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ISLE OF MAY SEABIRD STUDIES

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2 METHODS

2.1 Breeding success

The methods used involved minimal disturbance of birds and are described in detail in 'Development of monitoring of seabird populations and performance' - Final Report to NCC for contract HF3-08-15.

Fulmar: The positions of apparently incubating birds were marked on photographs on 18, 22 and 28 May; sites where birds appeared to be incubating on all three visits, or where an egg was seen, were assumed to have been bred at. These sites were checked again on 7 August and those with a large chick were assumed to have been successful.

Shag: The positions of nests in 14 areas were marked on photographs and the state and contents of these nests were checked weekly from early April until mid-August.

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 checked on 20 May, early June, 3 July and then weekly until all young had left. Chicks reaching a size where they appeared capable of flight before the next weekly check were assumed to have fledged successfully.

Guillemot, razorbill: At least daily checks of the state of breeding of numbered nest-sites were made from permanent hides.

Puffin: Samples of burrows where an egg could be felt on 2-3 May (when most pairs had laid) were staked and rechecked on 29-30 June (when chicks were near fledging). All large young were assumed to have fledged as were young from empty burrows where there were many droppings, moulted down and feather sheaths.

Common and arctic terns: Nests with eggs were staked and counted and the cumulative total was taken as an estimate of the population. Checks of chicks would have resulted in unacceptable levels of disturbance, therefore only a general assessment was made of the numbers of juveniles seen as they gathered in groups at the fringe of the colony.

2.2 Adult survival

These were based on sightings of individually colour-ringed birds in several parts of the colony. Searches were made for birds which had moved out of the study areas. These searches are time consuming, and superficially unrewarding but they are essential if accurate estimates of survival are to be obtained.

2.3 Food of chicks

Food regurgitated by young shags and kittiwakes and loads of fish dropped by adult puffins caught in mist-nets were collected, weighed and the fish identified and, where possible measured (total length to tip of tail). If necessary, fish otoliths were extracted and examined. Records were kept of fish brought to young guillemots and razorbills and uneaten fish were collected from breeding ledges.

2.4 Feeding frequency

All-day watches were made of marked sites or burrows of guillemot, razorbill and puffin from permanent hides. Observers took 2 hr shifts. and where possible noted the species and size of the fish brought to the young.

3 RESULTS

3.1 Breeding success

All species had a successful season (Tables 1-4). The successes of shag (1.09 fledged/pair), kittiwake (1.11) and fulmar (0.54) returned to normal after the relatively low levels of 1988 (0.61, 0.82 and 0.31, respectively; Table 5).

Common and arctic terns had a successful season. More details can be found in the Isle of May NNR Warden's report for 1989.

3.2 Adult survival

Not every adult alive is seen each year and some probably do not return every season. Thus the survival figures in Table 6 are minimal. Even so these recorded for guillemot, razorbill and kittiwake are at the top end of the range of similar figures collected in previous years and at other colonies.

In 1989 7 (out of 23) kittiwakes seen in 1987 but not seen in 1988 were recorded, as were 9 (of 39) missing shags and 15 (of 39) missing Puffins. These increase the 1987-88 survival figures for these three species to 90.2% (from 86%), 82.5% (from 77.3%) and 85.0% (from 76.1), respectively.

Increases in the runs of data and the development of more powerful analytical techniques will allow us to improve these survival estimates but only several years after any given year's results have been collected.

During 1989 a further 25 kittiwakes, 41 shags, 31 puffins and 21 breeding (and 40 nonbreeding) guillemots were colour-ringed.

3.3 Food of young

Sandeels *Ammodytes* sp. were by far the most important food of all species which were sampled. They occurred in all regurgitations from kittiwake and shag (Table 7). The only other prey recorded from these species were the remains of a whiting *Merlangius merlangus*, an unidentifiable gadoid and a single polychaete jaw, one in each of three kittiwake samples. Most of the measurable sandeels were 6-9 cm long (shag) and 12-17 cm (kittiwake). Sandeels were also the commonest recorded food of adult shags, their otoliths being recorded in 108 (94%) of 115 pellets collected in June and July which had food remains present.

Small sandeels (6-10 cm) made up most of the fish brought to young auks (Table 8-10). The mean weight of loads of fish recovered from adult puffins was 9.3 which is similar to 1973-88 mean of 9.5 g. The calculated mean weight of fish brought to young guillemots was 4.1 g, by far the lowest since records began in 1981 (range = 7.9-11.7) but chicks received more feeds per day than usual (below).

Clupeidae (herring Clupea harengus and sprat Sprattus sprattus) made up a relatively small proportion of the diet of young auks in 1989; 26% (by weight) in guillemot (compared to a previous recorded annual range 8-59%), 10% in puffin (5-86%) and less than 5% in razorbill (1-10%).

3.4 Feeding frequency

Two all-day watches on different groups of guillemot and razorbill chicks and one on puffin burrows indicated that the feeding frequencies of all three species were extremely high (Table 11). Less systematic coverage through the rest of the season confirmed that birds had little trouble feeding their young.

4 CONCLUSION

(a) Conditions for breeding seabirds on the Isle of May were good and young were fed mainly on sandeels.

(b) Annual survival of adult razorbills, guillemots and kittiwakes were high.

(c) Annual survival of adult puffins is substantially lower than it was in the early 1970s. Simple population models suggest that unless immature survival is extremely high (and available evidence suggests that it is not) or there is substantial net immigration, the Isle of May population should decline.

(d) The survival of adult shags from retrap data over the last two winters has been lower than the 85.4% calculated from retrap data by Aebischer (1986: *J. Anim. Ecol.* 55: 613-629) for the period 1965-81. Continuing work should clarify whether the apparent decline in survival is real.

5 ACKNOWLEDGEMENTS

Bob Proctor, NCC summer warden helped with much of the work and Sarah Wanless took a major part in the estimation of guillemot survival, breeding success and the feeding studies. Many people helped collect fish from puffins. The World Wide Fund for Nature gave financial support towards a study of the puffin on the Isle of May in 1989.

Table 1. Fledging success of fulmars on the Isle of May in 1989

Area	Incubating birds	Young Fledged	
1 Cleaver	8	4	
2 Pilgrims Haven	2	2	
3 Cornerstone	10	4	
4 Loch (S)	25	13	
5 Greengates	22	12	
6 Horse Hole	9	4	
7 Rona	1	0	
8 Tarbet	11	7	
9 Low Light	3	3	
10 Colm Hole	1	1	
Total	92	50	0.54 fledged/ pair

Notes: Incubating birds were those sitting tight on three checks 18, 22 and 28/5 or where an egg was seen. Chicks present on 7 August were assumed to have fledged.

There were 16 additional sites where adults appeared to be incubating on two of the three checks.

Table 2. Fledging success of shags on the Isle of May in 1989

Area	Total incubated	0	1	2	3	4	Other nests	Total young fledged	Mean young fledged per incubated nest
1 Lady's Bed (South)	11	5	5 ¹⁾	0	1	0	0	8	0.73
2 Lady's Bed (Mid)	9	5 ²⁾	1	2	1	0	0	8	0.89
3 Maidens	10	6	2	1	1	0	0	7	0.70
4 South Horn	4	1	1	1	1	0	0	6	1.5
5 Chatterstones	8	3	1	2	2	0	0	11	1.37
7 South Face	6	1	4	0	1	0	0	7	1.17
8 Greengates (S)	33	15	9	8	1	0	0	28	0.85
9 Greengates (N)	29	17	2	6	4	0	0	26	0.90
10 Bishops Cove	4	1	3	0	0	0	0	3	0.75
11 Rona	25	11	3	6	4	1	0	31	1.24
12 Tarbet	38	10	5	13	12	0	1	67	1.76 (1.72)
13 Colm Hole (N)	20	10	0	5	5	0	0	25	1.25
14 Colm Hole (S)	37	19	7	4	5	2	1	38	1.03 (1.00)

Mean ± SE
1.09±0.09

- Notes: 1) includes 2 x b/1 present in early August assumed to have fledged
 2) includes 1 still incubating and 1 just hatching in early August
 3) Mean production in brackets includes completed nests where birds not seen to incubate
 4) Checks made by R Proctor

Table 3. Fledging success of kittiwakes on the Isle of May in 1989.

Area	Completed nests	Trace nests	fledged young/ nest			Total young produced nest)	Fledging success		
			0	1	2		3	per completed nest	All pairs (incl. trace of nest)
1 Cleaver	49	1	13	12	13	1	41	0.84	0.82
2 Pilgrims	30	1	10	7	12	1	34	1.13	1.10
3 South Face	38	4	5	16	17	0	50	1.32	1.19
4 Colony 4	147	12	47	35	63	2	167	1.14	1.05
5 Cornerstone	123	5	28	30	61	4	164	1.33	1.28
6 Loch (S)	140	9	52	52	36	0	124	0.89	0.83
7 Loch (N)	124	4	29	46	48	1	145	1.17	1.13
8 Greengates	182	6	38	59	82	3	232	1.27	1.23
9 Bishops Cove	81	9	15	24	41	1	109	1.35	1.21
10 Horse Hole	9	3	5	4	0	0	4	0.44	0.33
11 Iron Bridge	56	2	15	13	26	2	71	1.27	1.22
12 Rona	62	4	10	19	32	1	86	1.39	1.30
13 Tarbet	166	24	65	54	47	0	148	0.89	0.77
14 Low Light	102	14	21	55	26	0	107	1.04	0.92
15 Colm	18	2	4	6	8	0	22	1.22	1.10
							Mean	1.11	1.03
							SE	0.07	0.07

Table 4. Breeding success of auks on the Isle of May in 1989.

Species	Area	Pairs laying	Young hatched	Young 'fledged'	Young leaving/ pair
Guillemot	Dense	267	245	239	0.90
	Hide/White	88	72	65	0.74
	Colony 4	229	197	181	0.79
	South	43	40	39	0.91
	Cornerstone	130	121	116	0.89
	Mean				0.85
Razorbill	Hide/White	24	16	15	
	Colony 4	32	27	27	
	South	11	8	7	
	Cornerstone	30	24	23	
	Total	97	75	72	0.74
Puffin	Lady's Bed	44	?	34	
	Kirkhaven	45	?	37	
	Burrian	39	?	38	
	Rona	36	?	35	
	Total	164	?	144	0.88

Table 5. Breeding success (young reared per pair breeding) of some seabirds on the Isle of May 1986-89

Species	1986	1987	1988	1989
Fulmar	0.53(79)	0.47(69)	0.31(64)	0.54(93)
Shag	0.75(223)	1.09(288)	0.61(221)	1.09(234)
Kittiwake	1.33(1133)	1.09(1291)	0.82(1278)	1.11(1327)
Guillemot	0.82(785)	0.76(800)	0.85(732)	0.85(757)
Razorbill	0.72(84)	0.71(64)	0.70(98)	0.74(97)
Puffin	0.80(136)	0.93(62)	0.88(157)	0.88(164)

Notes: The number of pairs followed is given in brackets. Details of methods, etc. can be found in this and previous reports to NCC.

Table 6. Annual survival of adult seabirds on the Isle of May 1988-89

Species	No. alive in 1988	No. seen in 1989	Survival		
			1988/9	% 1987/8	1986/7
Shag	151	118	78.1	77.3	91.4
Kittiwake	164	149	90.9	86.0	96.1
Guillemot	370	342	92.4	91.5	97.3
Razorbill	63	57	90.5	88.1	92.7
Puffin	142	121	85.2	76.1	81.2

- Notes 1. Only birds which had definitely bred in 1988 or earlier are included
2. Directly comparable figures for adult survival 1987/8 and 1986/7 are given. These have not been corrected for missing birds seen in later years, and so are serious underestimates of survival. These figures should not be used for population dynamic calculations without consultation with M P Harris.
3. Details of earlier estimates are given in previous reports to NCC.

Table 7. Food fed to young kittiwakes and shags on the Isle of May in 1989

	Kittiwake	Shag
No. of regurgitations	25	30
Range of dates	9 June-9 July	20 June-27 July
Total weight (g)	287	1027
% regurgitations with sandeels	100	100
% (by weight) of sandeels in sample	95	100
Lengths (cm of majority of sandeels)	12-17	6-9
Other prey remains	1 whiting 14 cm long 1 gadoid 20-25 cm long 1 polychaete jaw	

Note: Samples collected from chicks or adults brooding chicks

Table 8. Food of young guillemots on the Isle of May in 1989

	minute/ larval	SANDEEL			CLUPEIDAE		
		small	medium	large	small	medium	large
Length (cm)	6	10	13.5	16	8	11	13
11 June	7	322	77	15	11	22	15
18 June	15	130	6	0	6	4	1
Other days							
24 May-14 July	28	89	32	3	11	16	5
TOTAL	50	541	115	18	28	42	21

- Notes: 1) There were single gadoids (c. 15 cm long), possibly whiting, on 11 June and 31 May
- 2) Lengths were based on visual estimates against the bird's bill checked by samples of dropped fish collected from the breeding ledges

Table 9. Food of young razorbills on the Isle of May in 1989.

	Load of					Clupeidae
	single sandeel		several sandeels			
	large	medium	2 medium	3-6 small	very small	
Length (cm)	10	6	6	5	4	?
11 June	5	1	1	15	14	0
16 June	0	1	2	16	3	2
Other dates 4 June- 8 July	0	1	0	4	3	0
TOTAL	5	3	3	35	20	2

- Notes
- 1) Results from 11 and 16 June came from all-day watches of chicks
 - 2) The clupeids were single small and very small fish, almost certainly herring

Table 10. Food of young puffins on the Isle of May 1989

	Sample	Mean	S.E.
a) Load weight (g)	101	9.3	0.36
b) Fish/load	101	5.9	0.28
c) Numbers and lengths of fish (mm)			
Sandeels <u>Ammodytes sp.</u>	598	78.6	0.46
Herring <u>Clupea harengus</u>	38	76.6	1.89
Rockling <u>Gaidropsarus ciliata</u>	21	34.5	0.84
Sprat <u>Sprattus sprattus</u>	1	120	
Unidentified flatfish	1	30	
Unidentified Gadidae	2	28, 29	

Table 11. Feeding frequencies of young auks on the Isle of May in 1989

Species	Date	No. of	Mean (\pm S.E.) feeds/chick/day
Guillemot	11 June	92	5.35
	18 June	30	7.0 \pm 0.43
Razorbill	11 June	10	4.8
	18 June	7	5.3 \pm 0.71
Puffin	16 June	42	5.7 \pm 0.36

Notes 1) Based on all-day watches by observers taking
2 hr shifts

2) No S.E. estimate available for 11 June as the fish delivered
were not assigned to specific chicks