³	1.11 (0.17, 47)
				Clutch size ⁴	2.08 (0.13, 25)
Kittiwake	+ 1 ^p	2013-14 (1)	75.4 (3.9, 330)	Clutch size/pair ⁵	1.62 (0.17, 47)
				Large chicks/nest	0.59 (0.17, 47)
Puffin	+ 15 ^p	2013-14 (1)	78.7 (4.6, 366)	Hatching success	0.79 (0.05, 46)
				Chicks $\geq 20d$ / nest	0.72 (0.06, 42)
				Chicks $\geq 30d$ / nest	0.71 (0.06, 41)
Black guillemot	+ 2 ^t				

1) Including empty nests, counted on 24 June; **2)** Excluding empty nests, counted on 24 June; **3)** Including empty nests, counted on 21 June; **4)** Excluding empty nests, counted on 21 June; **5)** Excluding empty nests, counted on 17 June.

Table A8 Key population parameters (SE, n) of seabirds on **Røst** in 2015.

Species	Population change %	Annual adult survival		Reproductive performance	
		Period (yrs)	Estimate %	Sampling unit	Estimate
Fulmar	+ 9 ^p				
Cormorant	+ 27 ^t			Clutch size ^{1,2}	2.89 (0.14, 36)
				Large chicks/nest ²	1.78 (n=49)
Shag	- 24 ^p	2013-14 (1)	82.9 (4.9, 498)	Clutch size ^{4,5}	2.31 (0.04, 301)
				Clutch size ^{1,5}	2.07 (0.05, 351)
				Large chicks/nest ⁴	0.41 (0.17, 17)
Common eider	+ 44 ^p			Clutch size	3.99 (0.09, 121)
Great skua	+ 33 ^{t6}			Breeding success	1.25 (0.31, 8)
Common gull	- 12 ^p			Clutch size ⁴	2.63 (0.09, 81)
				Large chicks/nest ⁴	0.49 (n=81)
Lesser black-backed gull	+ 18 ^p			Clutch size ⁴	2.77 (0.06, 60)
				Large chicks/nest ⁴	0.76 (n=58)
Herring gull	- 9 ^p			Clutch size ⁴	2.45 (0.06, 137)
				Large chicks/nest ⁴	1.08 (n=118)
Great black-backed gull	+ 21 ^p			Clutch size ⁴	2.33 (0.06, 177)
				Large chicks/nest ⁴	1.51 (n=151)
Kittiwake	<i>Vedøy</i> - 22 ^{p7}			Large chicks/nest ⁷	0.12 (0.04, 92)
	<i>Gjelfruvær</i> ⁹ - 7 ^{t8}			Large chicks/nest	0.38 (0.05, 176)
	<i>Kårøy area</i> + 8 ^{t9}	2013-14 (1)	70.5 (6.0, 304)	Clutch size/pair ¹⁰	1.97 (0.10, 32)
				Clutch size/pair ¹¹	1.53 (0.07, 138)
				Large chicks/pair ¹⁰	0.47 (0.10, 32)
				Large chicks/nest ¹²	0.31 (0.02, 726)
Arctic tern				<i>No breeding 2015</i>	
Common guillemot	+ 129 ^{p13}		<i>No data 2015</i>	Breeding success	<i>No data 2015</i>
Razorbill	+ 289 ^{p13}				
Puffin	- 7 ^p	2013-14 (1)	89.3 (3.8, 521)	Hatching success	0.44 (0.06, 61)
				Breeding success	0.00 (0.00, 61)
Black guillemot	<i>Not analysed</i>	1997-15 (18)	83.5 (1.6, 119)	Clutch size	1.87 (0.06, 38)
				Large chicks/clutch	1.25 (0.32, 8)

1) Including empty nests. **2)** Minimum estimate for largest colony on 12 June, when 22 clutches (61%) had hatched but none of the 49 chicks had reached ringing age. **3)** Largest and second largest colony on 11 and 19 July, respectively. **4)** Excluding empty nests. **5)** On 1 July; estimated by linear regression of mean values for counts on six different days between 17 June and 16 July. **6)** Eight breeding pairs in 2015. **7)** Main colony with about 2500 pairs in 2015. **8)** Small cliff-breeding colony 9 km SW of Vedøy with 176 pairs in 2015. **9)** Population of 726 pairs in 2015 breeding on/near buildings in Røst harbour. **10)** On main ledges monitored at regular intervals (plot VIII only). **11)** All nests monitored at regular intervals (plot VIII only). **12)** Based on total counts of entire colony on buildings. **13)** Only very small numbers on open ledges (quasi-extinct colony).

Table A9 Key population parameters (SE, n) of lesser black-backed gull on **Horsvær** in 2015.

Species	Population change %	Annual adult survival		Reproductive performance	
		Period (yrs)	Estimate %	Sampling unit	Estimate
Lesser black-backed gull	- 21	2005-15 (10)	90.5 (1.5, 180)	Clutch size	2.51 (0.05, 141)
				Fledged juv./pair	0.08 (n=11)

Table A10 Key population parameters (SE, n) of seabirds on *Skinna* in 2015.

Species	Population change %	Annual adult survival		Reproductive performance	
		Period (yrs)	Estimate %	Sampling unit	Estimate
Fulmar	0 ^t				
Great cormorant	23 ^t			<i>No data 2015</i>	
Shag	- 15 ^t	2013-14 (1)	83.3 (11.1, 409)	Clutch size ²	1.98 (0.06, 365)
				Hatching success/nest	0.78 (n=50)
				Clutch size hatching	1.66 (0.02, 50)
				Chicks ≥ 10d/nest	2.03 (n=36)
				Chicks ≥ 20d/nest	1.78 (n=27)
				Chicks ≥ 30d/nest	1.89 (n=18)
Common eider	- 17 ^{t3}			Clutch size	3.63 (0.56, n=8)
Common gull				<i>No data 2015</i>	
Herring gull ⁴	- 43 ^p			Clutch size ⁵	1.33 (0.18, 27)
				Clutch size ⁶	1.80 (0.14, 20)
Great black-backed gull	+ 38 ^p			Clutch size ⁷	1.42 (0.19, 26)
				Clutch size ⁸	1.76 (0.15, 21)
Kittiwake	0 ^{t9}				
<i>Skinna</i> <i>Sør-Gjæslingan</i>	- 36 ^{t10}	2013-14 (1)	54.7 (6.5, 285)	Large chicks/nest ¹¹	0.07 (n=176)
Common guillemot	+ 33 ^t	2008-15 (7)	91.3 (1.3, 268)		
Razorbill	+ 65 ^t				
Puffin	- 35 ^p	No estimate yet possible ¹²		Hatching success/nest	1.00 (0.00, 9)
				Chicks ≥ 10d/nest	1.00 (0.00, 9)
				Chicks ≥ 20d/nest	0.78 (0.15, 9)
Black guillemot	+ 23 ^p	2008-15 (7)	89.1 (2.6, 60)		

2) On 5-6 June; **3)** Applies to Hortavær, Leka municipality, which was not counted in 2014. The estimate therefore represents only the average annual change from 2013 to 2015; **4)** Monitoring of adult survival was discontinued in 2010; **5)** On 6 June, including empty nests; **6)** On 6 June, excluding empty nests; **7)** On 5 June, including empty nests; **8)** On 5 June, excluding empty nests; **9)** No kittiwakes have bred on *Skinna* since 2010; **10)** Based on numbers of breeding birds counted from pictures taken in mid-May; **11)** Based on nest count in May and chick count on 12 July; **12)** Colour ringing was initiated in 2007, but re-sighting rate in all later years has been very low because few birds have attended the colony by sitting out in the open.

Table A11 Key population parameters (SE, n) of seabirds on *Runde* in 2015.

Species	Population change %	Annual adult survival		Reproductive performance	
		Period (yrs)	Estimate %	Sampling unit	Estimate
Common eider	- 1 ^t				
Gannet	+ 7 ^{t1}			Large chicks/nest ²	0.88 (n=694)
Shag	0 ^{p3}	No estimate yet possible ⁴		<i>No breeding in 2015</i>	
Great skua	+ 14 ^{t1}			Large chicks/nest	0.50 (n=95)
Kittiwake	0 ^{p3}			<i>No breeding in 2015</i>	
<i>Runde</i> <i>Sildegarnsholmen</i>	+ 7 ^t			Large chicks/nest	0.69 (n=687)
Common guillemot	0 ^{p3}			<i>No breeding on open ledges in 2015</i>	
Puffin	- 5 ^{p1}	2007-15 (8)	87.2 (1.2, 247)	Hatching success/egg	0.78 (n=49)
				Chicks ≥ 20d/egg	0.61 (n=38)
				Chicks ≥ 40d/egg	0.45 (n=38)
				Fledged chicks/egg ⁵	0.39 (n=38)

1) Not counted in 2014. The estimate therefore represents only the average annual change from 2013 to 2015; **2)** Counted in 4 study plots on 6 August; **3)** As in the preceding year, no breeding was recorded in the study plots in 2015; **4)** Colour ringing was initiated in 2008, but sample size is still too low; **5)** Maximum estimate.

Table A12 Key population parameters (SE, n) of seabirds on the different localities in **Hordaland** in 2015.

Species	Population change %	Annual adult survival		Reproductive performance	
		Period (yrs)	Estimate %	Sampling unit	Estimate
Lesser black-backed gull	– 30 ^t	2009-15 (6)	81.8 (4.6, 44)	Clutch size ¹	2.00 (0.14, 79)
				Fledged chicks/nest	0.44 (n=79)
Herring gull	+ 6 ^t	2009-15 (6)	79.8 (5.4, 79)	Clutch size ¹	1.98 (0.05, 365)
				Fledged chicks/nest	0.24 (n=377)

1) Including empty nests.

Table A13 Key population parameters (SE, n) of seabirds on the different sites in **Vest-Agder** in 2015.

Species	Population change %	Annual adult survival		Reproductive performance	
		Period (yrs)	Estimate %	Sampling unit	Estimate
Cormorant	+ 10	No estimate yet available ¹		Clutch size	3.35 (0.07, 264)
				Large chicks/nest	1.25 (n=264)
Common eider	+ 22 ²			Clutch size	3.10 (0.19, 41)
				Chicks on sea ³	0.48 (n=276)
Lesser black-backed gull	– 12	2001-15 (14)	81.7 (1.4, 554) ⁴	Clutch size ⁵	1.96 (0.12, 101)
				Fledged juv./pair	0.69 (n=101)
<i>Slettingene</i>				Clutch size ⁵	1.98 (0.10, 84)
<i>Storøy</i>	– 59			Fledged juv./pair	0.00 (n=84)
<i>Klovholmene</i>	– 76			Clutch size ⁵	1.93 (0.25, 28)
				Fledged juv./pair	0.00 (n=28)
<i>Rauna</i>	+ 2	2014-15 (1)	89.5 (33.0, 1008)	Clutch size ⁵	1.90 (0.21, 30)
				Fledged juv./pair	0.28 (n=2143)
Herring gull	– 24	2001-15 (14)	82.7 (2.0, 313) ⁴	Clutch size ⁵	2.15 (0.13, 59)
				Fledged juv./pair	0.63 (n=88)
<i>Slettingene</i>				Clutch size ⁵	2.38 (0.10, 110)
<i>Storøy</i>	+ 6			Fledged juv./pair	0.26 (n=114)
<i>Klovholmene</i>	– 38			Clutch size ⁵	1.92 (0.34, 12)
				Fledged juv./pair	0.17 (n=23)
<i>Rauna</i>	– 11	2002-15 (13)	79.6 (3.6, 128)	Clutch size ⁵	2.71 (0.19, 17)
				Fledged juv./pair	0.60 (n=250)

1) Colour-ringing of chicks for later monitoring of survival rates was initiated in 2008; **2)** Based on counts of adult males in Farsund municipality; **3)** Based on the total number of males around Rauna 12 May and the number of ducklings observed in June and July; **4)** General estimate for birds from Slettingene, Storøy and Klovholmene; **5)** Including empty nests.

Cover photo:

Adult razorbill (© Tycho Anker-Nilssen)

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