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Isle of May seabird studies in 2011

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Summary

Following two successful breeding seasons in 2009 and 2010, 2011 was a mixed year for seabirds on the Isle of May NNR. A severe westerly storm in late May affected the breeding of many individuals and, although there were some relay attempts, it may have depressed breeding success for some species.

Of the six species studied intensively, Atlantic puffins had the most productive breeding season since 1995, while black-legged kittiwakes had the second most successful season since 1989. European shag had an above average breeding season, while common guillemots had an average season with northern fulmar slightly below average. In contrast razorbills had the lowest productivity on record. Return rates were above average for all species with razorbills having the joint second highest on record and common guillemot the second highest since 1997. Although lesser sandeels (*Ammodytes marinus*) remained the main food of young Atlantic puffins and European shags, common guillemots fed their young mainly on clupeids. Razorbill chick diet was evenly split between sandeels and clupeids. Kittiwake diet was dominated by clupeids; however, these clupeids were small in size so sandeels were the most important prey in terms of total biomass.

- Northern fulmar breeding success (0.36 chicks per incubating pair) was a slight increase on 2010 but still below the long term average.
- European shags had a successful breeding season (1.52 chicks per pair), which was above the long term average but lower than the previous three years. Return rate was well above the long term mean at 93%. The food was very consistent with sandeels making up 92% by mass of the diet.
- Black-legged kittiwakes had a good season with productivity (0.87 chicks per completed nest), the highest since 2000 and well above the long-term average. Adult return rate (80%) was also above average. The proportion of sandeel in the diet (51% by biomass) was below average while the proportion of clupeid (35% by biomass) was the second highest on record.
- Guillemots had an average breeding season (0.71 chicks leaving per pair). Return rate of adults (92.1%) was similar to the previous two years and above the long term average. Adults fed their chicks mainly on medium-sized sprats (92% by number).
- Razorbill breeding success (0.52 chicks leaving per pair) was the lowest on record. Adult return rate (95.2%) equalled the second highest ever recorded on the Isle of May. Chick diet was fairly evenly split between sandeels (52%) and medium-sized sprats (46%).
- Atlantic puffins had a successful season with 0.79 chicks fledging per pair laying. The return rate for adults (87.9%) was high and continued the improvement noted in the previous two years. Chicks were fed mainly sandeels (69% by number) with rockling also numerous (21% 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 lie 30-50 km 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 2011, 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).

A significant improvement in breeding success and adult survival has occurred in most species in the last three years. Continued monitoring of the Isle of May seabirds is vital to assess whether 2009, 2010 and 2011 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, 6 and 12 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 4 July to determine those that had hatched eggs. A final check was made on 22 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 16 March until 3 August. Young (medium-sized or larger) that remained on 22 August 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 2011. Checks of nests were made on 22 May when regular checks of sample areas showed that most pairs had constructed nests. The first fledged young was seen on 2 July and a complete check of nests was made on 3 July. Further checks of the nests with small chicks on 3 July were made on 6, 9, 14 and 21 July and 3 August. Chicks alive on 3 August 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 29 and 30 April (by when most pairs had laid). The staked burrows were re-checked on 27 and 28 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 lengths of the fish from which they came were calculated using regressions derived from the otoliths of fish of known length where possible collected from birds on the island in 2011, otherwise from previously 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 assessed against the bird's bill but were essentially orders of size as it was not possible to collect samples directly from this species.

3 Results

3.1 Breeding success

Appendix 1 contains species summaries are given 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 0.36 chicks fledged per incubating pair (Figure 1) was a slight increase from 2010 (0.34). This compared to the long-term average of 0.39 (CI=0.35-0.43).

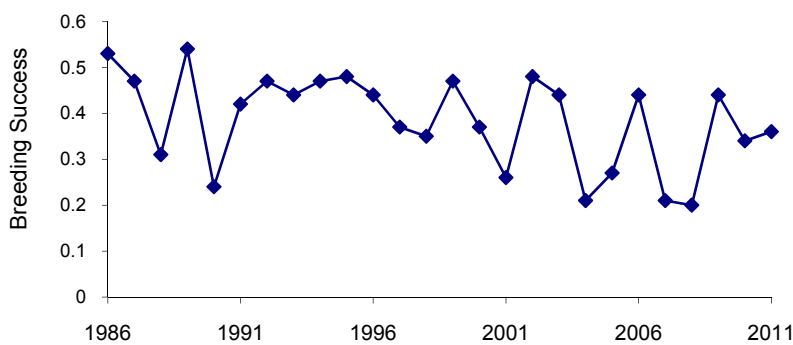


Figure 1. Breeding success (young reared per pair breeding) of Northern fulmar on the Isle of May 1986 – 2011

European shag

A total of 160 chicks were raised to fledging from the 105 nests completed. Productivity at 1.52 chicks per nest built was a drop from the previous three highly successful seasons but still well above average (Figure 2). The 1986-2010 average was 1.05 (CI=0.83-1.26). As with other species several nests were lost in the westerly storm of 23 May.

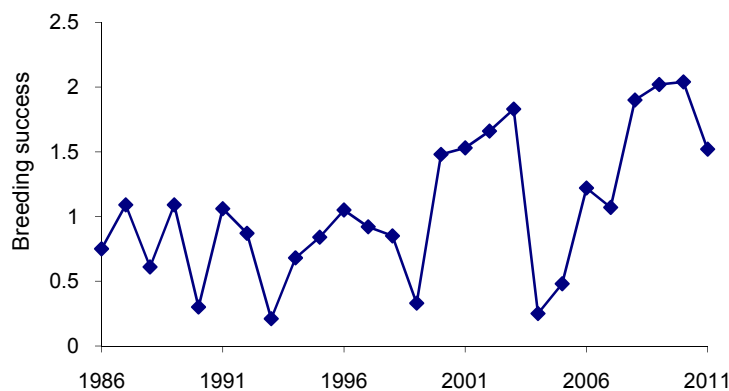


Figure 2. Breeding success (young reared per pair breeding) of European shag on the Isle of May 1986 – 2011

Black-legged kittiwake

Mean breeding success was 0.77 chicks per completed nest, averaged across the plots and 0.87 after pooling areas (Figure 3). This value was well above the 95% Confidence Interval for the 1986-2010 average (0.52, CI=0.39-0.66) and a major increase after the poor season in 2010 (0.29). Breeding success was very variable between plots which may have been down to high predation levels in some areas. Although predation by gulls, particularly herring gulls, has been suspected in past years it has been very noticeable in the previous three years. Although much less apparent than in 2010, lesser black-backed gulls were observed removing chicks from the Rona colony and may have been responsible for sudden losses in other colonies. In addition, a pair of carrion crows which nested within the study areas systematically removed eggs as soon as they were laid along a section of cliffs which included Pilgrim's Haven, South Face and Colony 4 plots. However, some pairs re-laid and successfully reared chicks in these areas. Some nests were lost due to the storm of 23 May.

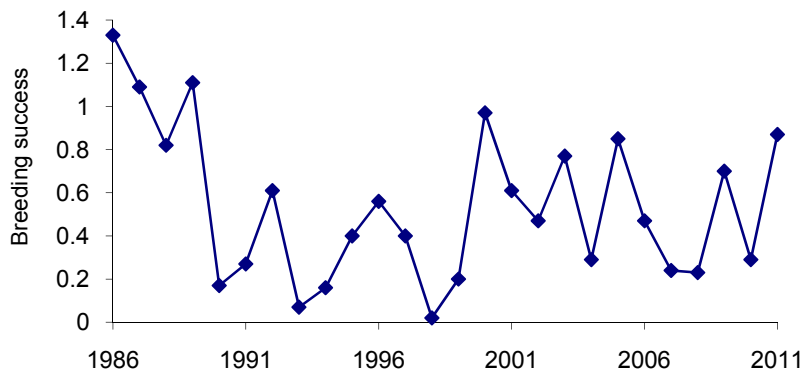


Figure 3. Breeding success (young reared per pair breeding) of black-legged kittiwake on the Isle of May 1986 – 2011

Common guillemot

Breeding success (0.73 per pair laying for the plot average and 0.71 for the summed total) was slightly lower than 2010 (0.77 and 0.80, respectively) (Figure 4). This was due, at least in part, to the severe gale of 23 May when waves lashed the west cliffs on the Isle of May where most guillemots breed.

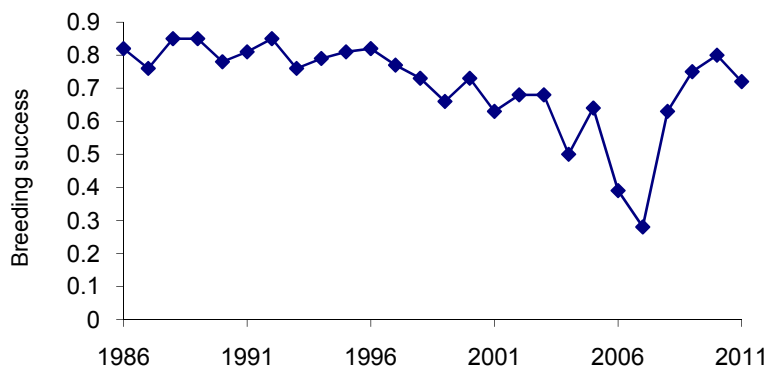


Figure 4. Breeding success (young reared per pair breeding) of common guillemot on the Isle of May 1986 – 2011

Razorbill

Mean breeding success (0.51 per pair laying for the plot average and 0.52 for total pairs laying), was the lowest since observations started in 1982 (Figure 5). This was due at least in part, to the severe gale of 23 May when waves lashed the west cliffs on the Isle of May where the study plots are situated.

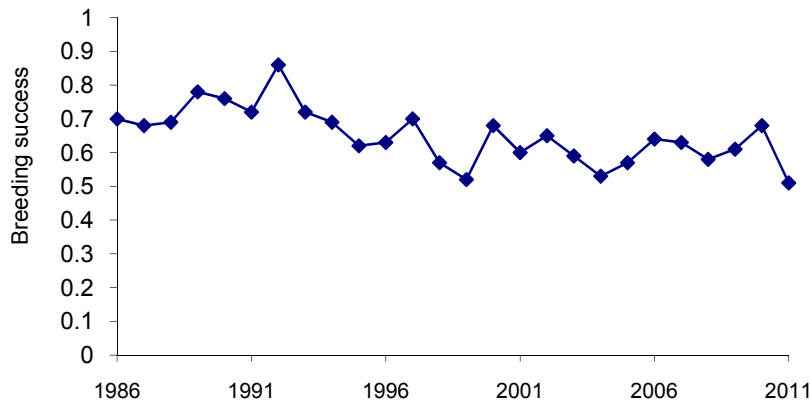


Figure 5. Breeding success (young reared per pair breeding) of razorbill on the Isle of May 1986 – 2011

Atlantic puffin

The mean breeding success based on chicks alive on 27-28 June was 0.79 chicks per egg laid (Figure 6). This continued the improvement in 2010 (0.74).

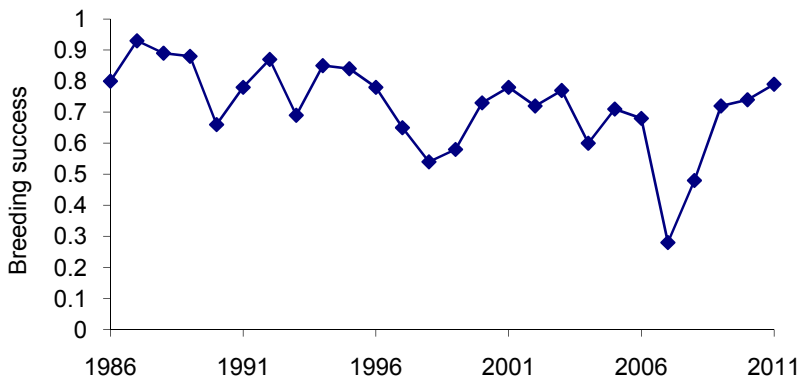


Figure 6. Breeding success (young reared per pair breeding) of Atlantic puffin on the Isle of May 1986 – 2011

3.2 Adult survival 2010-2011

Not every adult alive is seen each year and thus return rates for 2011 presented here need to be treated as minimum estimates of survival of birds seen in 2010. The results are compared with those of previous years in Table 3 in Appendix 2. During 2011, 21 European shags, 19 black-legged kittiwakes, 17 Atlantic puffins and 7 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 2011 (92.6%) was a slight drop on 2010 (95.0%) but still well above the long-term average (78.4%, 95% CI = 71.1-86.5) (Figure 7).

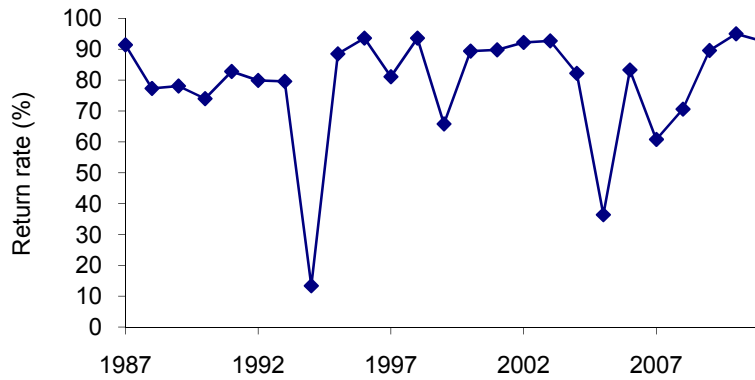


Figure 7. Annual return rates of adult European shag on the Isle of May 1987 – 2011

Black-legged kittiwake

The return rate of black-legged kittiwakes (80.0%) was above the 1986-2010 average (78.2%, 95% CI =75.0-81.5) (Figure 8).

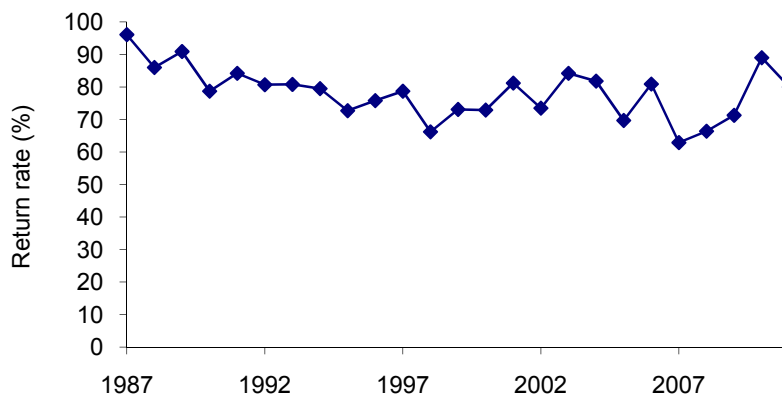


Figure 8. Annual return rates of adult black-legged kittiwake on the Isle of May 1987 – 2011

Common guillemot

The return rate for common guillemot was 92.1% (197/213), which was almost identical to 2010 (92.4%) and a marked contrast to the very low values recorded in 2008 (75.0%) and 2007 (75.2%) and above the value for 2009 (88.7%) (Figure 9).

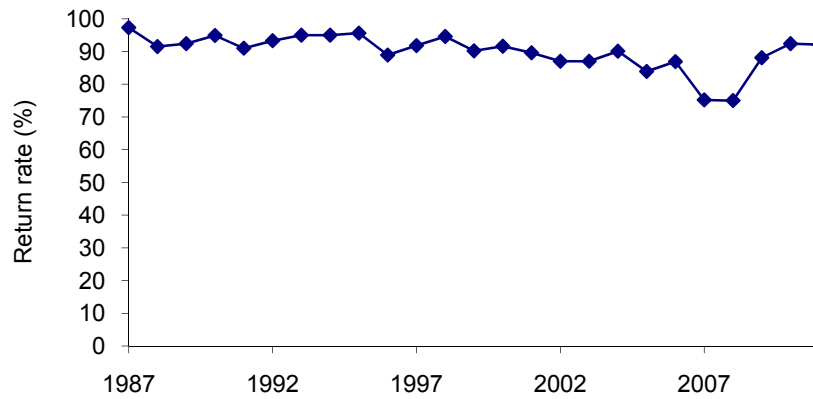


Figure 9. Annual return rates of adult common guillemot on the Isle of May 1987 – 2011

Razorbill

The return rate of razorbills (40/42 or 95.2%) was identical to that in 2010 and these were exceeded only by the return rate of 97.3% recorded in 2009 (Figure 10).

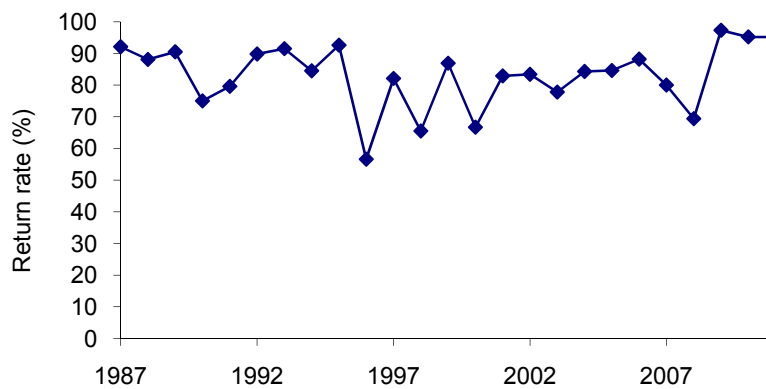


Figure 10. Annual return rates of adult razorbill on the Isle of May 1987 – 2011

Atlantic puffin

In 2011, the return rate of Atlantic puffins was 87.9%. This follows a good return in 2010 (90.9%) and 2009 (84.7%). These are dramatic improvements over the 56.9% and 59.4% in 2007 and 2008, respectively (Figure 11).

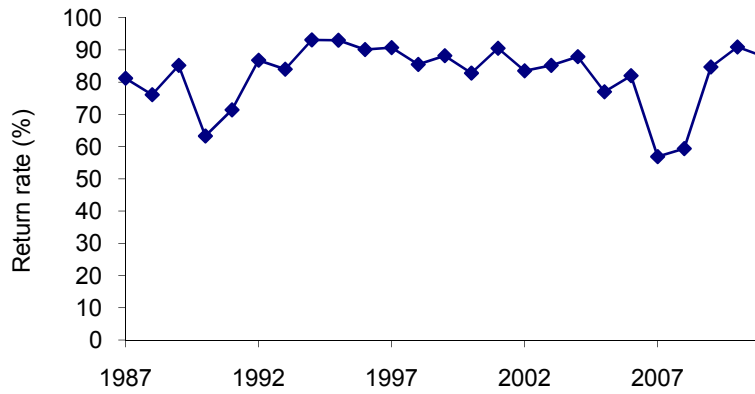


Figure 11. Annual return rates of adult Atlantic puffin on the Isle of May 1987 – 2011

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 47 regurgitations was sandeel which occurred in 97.9% of samples (Table 4). Sandeels constituted 92.4% of the biomass, the highest for eight years. The remains of other items found were mollusc (5 samples), flatfish (4), butterfish (3), wrasse (2), goby (2), dragonet (1), eelpout (1), crustacea (1) and polychaete worm (1).

Black-legged kittiwake

Of the 43 food samples, 79.1% contained sandeels (Table 4). In terms of biomass, sandeels contributed 50.9% to the diet (Figure 12). Although the proportion of sandeels was up on 2010 it is still below the long term average. Clupeid (mainly sprat *Sprattus sprattus*) contributed 35.2% of the biomass and was the second highest on record and occurred in 76.7% of regurgitations. Gadids contributed 9% of the biomass and Rockling 4.3%, the latter having been absent from samples in 2010. The remains of other items found were mollusc (3 samples), crustacean (1) and polychaete worm (1).

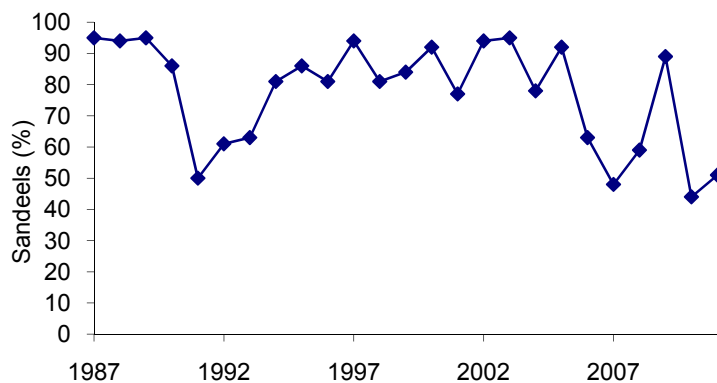


Figure 12. Percentage of sandeels (by weight) in the diet of young black-legged kittiwakes on the Isle of May, 1987-2011

Common guillemot

Of the 668 food items delivered to chicks, 615 (92.1%) were clupeids (all thought to be sprat) and 150 (7.5%) were sandeels (Figure 13). There were two Gadidae and one of an unidentifiable family.

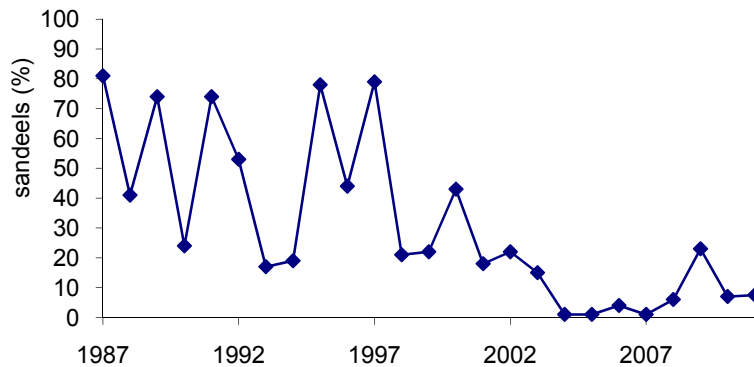


Figure 13. Percentage of sandeels (by weight) in the diet of young common guillemot on the Isle of May, 1987-2011

Razorbill

Of the 46 loads seen clearly, 24 (52.2%) contained sandeels, 21 (45.7%) small clupeids and one (2.2%) was of small rockling. All the clupeids were thought to be sprats.

Atlantic puffin

Sandeels made up 69.2% of the 2505 fish collected from puffins (Figure 14), 21.3% were small rockling and 9.4% were clupeids (Table 7). There was also a single squid. Sandeels represented 54% of the diet by biomass.

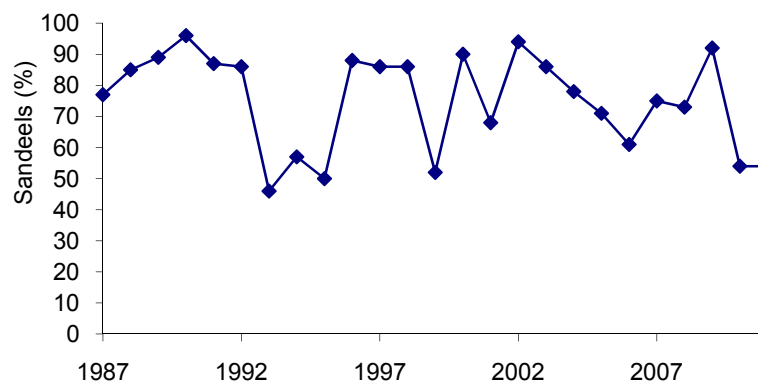


Figure 14. Percentage of sandeels (by weight) in the diet of young Atlantic puffin on the Isle of May, 1987-2011

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Wanless, S. & Harris, M.P. (1989) Kittiwake attendance patterns during chick-rearing on the Isle of May. *Scottish Birds* 15: 156-161.

5 Further reading

The following is a list of papers on Isle of May seabirds published or in press since publication of the 2010 report.

Ashbrook, K., Wanless, S., Heubeck, M., Harris, M.P. & Hamer K.C. Kleptoparasitism in common guillemots at two colonies during a period of poor food availability. *Seabird* 25 (In press)

Barlow, E. J., Daunt, F., Wanless, S., Alvarez, D., Reid, J. M. & Cavers, S. 2011 Weak large-scale population genetic structure in a philopatric seabird, the European shag *Phalacrocorax aristotelis*. *Ibis*, 153 (4). 768-778. 10.1111/j.1474-919X.2011.01159.x

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Diversity & Distributions (In press)

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6 Appendices

Appendix 1: Breeding success

Table 1. Breeding success of seabirds on the Isle of May in 2011

	Plots	Plot average	Total nests	Total success
Common guillemot	5	0.73 +/- 0.02	858	0.71
Razorbill	4	0.51 +/- 0.02	175	0.52
Atlantic Puffin	4	0.82 +/- 0.02	173	0.79
Northern fulmar	10	0.34 +/- 0.08	149	0.36
Black-legged kittiwake	15	0.77 +/- 0.10	449	0.87
European shag	11	1.49 +/- 0.22	105	1.52

Table 2. Breeding success (mean number of young reared per breeding pair) of seabirds on the Isle of May, 1998-2011

<i>Species</i>	1998	1999	2000	2001	2002	2003	2004
Northern fulmar	0.35 (120)	0.47 (115)	0.37 (143)	0.26 (134)	0.48 (131)	0.44 (109)	0.21 (97)
European shag	0.85 (125)	0.33 (58)	1.48 (127)	1.53 (135)	1.66 (130)	1.83 (156)	0.25 (103)
Black-legged kittiwake	0.02 (683)	0.20 (616)	0.97 (545)	0.61 (459)	0.47 (477)	0.77 (423)	0.29 (476)
Common guillemot	0.73 (852)	0.66 (870)	0.73 (942)	0.63 (975)	0.68 (955)	0.68 (1014)	0.50 (984)
Razorbill	0.57 (134)	0.52 (142)	0.68 (149)	0.60 (167)	0.65 (167)	0.59 (177)	0.54 (190)
Atlantic puffin	0.54 (179)	0.58 (181)	0.73 (132)	0.78 (185)	0.72 (174)	0.77 (195)	0.60 (196)
	2005	2006	2007	2008	2009	2010	2011
Northern fulmar	0.27 (135)	0.44 (139)	0.21 (141)	0.20 (121)	0.44 (147)	0.34 (176)	0.36 (149)
European shag	0.48 (42)	1.22 (81)	1.07 (57)	1.90 (60)	2.02 (61)	2.04 (77)	1.52 (105)
Black-legged kittiwake	0.85 (675)	0.47 (613)	0.24 (609)	0.23 (485)	0.70 (491)	0.29 (494)	0.87 (449)
Common guillemot	0.63 (945)	0.41 (932)	0.28 (850)	0.63 (807)	0.75 (824)	0.80 (846)	0.71 (858)
Razorbill	0.55 (200)	0.62 (190)	0.63 (188)	0.58 (170)	0.61 (180)	0.68 (177)	0.52 (175)
Atlantic puffin	0.71 (184)	0.68 (166)	0.29 (158)	0.48 (179)	0.72 (176)	0.74 (169)	0.79 (173)

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.

Appendix 3: Chick diet

Table 4. Food of young black-legged kittiwakes and European shags on the Isle of May during chick-rearing in 2011

	<i>Black-legged kittiwake</i>	<i>European shag</i>
No. of regurgitations	43	47
Range of dates	25 May-15 July	16 May-17 July
Total weight (g)	924	1634
% regurgitations with sandeels	79.1	97.9
with Gadidae	53.5	0.02
with Clupeidae	76.7	0.02
with flatfish	0	0.09
% (by weight) of sandeels in sample	50.9	92.4
% (by number) of sandeels in sample	39.6	91.9
Other remains identified	mollusc (3), crustacea (1), polychaete worm (1)	mollusc (5), flatfish (4), butterfish (3), wrasse (2), goby (2), crustacea (1), dragonet (1), eelpout (1), polychaete worm (1).

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 2011

	<i>Sandeels</i>	<i>Clupeidae</i>	<i>Gadidae</i>
All-day watches			
5 June	49	204	0
13 June	10	79	0
Other records			
25 May - 4 July	91	332	2
Total	150	615	2

Note: There was also a single small unidentified fish.

Table 6. Food of young razorbills on the Isle of May in 2011

	<i>Sandeels</i>	<i>Single Clupeidae</i>	<i>Several Clupeidae</i>
All-day watches			
5 June	3	7	1
13 June	7	11	0
Other records			
1-21 June	14	2	0
Total	24	20	1

Note: There was also one load of small rockling.

Table 7. Food of young Atlantic puffins on the Isle of May, 23 May to 16 July 2011

	<i>No.</i>
Sandeels <i>Ammodytes sp.</i>	1734
Unidentified Clupeid (<i>Clupeidae</i>)	170
Sprat <i>Sprattus sprattus</i>	62
Probable herring <i>Clupea harengus</i>	4
Saithe <i>Pollachius virens</i>	2
Rockling <i>sp.</i> (<i>Gadidae</i>)	533

Note: There was also one small squid.

Table 8. Percentage of sandeels (by weight) in the diet of young seabirds on the Isle of May, 1991-2011

	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000
Shag	100	97	99	86	85	99	100	98	<50	87
Kittiwake	50	61	63	81	86	81	94	81	84	92
Guillemot	74	53	17	19	78	44	79	21	22	43
Puffin	87	86	46	57	50	88	86	86	52	90

	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011
Shag	95	98	96	49	41	53	28	48	52	91	92
Kittiwake	76	94	91	79	92	63	48	59	89	44	51
Guillemot	18	22	15	2	1	4	1	6 23		7	8
Puffin	68	94	86	78	71	61	75	72	92	54	54

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