



**JNCC Report  
No: 475i**

**Isle of May seabird studies in 2013**

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## Summary

Following on from two mixed years, 2013 proved to be another variable breeding season on the Isle of May NNR. Poor weather through much of the winter and early spring delayed the breeding season for most species and reduced the breeding numbers of some species, most notably European shags.

Of the six study species, Northern fulmars had the most successful season since 2002 while European shags had an above average season. In contrast, razorbills had the lowest productivity on record, while black-legged kittiwakes were also well below average. Atlantic puffins and common guillemots had slightly below average seasons. Return rates were above average for Atlantic puffin, common guillemot and black-legged kittiwake, below average for razorbill and the third lowest on record for European shags. Lesser sandeels (*Ammodytes marinus*) remained the main food of young Atlantic puffins while European shags fed mainly on butterfish. Although the diet of razorbills and kittiwakes was dominated by sandeels the proportion was below average. Common guillemots fed their young mainly on clupeids.

- Northern fulmar breeding success (0.47 chicks per incubating pair) was the highest since 2002.
- European shags had an above average breeding season (1.20 chicks per pair) despite the late start and much reduced numbers. Return rate was one of the lowest on record at 43%. Diet was dominated by butterfish (40% by biomass) with sandeels making up only 28% by mass of the diet, the equal lowest on record.
- Black-legged kittiwakes had a poor season with productivity (0.41 chicks per completed nest) being below the long-term average. Adult return rate (81%) was above average. The proportion of sandeel in the diet (65% by biomass) was below average while the proportion of clupeid (29% by biomass) was above average.
- Guillemots had a slightly below average breeding season (0.69 chicks leaving per pair). Return rate of adults (91.3%) was similar to the previous three years and above the long term average. Adults fed their chicks mainly on medium-sized sprats (86% by number).
- Razorbill breeding success (0.48 chicks leaving per pair) was the lowest on record. Adult return rate (76.9%) was considerably below average. Chick diet contained slightly more sandeels (56% of loads) than small-sized sprats (44%).
- Atlantic puffins had a slightly below average season with 0.70 chicks fledging per pair laying. The return rate for adults (85.4%) was above average despite the wreck just prior to the breeding season. Chicks were fed mainly sandeels (76% by number) with Gadidae, mainly consisting of rockling, also numerous (14% 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 still in place in 2013, 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 was observed in the following five years up to 2013. Continued monitoring of the Isle of May seabirds is vital to assess whether the period 2009-2013 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 6, 9, 12 and 16 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 7 July to determine those that had hatched eggs. A final check was made on 19 August, when chicks present were assumed to have fledged successfully.

#### **European shag**

The positions of nests constructed in nine areas were marked on photographs and the state and contents of these nests were checked weekly from 23 April until 6 August. Young (medium-sized or larger) that remained on 6 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 2013. Checks of nests were made on 9 June when regular checks of sample areas showed that most pairs had constructed nests. The first fledged young was seen on 26 July and a complete check of nests was made on this date. Further checks of the nests with small chicks on 26 July were made on 30 July. Chicks alive on 30 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**

Breeding was delayed, presumably the result of the severe wreck of puffins in March. Samples of 50 burrows where an egg was present were staked in each of four areas on 11-14 May by when checks suggested that most pairs had laid. The staked burrows were re-checked on 15-16 July 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 Tabet, Rona (North Horn Gully), Low Light Gully, Cornerstone and its nearby cliffs. The Little Hole plot no longer has any kittiwakes while a new plot was added at Kittiwake Gully where returning birds will be searched for in 2014.

## **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 2013, 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.

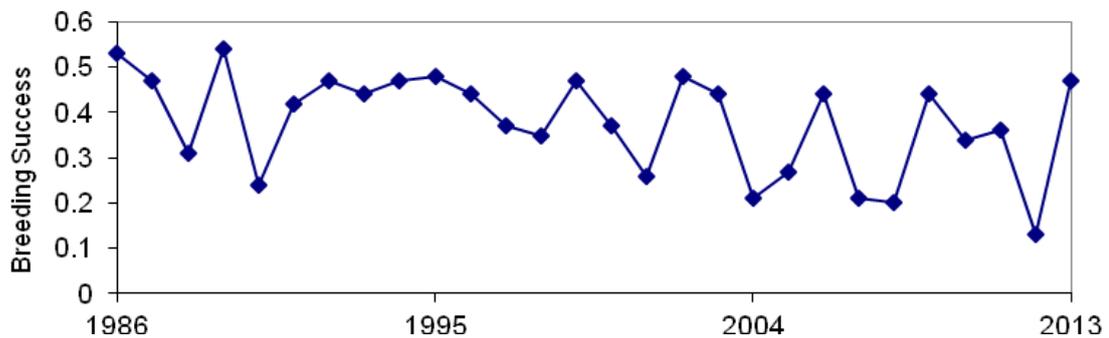
### 3 Results

#### 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

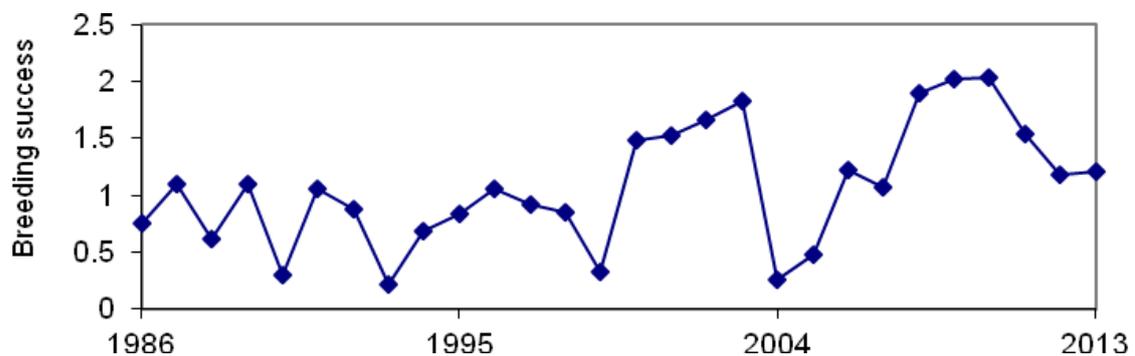
Breeding success at 0.47 chicks fledged per incubating pair (Table 1) was above average. This compared to the long-term average of 0.38 (CI=0.33-0.42).



**Figure 1.** Breeding success (young reared per pair breeding) of northern fulmar on the Isle of May 1986 – 2013.

##### European shag

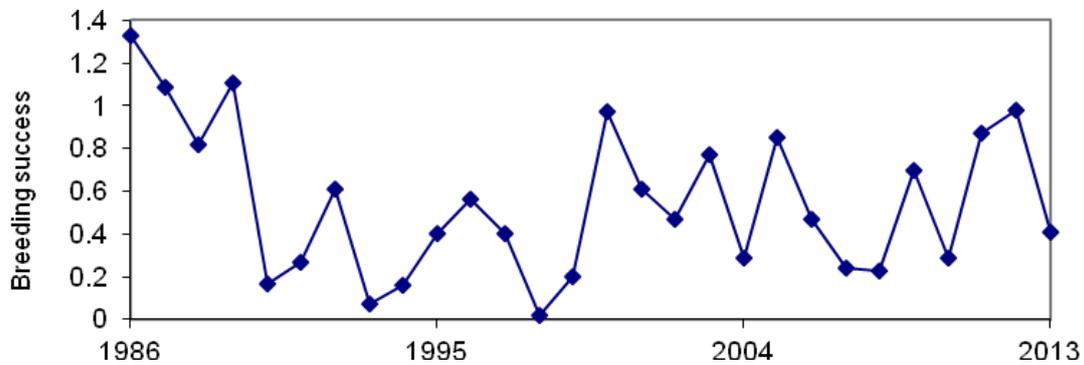
A total of 66 chicks were raised to fledging from the 55 completed nests. The number of completed nests was half of the 2012 total (108) due to poor over winter survival of adults. Productivity at 1.2 chicks per nest built was above average (Table 1, 1986-2012 average = 1.07; CI=0.86-1.27).



**Figure 2.** Breeding success (young reared per pair breeding) of European shag on the Isle of May 1986 – 2013.

### Black-legged kittiwake

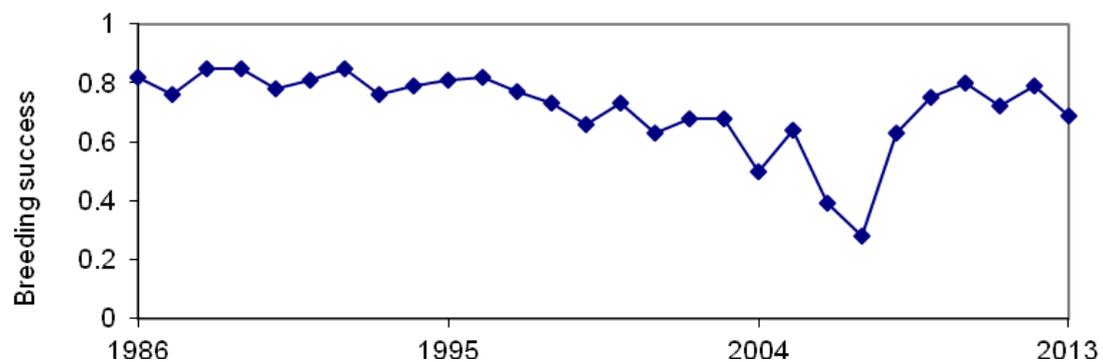
Mean breeding success was 0.38 chicks per completed nest averaged across the plots and 0.41 after pooling plots (Table 1). This value was below the 1986-2012 average (0.55, CI=0.42-0.69). As in previous years, breeding success was very variable between plots which may have been down to high predation levels in some areas.



**Figure 3.** Breeding success (young reared per pair breeding) of black-legged kittiwake on the Isle of May 1986 – 2013.

### Common guillemot

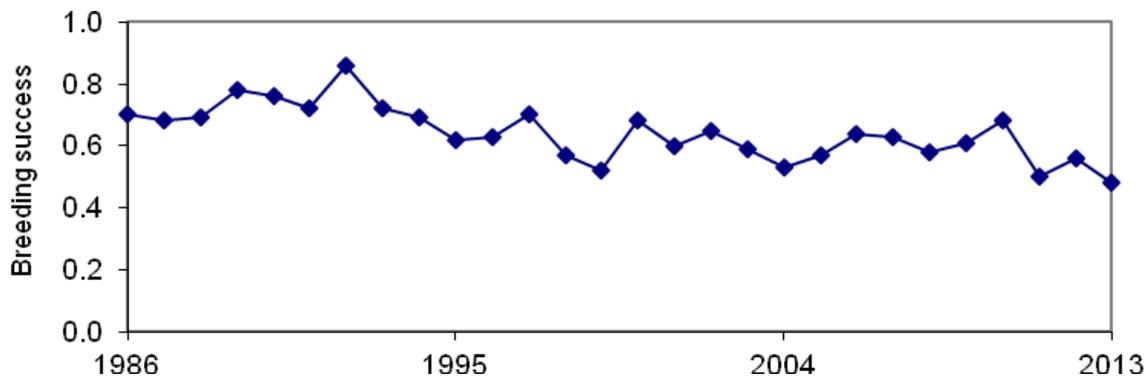
Breeding success (0.67 young leaving per pair laying for the plot average and 0.69 for the summed total; Table 4) was normal.



**Figure 4.** Breeding success (young reared per pair breeding) of common guillemot on the Isle of May 1986 – 2013.

## Razorbill

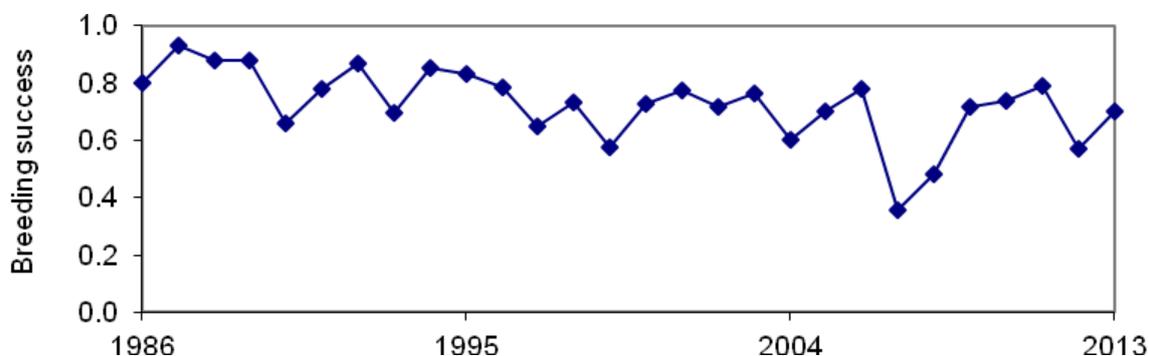
Mean breeding success (0.55 per pair laying for the plot average and 0.48 for the summed total; Table 4), was the lowest recorded in recent years.



**Figure 5.** Breeding success (young reared per pair breeding) of razorbill on the Isle of May 1986 – 2013.

## Atlantic puffin

The mean breeding success based on chicks alive on 15-16 July, 0.70 chicks per egg laid, was normal despite the earlier wreck and delayed laying (Table 4).



**Figure 6.** Breeding success (young reared per pair breeding) of Atlantic puffin on the Isle of May 1986 – 2013.

## 3.2 Adult survival 2012-2013

Not every adult alive is seen each year and thus return rates for 2013 presented here need to be treated as minimum estimates of survival of birds seen in 2012. The results are compared with those of previous years in Table 3 in Appendix 2. During 2013, 23 European shags, 27 black-legged kittiwakes, 15 Atlantic puffins and 12 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 2013 (42.7%) was markedly below the long-term average (79.8%, 95% CI = 72.6-87.1).

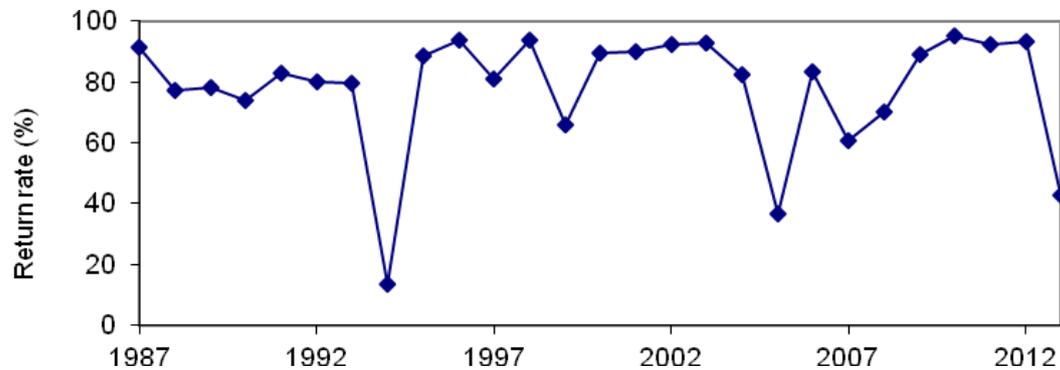


Figure 7. Annual return rates of adult European shag on the Isle of May 1987 – 2013.

### Black-legged kittiwake

The return rate of black-legged kittiwakes (80.6%) was slightly above the 1986-2012 average (78.3%, 95% CI = 75.4-81.4).

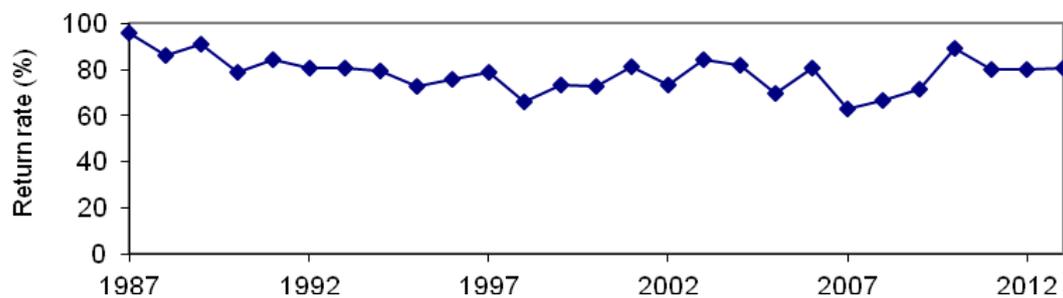


Figure 8. Annual return rates of adult black-legged kittiwake on the Isle of May 1987 – 2013.

### Common guillemot

The return rate for common guillemot at 91.3% (178/195) was normal.

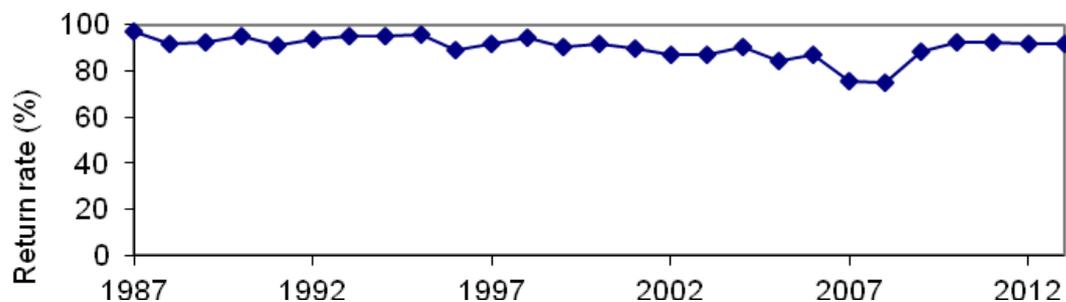


Figure 9. Annual return rates of adult common guillemot on the Isle of May 1987 – 2013.

## Razorbill

The return rate of razorbills (30/39 or 76.9%) was amongst the lowest recorded on the Isle of May.

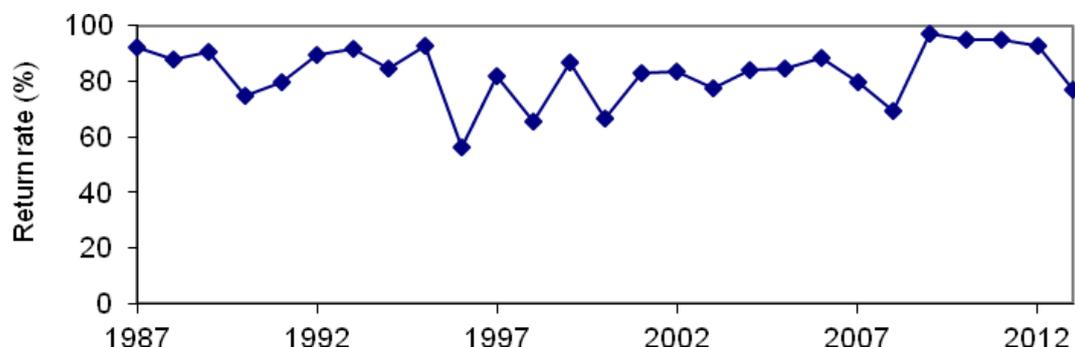


Figure 10. Annual return rates of adult razorbill on the Isle of May 1987 – 2013.

## Atlantic puffin

In 2013, the return rate of Atlantic puffins was 85.4% (146/171). This was higher than anticipated given the wreck of puffins in the area in March and may have been partly due to increased resighting effort.

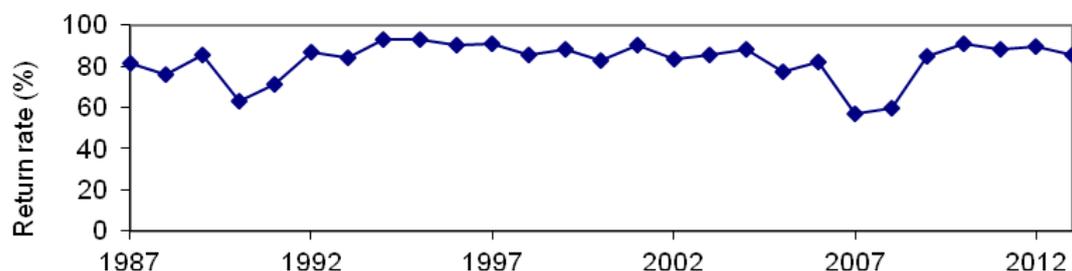


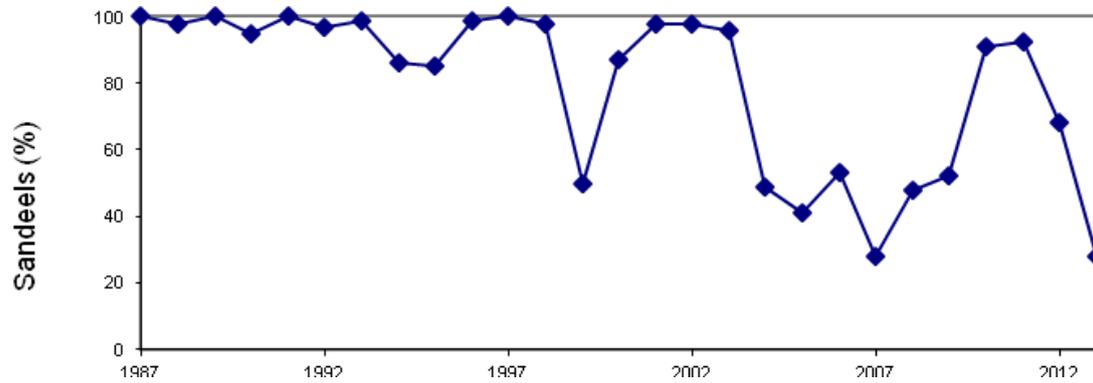
Figure 11. Annual return rates of adult Atlantic puffin on the Isle of May 1987 – 2013.

## 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

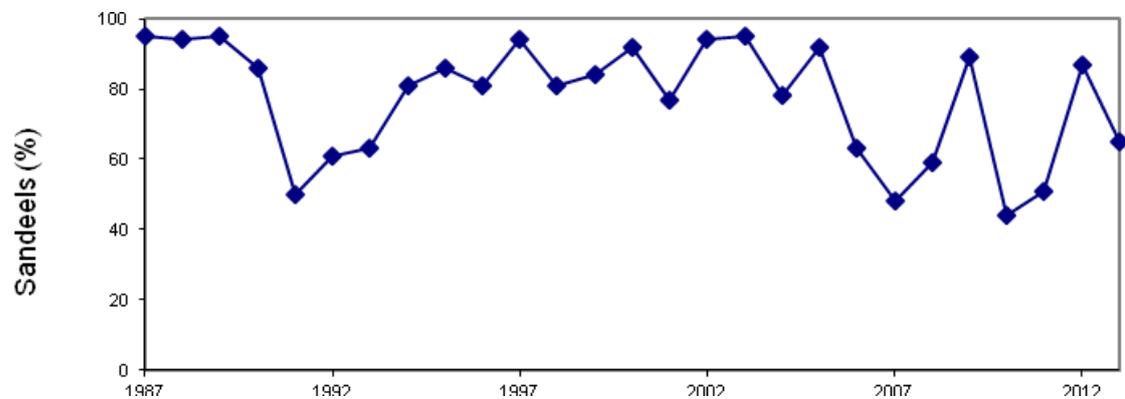
The most frequent prey (by occurrence in a regurgitate) in the 13 regurgitations was butterfish which occurred in 53.8% of samples (Table 4). Sandeels constituted only 28.2% of the biomass, the joint lowest on record. The remains of other items found were Cottidae (2 samples), flatfish (1), Gadidae (1), dragonet (1) and crustacea (1).



**Figure 12.** Percentage of sandeels (by weight) in the diet of young European shags on the Isle of May, 1987-2013.

### Black-legged kittiwake

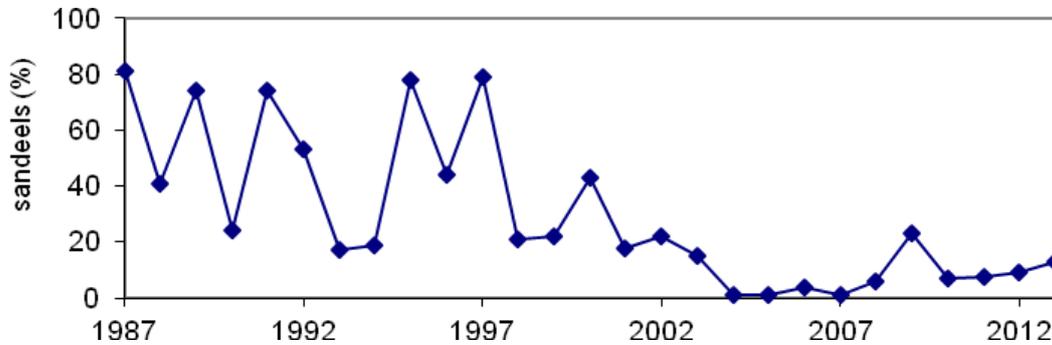
Of the 38 food samples obtained, 92.1% contained sandeels (Table 4). In terms of biomass, sandeels contributed 64.8% to the diet, which is below the long term average (77.6%). Clupeid (mainly sprat *Sprattus sprattus*) contributed 29.4% of the biomass and occurred in 47.4% of regurgitations. Gadids contributed 6% of the biomass of which 2.1% were rockling.



**Figure 13.** Percentage of sandeels (by weight) in the diet of young black-legged kittiwakes on the Isle of May, 1987-2013.

### Common guillemot

Of the 659 food items delivered to chicks, 569 (86.3%) were clupeids (most thought to be sprat) and 86 (13.1%) were sandeels. There were 3 Gadidae (0.1%) and one small squid.



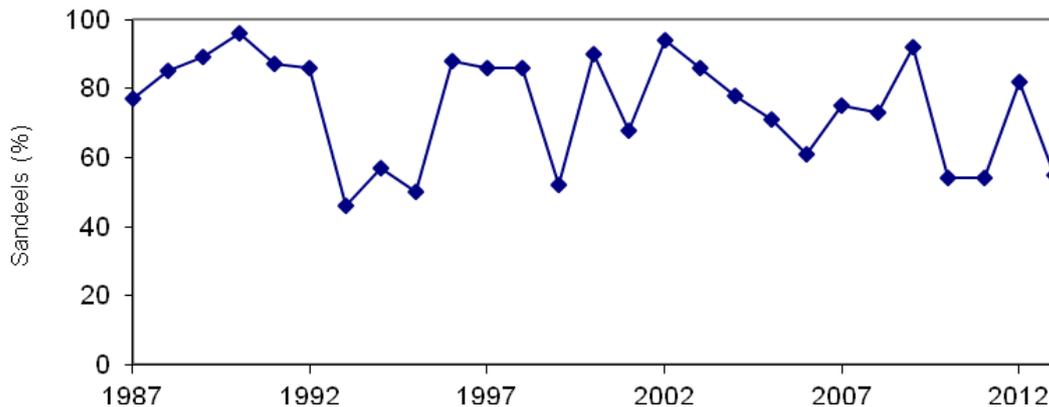
**Figure 14.** Percentage of sandeels (by weight) in the diet of young common guillemot on the Isle of May, 1987-2013.

### Razorbill

Of the 108 loads seen clearly, 60 (56%) contained sandeels and 48 (44%) clupeids.

### Atlantic puffin

Sandeels predominated the diet of puffins making up 76% of the 2015 fish collected. Clupeids (mainly sprat) made up 10% and Gadidae (including small rockling) 14% (Table 11).



**Figure 15.** Percentage of sandeels (by weight) in the diet of young Atlantic puffin on the Isle of May, 1987-2013.

## **4 Acknowledgements**

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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 2013.

	<b>Plots</b>	<b>Plot average</b>	<b>Total nests</b>	<b>Total success</b>
Northern fulmar	10	0.49 +/- 0.09	167	0.47
European shag	9	1.40 +/- 0.18	55	1.20
Black-legged kittiwake	15	0.38 +/- 0.09	351	0.41
Common guillemot	5	0.67 +/- 0.04	797	0.69
Razorbill	4	0.55 +/- 0.09	191	0.48
Atlantic puffin	4	0.70 +/- 0.07	163	0.70

**Table 2.** Breeding success (mean number of young reared per breeding pair) of seabirds on the Isle of May, 2002-2013.

<b>Species</b>	<b>2002</b>	<b>2003</b>	<b>2004</b>	<b>2005</b>	<b>2006</b>	<b>2007</b>
Northern fulmar	0.48 (131)	0.44 (109)	0.21 (97)	0.27 (135)	0.44 (139)	0.21 (141)
European shag	1.66 (130)	1.83 (156)	0.25 (103)	0.48 (42)	1.22 (81)	1.07 (57)
Black-legged kittiwake	0.47 (477)	0.77 (423)	0.30 (466)	0.85 (675)	0.47 (613)	0.24 (609)
Common guillemot	0.68 (955)	0.68 (1014)	0.50 (984)	0.63 (945)	0.41 (932)	0.28 (850)
Razorbill	0.65 (167)	0.59 (177)	0.54 (190)	0.55 (200)	0.62 (190)	0.63 (188)
Atlantic puffin	0.72 (174)	0.77 (195)	0.60 (196)	0.71 (184)	0.68 (166)	0.29 (158)
	<b>2008</b>	<b>2009</b>	<b>2010</b>	<b>2011</b>	<b>2012</b>	<b>2013</b>
Northern fulmar	0.20 (121)	0.44 (147)	0.34 (176)	0.36 (149)	0.13 (157)	0.47 (167)
European shag	1.90 (60)	2.02 (61)	2.04 (77)	1.54 (104)	1.18 (108)	1.20 (55)
Black-legged kittiwake	0.23 (485)	0.70 (491)	0.29 (494)	0.87 (449)	0.98 (470)	0.41 (351)
Common guillemot	0.63 (807)	0.75 (824)	0.80 (846)	0.72 (858)	0.79 (812)	0.69 (797)
Razorbill	0.58 (170)	0.61 (180)	0.68 (177)	0.50 (175)	0.56 (195)	0.48 (191)
Atlantic puffin	0.48 (179)	0.72 (176)	0.74 (169)	0.79 (173)	0.57 (167)	0.70 (163)

**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.



### 7.3 Appendix 3: Chick diet

**Table 4.** Food of young black-legged kittiwakes and European shags on the Isle of May during chick-rearing in 2013.

	<b>Black-legged kittiwake</b>	<b>European shag</b>
No. of regurgitations	38	13
Range of dates	19 June - 22 July	30 June -23 July
Total weight (g)	440	423
% regurgitations with sandeels	92.1	30.8
with Gadidae	18.4	7.7
with Clupeidae	47.4	0
with flatfish	0	7.7
with butterfish	0	53.8
with Cottidae	0	15.4
% (by number) of sandeels in sample	66.9	72.9
Other remains identified		dragonet (1), crustacea (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 2013.

	<b>Sandeels</b>	<b>Clupeidae</b>	<b>Gadidae</b>
All-day watches			
30 June	20	174	1
2 July	7	33	0
Other records			
7 June-7 July	59	362	2
<b>Total</b>	<b>88</b>	<b>569</b>	<b>3</b>

Notes:

There was also a single small squid.

**Table 6.** Food of young razorbills on the Isle of May in 2013.

	<b>Sandeels</b>	<b>Clupeidae</b>	<b>Gadidae</b>
All-day watches			
30 June	23	8	8
2 July	22	15	7
Other records			
21 June- 9 July	15	7	3
<b>Total</b>	<b>60</b>	<b>30</b>	<b>18</b>

**Table 7.** Food of young Atlantic puffins on the Isle of May, 17 June to 6 August 2013.

	<b>n</b>	<b>Mean</b>	<b>s.e</b>
Sandeels <i>Ammodytes sp.</i>	1522	53.6	0.23
Unidentified Clupeid	10	73.8	2.89
Sprat (large) <i>Sprattus sprattus</i>	57	95.7	1.58
Sprat (small) <i>Sprattus sprattus</i>	97	38.2	0.35
Herring <i>Clupea harengus</i>	37	55.9	1.40
Rockling <i>sp.</i> (Gadidae)	278	32.6	0.26
Whiting <i>Merlangius merlangus</i>	9	45.8	5.21
Cod <i>Gadus morhua</i>	2	41.0	0.0
Unidentified Gadidae	3	47.7	5.70

**Table 8.** Percentage of sandeels (by weight) in the diet of young seabirds on the Isle of May, 1993-2013.

<b>Species</b>	<b>1993</b>	<b>1994</b>	<b>1995</b>	<b>1996</b>	<b>1997</b>	<b>1998</b>	<b>1999</b>	<b>2000</b>	<b>2001</b>	<b>2002</b>
Shag	99	86	85	99	100	98	<50	87	95	98
Kittiwake	63	81	86	81	94	81	84	92	76	94
Guillemot	17	19	78	44	79	21	22	43	18	22
Puffin	46	57	50	88	86	86	52	90	68	94

<b>Species</b>	<b>2003</b>	<b>2004</b>	<b>2005</b>	<b>2006</b>	<b>2007</b>	<b>2008</b>	<b>2009</b>	<b>2010</b>	<b>2011</b>	<b>2012</b>	<b>2013</b>
Shag	96	49	41	53	28	48	52	91	92	68	28
Kittiwake	91	79	92	63	48	59	89	44	51	87	65
Guillemot	15	2	1	4	1	6	23	7	8	9	8
Puffin	86	78	71	61	75	72	92	54	54	82	55

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.