



**JNCC Report
No: 475h**

Isle of May seabird studies in 2012

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Summary

Following a mixed year in 2011 and two successful breeding seasons in 2009 and 2010, another variable year was noted in 2012 for seabirds on the Isle of May NNR. A strong westerly storm in mid-May affected the breeding of many individuals and, although there were some relay attempts, it may have depressed breeding success for some species. Exceptionally high rainfall also affected the breeding of some species, most notably Atlantic puffins.

Of the six study species, black-legged kittiwakes had the most successful season since 1989 while common guillemots and European shags had an above average season. In contrast, northern fulmars had the lowest productivity on record. Atlantic puffins and razorbills had below average seasons with only three and two worse years respectively. Return rates were above average for all species with Atlantic puffin the second highest since 2001. Lesser sandeels *Ammodytes marinus* remained the main food of young Atlantic puffins and European shags, whilst they comprised a greater proportion of the diet of razorbills and kittiwakes than recorded in recent years. Common guillemots fed their young mainly on clupeids.

- Northern fulmar breeding success (0.13 chicks per incubating pair) was the lowest on record.
- European shags had a less successful breeding season (1.18 chicks per pair) than the previous four years, but breeding success was still above the long term average. Return rate was markedly above the long term mean at 93%. The food was varied with sandeels making up 68% by mass of the diet.
- Black-legged kittiwakes had a good season with productivity (0.98 chicks per completed nest) being the highest since 1989 and considerably above the long-term average. Adult return rate (80%) was also above average. The proportion of sandeel in the diet (87% by biomass) was above average while the proportion of clupeid (12% by biomass) was below average.
- Guillemots had an above average breeding season (0.79 chicks leaving per pair). Return rate of adults (91.8%) was similar to the previous two years and above the long term average. Adults fed their chicks mainly on medium-sized sprats (85% by number).
- Razorbill breeding success (0.56 chicks leaving per pair) was an improvement on 2011 but still well below average. Adult return rate (92.9%) was considerably above average. Chick diet was dominated by sandeels (91.5% of loads) with small-sized sprats the only other significant prey item (8.5%).
- Atlantic puffins had a poor season with 0.57 chicks fledging per pair laying. This was markedly below average and largely due to high rainfall flooding burrows. The return rate for adults (89.7%) was high and continued the improvement noted in the previous three years. Chicks were fed mainly sandeels (90.3% by number) with Gadidae, mainly consisting of rockling, also numerous (7.8% by number).

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1 Background

The Joint Nature Conservation Committee (JNCC) has a responsibility to advise on certain aspects of the condition of the natural marine environment. Seabirds are one of the more important components of this environment, and Britain has internationally important populations of several species. JNCC has designed a programme that will allow the numbers and breeding success of selected species of seabirds to be monitored at a range of colonies throughout the UK. In addition, selected colonies have been targeted for more detailed monitoring of reproductive performance and annual survival rates. These selected colonies are geographically spread in order to give as full a coverage as possible of British waters; the Isle of May NNR is the chosen site in eastern Britain.

The Centre for Ecology and Hydrology (CEH, formerly known as ITE) has had a long-term interest in seabirds on the Isle of May. Since 1986, CEH has received NCC-CSD/JNCC support for a more formalised seabird monitoring programme. Long-term studies on numbers, breeding success, adult survival, and chick food are carried out on up to eight species. Due to the long period of immaturity and high annual survival rates of seabirds, it is essential that continuity of these long-term studies is maintained. As part of its Seabird Monitoring Programme, JNCC has a contract with CEH to:

- a) ensure that the breeding success of northern fulmars *Fulmarus glacialis*, European shags *Phalacrocorax aristotelis*, black-legged kittiwakes *Rissa tridactyla*, common guillemots *Uria aalge*, razorbills *Alca torda* and Atlantic puffins *Fratercula arctica* is monitored;
- b) monitor adult survival of black-legged kittiwakes, common guillemots, razorbills and Atlantic puffins. Monitoring of European shag adult survival was also included up to March 1994, was then excluded for the 1994 season, but was reinstated in May 1995;
- c) assess food of young European shags, black-legged kittiwakes, common guillemots, razorbills and Atlantic puffins; and
- d) undertake special studies on species agreed between the nominated officer and the contractor.

Soon after the Seabird Monitoring Programme (SMP) on the Isle of May was initiated, the Danish industrial sandeel fishery started to use the fishing grounds on the Wee Bankie, Marr Bank and Scalp Bank. These lay 30-50km east of the island and are known to be important feeding areas for many seabirds during the breeding season. Considerable concern has been expressed about the potential impact of this fishery on the top predators in the area. In December 1999, EU Fishery Ministers agreed a ban on fishing for sandeels, effective for 2000 and continuing in 2012, in 20,000 square kilometres of sea off eastern Scotland (including the Wee Bankie grounds) and northeast England. The breeding success of kittiwakes and shags, which had declined whilst the fishery was in operation, increased during the period 2000-2003, suggesting that the industrial fishery on the Wee Bankie had adversely affected this species.

However, from 2004, breeding success and adult return rate declined in several species, including kittiwakes, despite the fishing ban still being in operation. The common guillemot was particularly hard hit, with the period 2004-2008 representing the five worst breeding seasons on record. Particularly poor breeding seasons were recorded in several species in 2004, 2007 and 2008. Over the same period, there were changes in

seabird diet with the sudden appearance of snake pipefish *Entelurus aequoreus* the most dramatic. Although numerous, this prey is difficult to digest and of poor nutritional value (Harris *et al* 2007).

Whilst not universal across all species in all years, a marked improvement in breeding success and adult survival has been observed in the last four years. Continued monitoring of the Isle of May seabirds is vital to assess whether the period 2009-2012 is the beginning of a recovery after the setback of the previous few years, or an outlier within a sustained period during which poor environmental conditions override any benefit of fishery closure, and catastrophic years such as 2004, 2007 and 2008 become commonplace.

2 Methods

2.1 Breeding success

The standardised methods used involved minimal disturbance of birds and are described in detail in Walsh *et al* (1995).

Northern fulmar

The positions of apparently incubating birds in ten areas were marked on photographs on 2, 4 and 6 June. At sites where birds appeared to be incubating on three consecutive visits, or where an egg was seen, breeding was assumed to have occurred. These sites were checked again on 5 July to determine those that had hatched eggs. A final check was made on 23 August, when chicks present were assumed to have fledged successfully.

European shag

The positions of nests constructed in eleven areas were marked on photographs and the state and contents of these nests were checked weekly from 14 March until 24 July. Young (medium-sized or larger) that remained on 24 July were assumed to have fledged successfully. Success was estimated both by averaging across the plots and summing over plots.

Black-legged kittiwake

The positions of nests in 15 areas were marked on photographs and the presence or absence of an incubating bird, or the number of young present at each, was noted. Because of the long-term decline in kittiwake numbers on the Isle of May, the extent of the plots at Greengates and Cornerstone were increased in 2005 with new plots also put in place at South Horn and Hide Face and these were continued in 2012. Checks of nests were made on 26 May when regular checks of sample areas showed that most pairs had constructed nests. The first fledged young was seen on 8 July and a complete check of nests was made on 8 July. Further checks of the nests with small chicks on 8 July were made on 13, 17, 22 and 24 July. Chicks alive on 24 July were assumed to have fledged. Successes are given averaged across the plots and summed over the plots.

Common guillemot and razorbill

Daily checks of the state of breeding of numbered nest-sites in five study plots were made from permanent hides.

Atlantic puffin

Samples of 50 burrows where an egg was present were staked in each of four areas on 1 May (by when most pairs had laid). The staked burrows were re-checked on 23, 24 and 25 June at the start of fledging.

2.2 Adult survival rates

Estimates of adult survival rates were based on sightings of individually colour-ringed birds and are therefore, strictly speaking, return rates. The areas in which birds were

originally marked were checked regularly throughout the season and adjacent areas were searched from time to time in an attempt to locate any individuals that had moved. Searches were periodically made of the whole island for birds that had moved out of the study areas. These latter searches are very time-consuming, and superficially unrewarding, but are essential if accurate estimates of survival are to be obtained. Observations on the survival of adult Atlantic puffins were concentrated at Little Hole (where many burrows are individually numbered). As in recent years, the area used for monitoring survival of adult black-legged kittiwakes included East Tarbet, Rona (North Horn Gully), Low Light Gully, Cornerstone and its nearby cliffs. The Little Hole plot no longer has any kittiwakes.

2.3 Food of chicks

Food regurgitated by young European shags, young black-legged kittiwakes and adults of both species feeding young, and loads of fish dropped by adult Atlantic puffins caught in mist-nets were collected. Regurgitates and food loads were weighed, fish identified and, where possible, measured (total length, snout to tip of tail). Fish otoliths were extracted from regurgitates, identified and measured. The weights of the fish from which they came were calculated from otolith length/fish length and fish length/mass regression relationships from fish collected from birds on the island in 2012, otherwise from published relationships. Observations were made of fish brought to young common guillemots and razorbills during two all-day watches, as well as opportunistically on most other days throughout the chick-rearing period. Uneaten fish were collected from breeding ledges to confirm identifications and size assessments of common guillemot diet. Fish sizes for razorbills were broadly assessed against the bird's bill but since it was not possible to collect samples directly from this species, fish were placed into size classes. Thus, biomass estimates are available for shags, kittiwakes, guillemots and puffins only.

3 Results

3.1 Breeding success

Appendix 1 contains species summaries in Table 1 and a comparison with recent years' results is shown in Table 2. Long-term averages presented do not include the current year.

Northern fulmar

Breeding success at 0.13 chicks fledged per incubating pair (Table 1) was the lowest on record. This compared to the long-term average of 0.38 (CI=0.35-0.42).

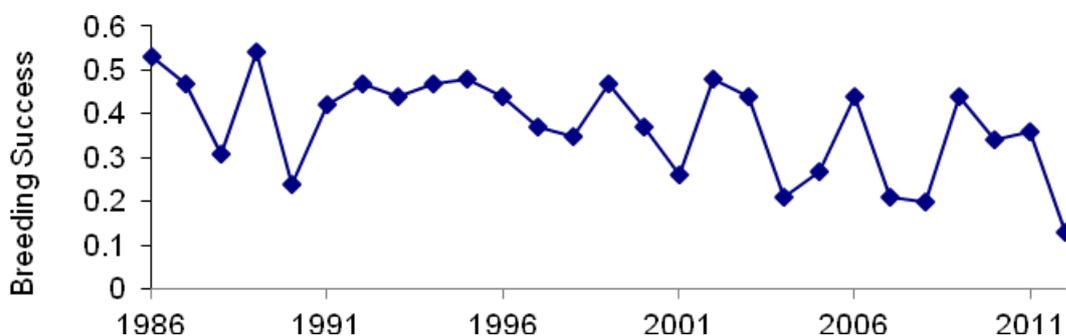


Figure 1. Breeding success (young reared per pair breeding) of northern fulmar on the Isle of May 1986 – 2012.

European shag

A total of 127 chicks were raised to fledging from the 108 nests completed. Productivity at 1.18 chicks per nest built was a drop from those of the previous four highly successful seasons but still above average (Table 1, 1986-2011 average = 1.06; CI=0.85-1.28).

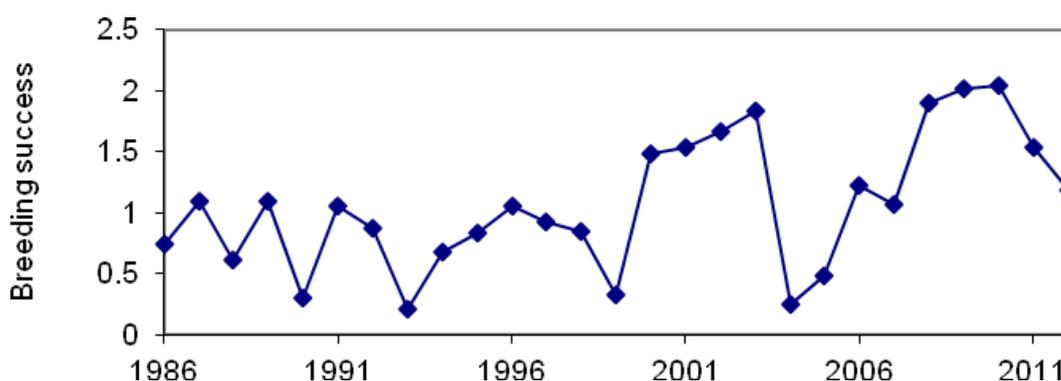


Figure 2. Breeding success (young reared per pair breeding) of European shag on the Isle of May 1986 – 2012.

Black-legged kittiwake

Mean breeding success was 0.97 chicks per completed nest averaged across the plots and 0.98 after pooling plots (Table 1). This value was markedly above the 95% Confidence Interval for the 1986-2011 average (0.54, CI=0.40-0.67) though similar to that

recorded in 2011. As in previous years, breeding success was very variable between plots which may have been down to high predation levels in some areas.

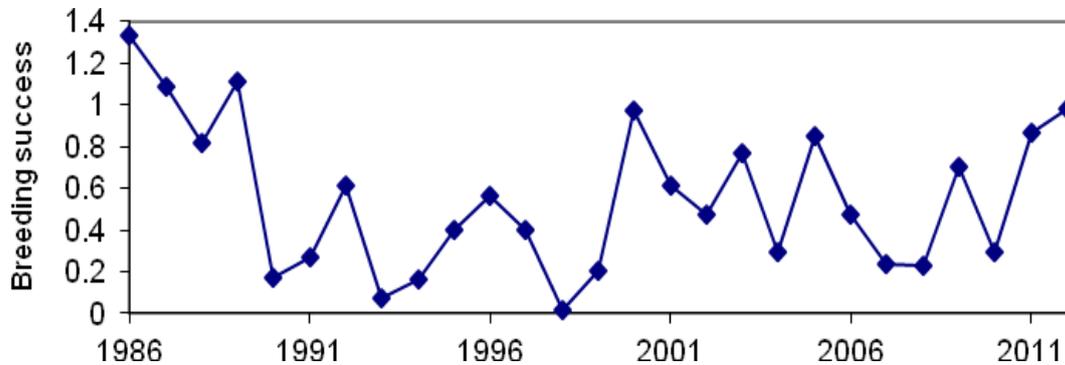


Figure 3. Breeding success (young reared per pair breeding) of black-legged kittiwake on the Isle of May 1986 – 2012.

Common guillemot

Breeding success (0.78 per pair laying for the plot average and 0.79 for the summed total; Table 1) was above average (Table 1, 1986-2011 average = 0.71; CI=0.66-0.76).

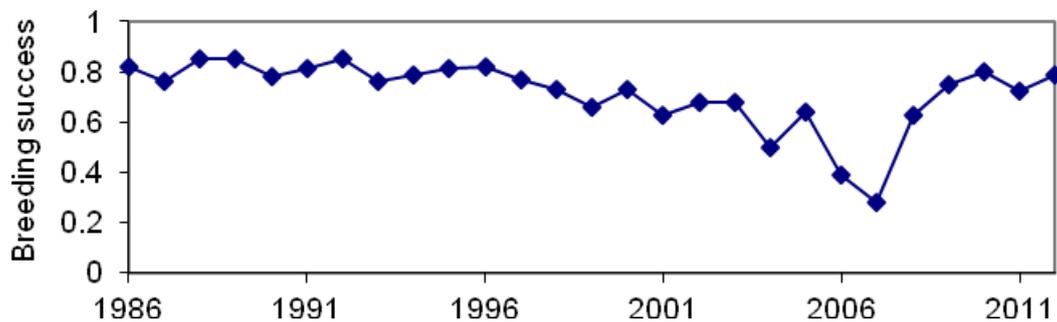


Figure 4. Breeding success (young reared per pair breeding) of common guillemot on the Isle of May 1986 – 2012.

Razorbill

Mean breeding success (0.55 per pair laying for the plot average and 0.56 for the summed total; Table 1) was among the lowest recorded.

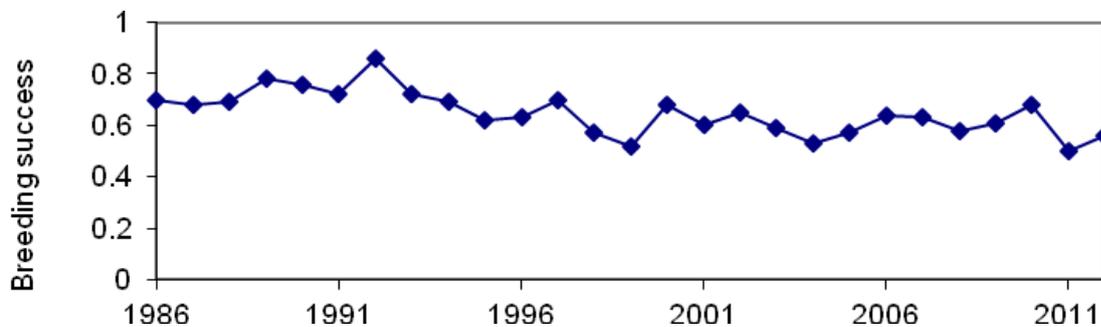


Figure 5. Breeding success (young reared per pair breeding) of razorbill on the Isle of May 1986 – 2012.

Atlantic puffin

The mean breeding success based on chicks alive on 23-25 June was 0.57 chicks per egg laid (Table 1). This low success appeared to be due mainly to the unusually high rainfall throughout the breeding season that resulted in many burrows becoming flooded.

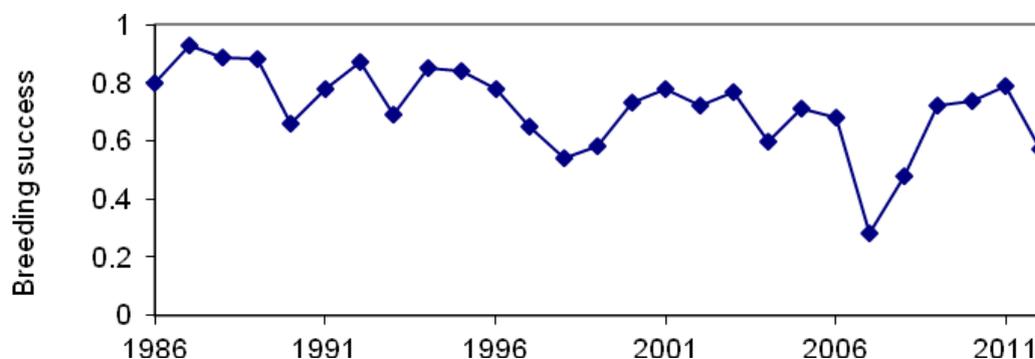


Figure 6. Breeding success (young reared per pair breeding) of Atlantic puffin on the Isle of May 1986 – 2012.

3.2 Adult survival 2011-2012

Not every adult alive is seen each year and thus return rates for 2012 presented here need to be treated as minimum estimates of survival of birds seen in 2011. The results are compared with those of previous years in Table 3 in Appendix 2. During 2012, 30 European shags, 3 black-legged kittiwakes and 43 common guillemots were newly colour-ringed. The long-term averages presented in this section do not include the current year.

European shag

The return rate for 2012 (92.9%) was markedly above the long-term average (79.4%, 95% CI = 71.9-86.8).

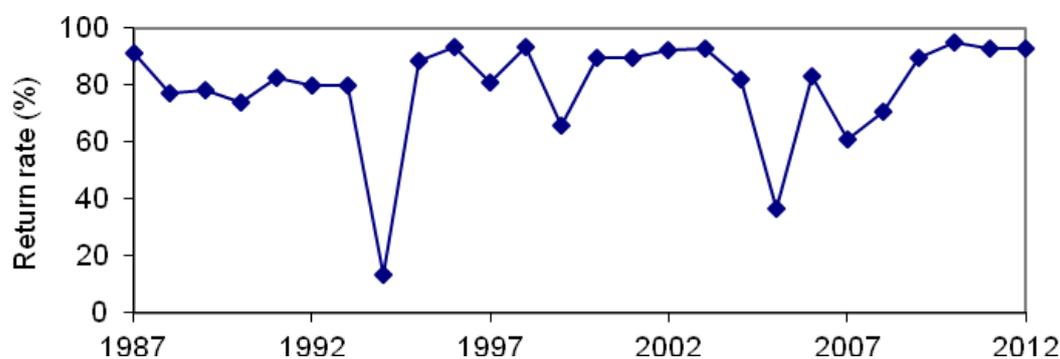


Figure 7. Annual return rates of adult European shag on the Isle of May 1987 – 2012.

Black-legged kittiwake

The return rate of black-legged kittiwakes (80.2%) was above the 1986-2011 average (78.3%, 95% CI =75.2-81.4).

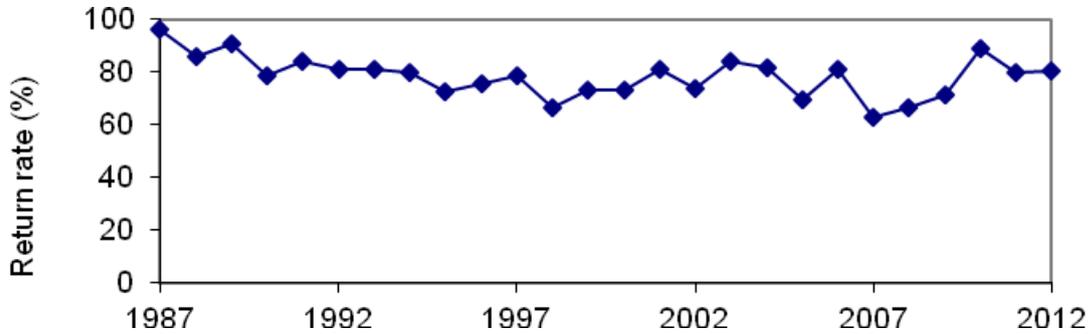


Figure 8. Annual return rates of adult black-legged kittiwake on the Isle of May 1987 – 2012.

Common guillemot

The return rate for common guillemot was 91.8% (169/184), slightly above the 1986-2011 average.

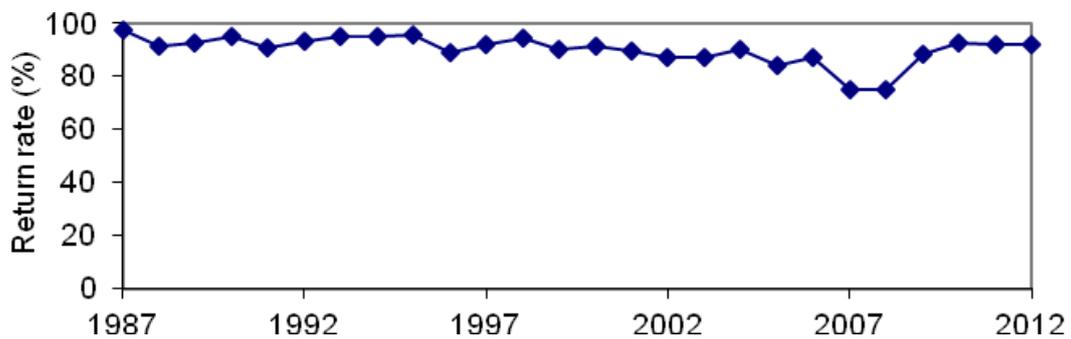


Figure 9. Annual return rates of adult common guillemot on the Isle of May 1987 – 2012.

Razorbill

The return rate of razorbills (39/42 or 92.9%) was lower than the previous three years (95.2 - 97.3%) but higher than normal.

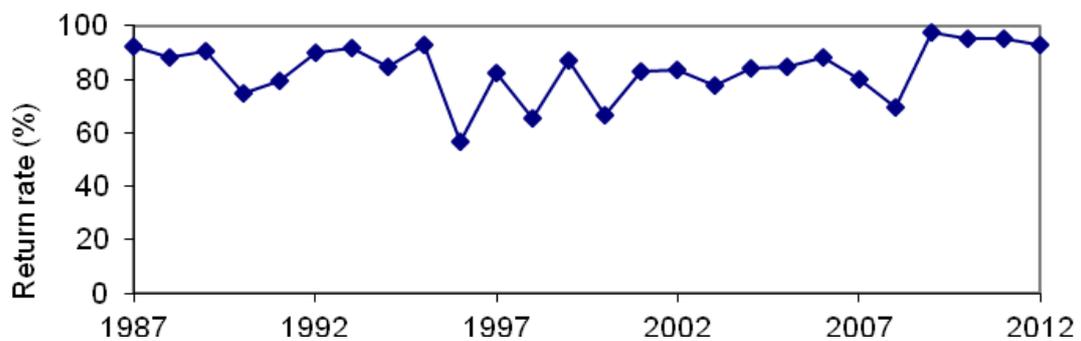


Figure 10. Annual return rates of adult razorbill on the Isle of May 1987 – 2012.

Atlantic puffin

In 2012, the return rate of Atlantic puffins was 89.7% (156/174) and above average continuing the high return rates observed over the previous three seasons.

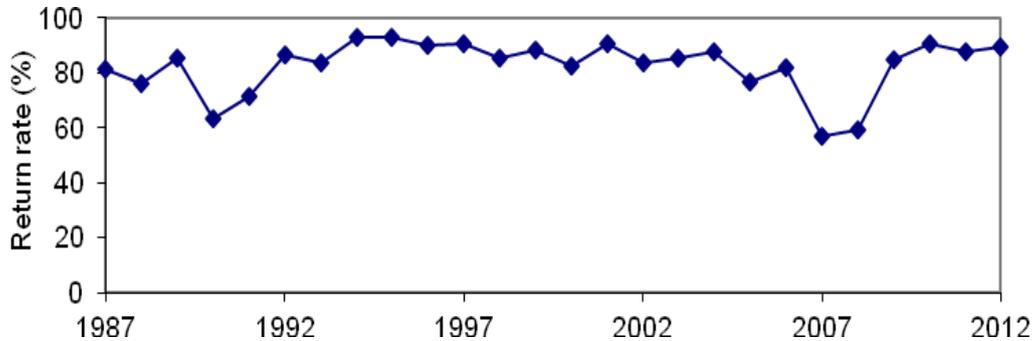


Figure 11. Annual return rates of adult Atlantic puffin on the Isle of May 1987 – 2012.

3.3 Food of young

Species summaries are given in Tables 4-7, and a comparison of sandeel biomass data with recent years' results is given in Table 8 in Appendix 3.

European shag

The most frequent prey (by occurrence in a regurgitate) in the 26 regurgitations was sandeel which occurred in 76.9% of samples (Table 4). Sandeels constituted 68.2% of the biomass, a large fall from the previous two years but still higher than the proportions recorded in 2004-2009. The remains of other items found were dragonet (6 samples), flatfish (5), butterfish (3), wrasse (2), goby (2), eelpout (2) and clupeid (2).

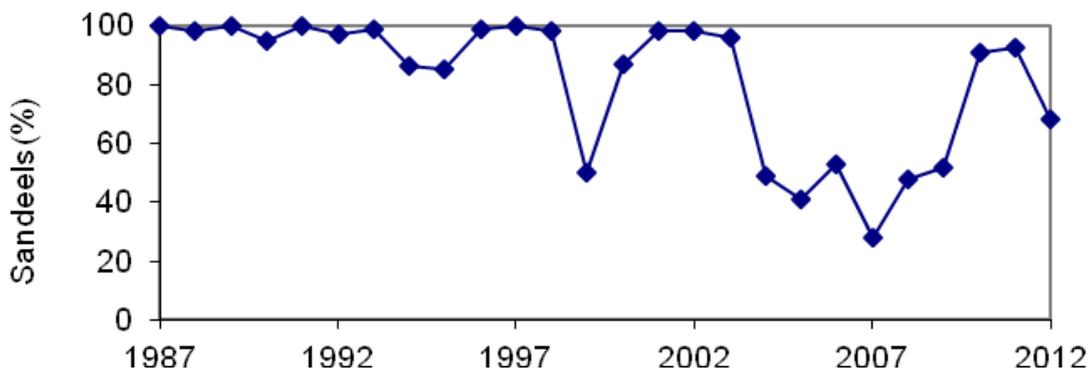


Figure 12. Percentage of sandeels (by weight) in the diet of young European shags on the Isle of May, 1987-2012.

Black-legged kittiwake

All the 59 food samples contained sandeels (Table 4). In terms of biomass, sandeels contributed 86.7% to the diet, which is an increase on the previous two years and above the long term average. Clupeid (mainly sprat *Sprattus sprattus*) contributed 12.3% of the biomass and occurred in 45.8% of regurgitations. Gadids contributed 8% of the biomass of which 5.4% were Rockling, a slight increase on 2011. The remains of other items found were crustacean (2 samples) and mollusc (1).

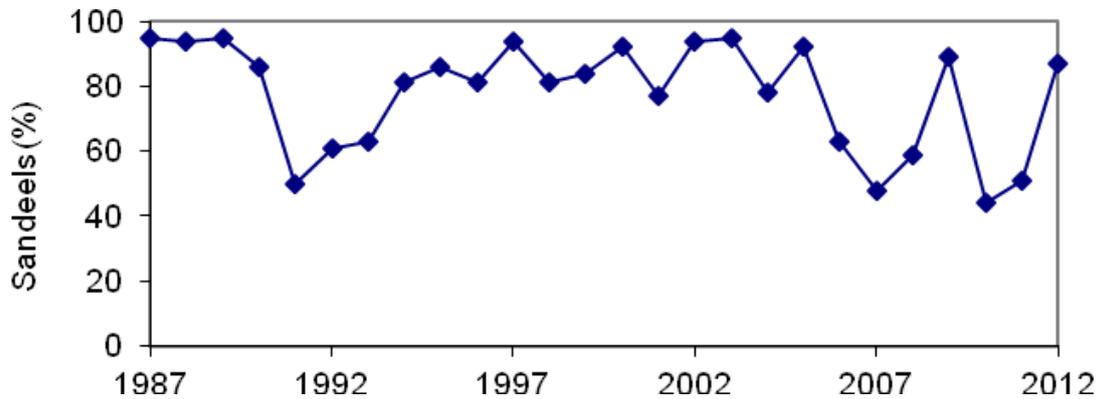


Figure 13. Percentage of sandeels (by weight) in the diet of young black-legged kittiwakes on the Isle of May, 1987-2012.

Common guillemot

Of the 772 food items delivered to chicks, 655 (85.0%) were clupeids (all thought to be sprat) and 102 (13.2%) were sandeels. There were 14 Gadidae (1.8%) and one unidentifiable species. The dominance of clupeids in the diet of guillemots continues a pattern that has been apparent since the last fifteen years.

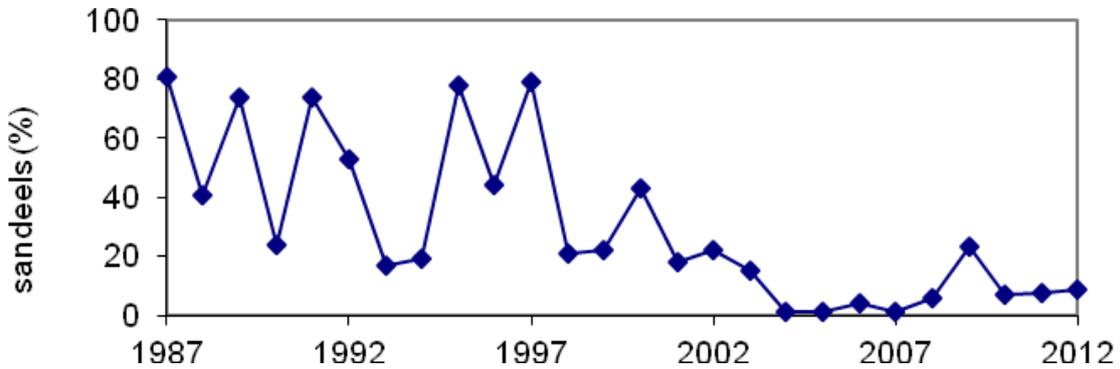


Figure 14. Percentage of sandeels (by weight) in the diet of young common guillemot on the Isle of May, 1987-2012.

Razorbill

Of the 188 loads seen clearly, 172 (91.5%) contained sandeels, 16 (8.5%) small clupeids and one (1%) was of small Gadidae. One load included both sandeels and Clupeidae.

Atlantic puffin

Sandeels predominated in the diet of puffins making up 90.3% of the 2489 fish collected. Clupeids (mainly sprat) made up 1.9% and Gadidae (including small rockling) 7.8% (Table 11).

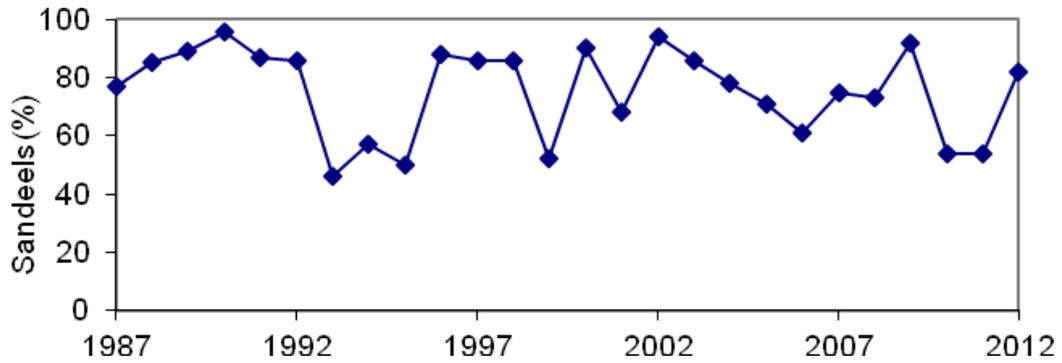


Figure 15. Percentage of sandeels (by weight) in the diet of young Atlantic puffin on the Isle of May, 1987-2012.

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6 Further reading

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7 Appendices

7.1 Appendix 1: Breeding success

Table 1. Breeding success of seabirds on the Isle of May in 2012.

	Plots	Plot average	Total nests	Total success
Northern fulmar	10	0.10 +/- 0.04	157	0.13
European shag	10	0.96 +/- 0.17	108	1.18
Black-legged kittiwake	15	0.97 +/- 0.07	470	0.98
Common guillemot	5	0.78 +/- 0.02	812	0.79
Razorbill	4	0.55 +/- 0.06	195	0.56
Atlantic puffin	4	0.58 +/- 0.06	167	0.57

Table 2. Breeding success (mean number of young reared per breeding pair) of seabirds on the Isle of May, 1999-2012.

Species	2001	2002	2003	2004	2005	2006
Northern fulmar	0.26 (134)	0.48 (131)	0.44 (109)	0.21 (97)	0.27 (135)	0.44 (139)
European shag	1.53 (135)	1.66 (130)	1.83 (156)	0.25 (103)	0.48 (42)	1.22 (81)
Black-legged kittiwake	0.61 (459)	0.47 (477)	0.77 (423)	0.29 (476)	0.85 (675)	0.47 (613)
Common guillemot	0.63 (975)	0.68 (955)	0.68 (1014)	0.50 (984)	0.63 (945)	0.41 (932)
Razorbill	0.60 (167)	0.65 (167)	0.59 (177)	0.54 (190)	0.55 (200)	0.62 (190)
Atlantic puffin	0.78 (185)	0.72 (174)	0.77 (195)	0.60 (196)	0.71 (184)	0.68 (166)
Species	2007	2008	2009	2010	2011	2012
Northern fulmar	0.21 (141)	0.20 (121)	0.44 (147)	0.34 (176)	0.36 (149)	0.13 (157)
European shag	1.07 (57)	1.90 (60)	2.02 (61)	2.04 (77)	1.54 (104)	1.18 (108)
Black-legged kittiwake	0.24 (609)	0.23 (485)	0.70 (491)	0.29 (494)	0.87 (449)	0.98 (470)
Common guillemot	0.28 (850)	0.63 (807)	0.75 (824)	0.80 (846)	0.72 (858)	0.79 (812)
Razorbill	0.63 (188)	0.58 (170)	0.61 (180)	0.68 (177)	0.50 (175)	0.56 (195)
Atlantic puffin	0.29 (158)	0.48 (179)	0.72 (176)	0.74 (169)	0.79 (173)	0.57 (167)

Notes:

The number of pairs followed is given in brackets. Details of the monitoring methods for these species can be found in this and previous reports to JNCC.

7.2 Appendix 2: Annual return rates

Table 3. Annual return rates of adult seabirds on the Isle of May, 1996-2012.

Species	No. seen in 2011	No. seen in 2012	Return rate (%)						
			2011-12	2010-11	2009-10	2008-09	2007-08	2006-07	2005-06
Kittiwake	106	85	80.2	80.0	89.0	71.3	66.4	62.9	80.9
Guillemot	184	169	91.8	92.1	92.4	88.1	75.0	75.2	86.9
Razorbill	42	39	92.9	95.2	95.2	97.3	69.4	80.0	88.2
Puffin	174	156	89.7	87.9	90.9	84.7	59.4	56.9	81.8
Shag	197	183	92.9	92.6	95.0	89.6	70.6	60.8	83.3
		2004-05	2003-04	2002-03	2001-02	2000-01	1999-00	1997-98	1996-97
Kittiwake		69.7	81.8	84.2	73.5	81.2	72.9	66.2	78.7
Guillemot		83.9	90.1	87.0	87.0	89.6	91.6	94.6	91.8
Razorbill		84.6	84.3	77.8	83.8	82.9	66.7	65.5	82.1
Puffin		77.0	87.9	85.2	83.5	90.5	82.8	85.5	90.7
Shag		36.4	82.2	92.7	92.2	89.8	89.4	93.6	91.1

Notes:

Only birds which had definitely bred in 2011 or earlier are included. Directly comparable figures for earlier seasons are given. These have not been corrected for missing birds seen in later years, and for some species may severely under-estimate actual survival rates. These figures should not be used for population dynamics calculations without consultation with S. Wanless.

7.3 Appendix 3: Chick diet

Table 4. Food of young black-legged kittiwakes and European shags on the Isle of May during chick-rearing in 2012.

	Black-legged kittiwake	European shag
No. of regurgitations	59	26
Range of dates	31 May-03 July	27 May-24 July
Total weight (g)	775	1053
% regurgitations with sandeels	100	76.9
with Gadidae	20.3	3.8
with Clupeidae	45.8	7.7
with flatfish	0	19.2
% (by weight) of sandeels in sample	86.7	68.2
% (by number) of sandeels in sample	91.4	85.2
Other remains identified	mollusc (1), crustacea (2).	dragonet (6), polychaete worm (3), butterfish (3), wrasse (2), goby (2), eelpout (2).

Notes:

Samples were collected from chicks or adults during the chick-rearing period.

Counts and lengths of fish were based on otoliths retrieved from the regurgitations.

Table 5. Food of young common guillemots on the Isle of May in 2012.

	Sandeels	Clupeidae	Gadidae
All-day watches			
10 June	22	234	4
17 June	12	52	0
Other records			
28 May-2 July	68	369	10
Total	102	655	14

Table 6. Food of young razorbills on the Isle of May in 2012.

	Sandeels	Clupeidae	Gadidae
All-day watches			
10 June	83	4	1
17 June	67	1	5
Other records			
1 June- 2 July	22	3	1
Total	172	8	7

Notes:

There was also one load of small gadoids, one sandeel load also included one small clupeid and one single clupeid also had a small unidentifiable fish.

Table 7. Food of young Atlantic puffins on the Isle of May, 24 May to 21 July 2012.

Species	Sample size	Mean	s.e
Sandeels <i>Ammodytes sp.</i>	2247	53.6	0.23
Sprat <i>Sprattus sprattus</i>	43	70.1	5.18
Herring <i>Clupea harengus</i>	5	67.8	1.59
Saithe <i>Pollachius virens</i>	5	60.8	12.5
Rockling <i>sp. (Gadidae)</i>	168	28.7	0.34
Whiting <i>Merlangius merlangus</i>	7	54.3	2.86
Cod <i>Gadus morhua</i>	2	57.5	0.5
Unidentified Gadidae	12	41.3	1.53

Table 8: Percentage of sandeels (by weight) in the diet of young seabirds on the Isle of May, 1992-2012.

Species	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001
Shag	97	99	86	85	99	100	98	<50	87	95
Kittiwake	61	63	81	86	81	94	81	84	92	76
Guillemot	53	17	19	78	44	79	21	22	43	18
Puffin	86	46	57	50	88	86	86	52	90	68

Species	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012
Shag	98	96	49	41	53	28	48	52	91	92	68
Kittiwake	94	91	79	92	63	48	59	89	44	51	87
Guillemot	22	15	2	1	4	1	6	23	7	8	9
Puffin	94	86	78	71	61	75	72	92	54	54	82

Notes:

Dates and sample sizes can be found in the contract reports for the respective years.

Sandeels also made up the bulk of the food of young razorbills in all years except 2004, but it is extremely difficult to assess proportions in terms of biomass.