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RESEARCH ON PUFFINS ON THE ISLE OF MAY FROM 1991 TO 1993

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Final Report

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CONTENTS

1 SUMMARY

1. Fieldwork was carried out on the Isle of May in March-July 1991, 1992 and 1993.

2. A complete count of occupied burrows in 1992 gave a total population of about 20 000 pairs. This, and annual monitoring counts, indicate that the Isle of May population is stable.

3. Breeding in all years was normal. Nesting success was very high in 1991 and 1992 but slightly lower in 1993.

4. There has been a significant decline in the weights of chicks over the last 20 years. This continues and is cause for concern for the survival of chicks after fledging.

5. Chicks were fed mainly on small sandeels, augmented in 1992 with small saithe and in 1993 by small herring. The long-term trend of reduced energy intake by chicks continued.

6. About 10% of the birds present in July 1991 and 1992 were immature. The 1993 estimate was 21%. These figures compare with up to 37% when the population was increasing rapidly in the 1970s.

7. Adult survival over the 1990-91 winter was only 77%, and although those over 1991-92 and 1992-93 winters were higher (91%, 89%, respectively). This gives cause for concern.

8. Initial results from a new study involving individually marked birds and permanently numbered burrows suggested that the divorce rate (at 10%) was higher than expected. The chances of a pair divorcing did not depend on whether or not they raised a chick the year before.

9. Pairs usually retained the same burrow from one year to the next.

10. Birds individually colour-ringed as chicks are starting to return to the colony.

11. The available data suggest that the population should continue to remain more-or-less stable.

12. About 38% of first year puffins have elastic in their stomachs. The figure is lower (10%) for adults. There is no evidence that ingested artifacts influence puffin numbers.

2 INTRODUCTION

In the late 1960s it was noted that the numbers of puffins *Fratercula arctica* in Britain had declined and in 1973 the Natural Environment Research Council instigated a nationwide study into the status of the puffin and the reasons for its decline. The Isle of May, Firth of Forth was chosen as a study site as the puffin population there was one of the few that was expanding rapidly. At the end of that project, it was concluded that the decline in numbers, in western Britain has been due to natural, probably oceanographic, causes and that numbers had stabilised by the mid-1970s. In the early 1980s work on the Isle of May seabirds broadened as the Institute of Terrestrial Ecology initiated a multi-species study of this seabird community. Work on puffins continued but at a much lower intensity than previously.

In 1987 it was realized that puffin numbers on the Isle of May had stopped increasing, the adult survival rate appeared to have declined and there were fewer immature present that there once had been. This coincided with the finding that very few immature guillemots *Uria aalge* were recruiting into the Isle of May population and reports that seabirds slightly further north, e.g. Shetland, were experiencing breeding failures.

In early 1989, the World Wide Fund for Nature commissioned ITE to reassess the status and fortunes of puffins on the Isle of May. This review confirmed that the rapid increase of puffin numbers on the Isle of May had stopped and showed an urgent need for up-to-date information on Isle of May puffins.

The summer of 1991 saw the start of a new research initiative into the biology of the puffins in the Firth of Forth funded by BP Exploration and NERC/ITE. The aims were to:-

1. Continue the long-term study of the puffin as only such studies can produce the information essential to understanding the population dynamics, and hence implement effective conservation, of long-lived seabirds

2. Survey the puffin population on the Isle of May and monitor changes in numbers

3. If numbers were declining, determine whether this was due to decreased adult survival, and/or to insufficient recruitment of young birds

4. Monitor the breeding output, and food and feeding of chicks

5. Determine the proportion of immatures in the population

6. Initiate a new study on the behaviour and breeding of individually marked immature and adult puffins.

This document reports on the work carried out and assesses the probable future of the population on the Isle of May.

3 METHODS

Fieldwork was carried out from late March until July in 1991, 1992 and 1993. The methods used were developed in the 1970s and are well documented in my published papers. Only the bare outlines are given here. All results are directly comparable between years.

3.1 Population counts

The Isle of May is a relatively flat island and puffins breed in burrows dug wherever there is soil. The population unit is the "occupied" burrow - that is one showing signs of occupation such as fresh digging or droppings in or in front of the entrance. Burrows are easily counted in the early spring when the birds are cleaning out the nest chambers, before young rabbits are born (as the activities of these can cause problems), and the vegetation has not started to grow.

3.1.1 Whole population counts

These are extremely time consuming to make as all areas must be carefully searched by lines of people walking in line-abreast delimiting areas counted with bamboo canes. A total count is made every 3-5 years. The most recent was 25-29 April 1992.

A check of the efficiency of counting was made by marking all burrows counted in each of four delimited areas. The next day a minute (hands-and-knees) search was made of each area to check the numbers of burrows which had been classified as occupied which were (a) occupied or (b) unoccupied, and also occupied burrows which had been overlooked.

3.1.2 Monitoring counts

The numbers of burrows in 13 large permanently staked plots or quadrats were counted during the last few days of April in 1991, 1992 and 1993. Burrows in seven of these plots (Figure 1) have been counted annually each late April since 1973 and the total of burrows in these plots is used as an annual index of the size of the population. The other plots were positioned in later years to document future changes in low-density and recently colonized areas.

3.2 Breeding success

Breeding success was monitored in four separate parts of the island without removing

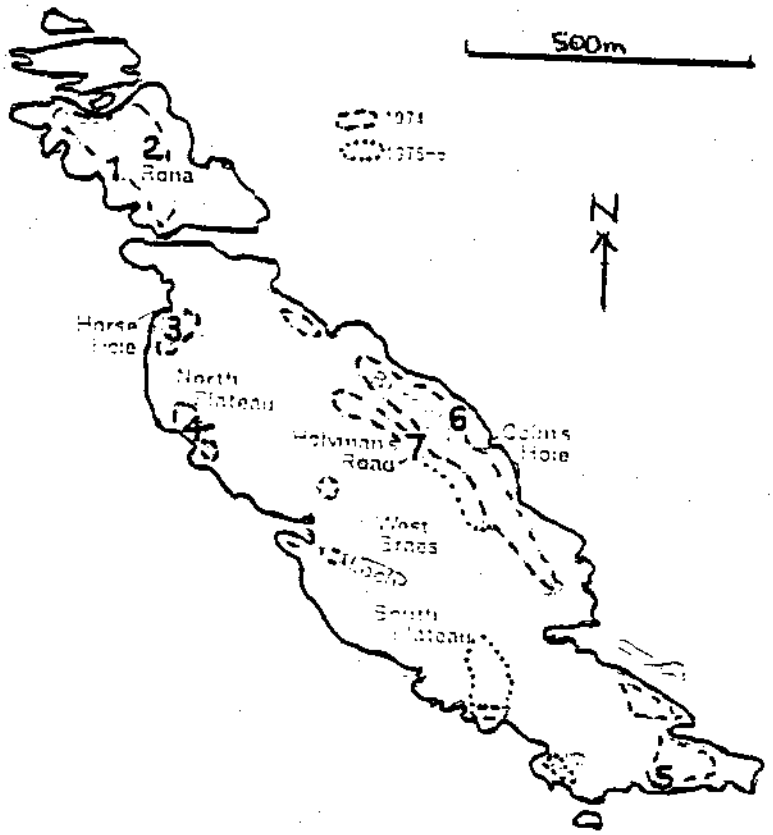

Figure 1. The Isle of May puffin colony. In 1992, puffins nested throughout the island. Numbers indicate the monitoring plots.

A one-year old puffin with a very narrow beak

adults or handling eggs by (a) feeling down marked burrows with a short stick to determine the presence or absence of an egg on 1-3 May in both 1991 and 1992 and 29-30 April 1993 when most birds had laid and, (b) rechecking those burrows where there had been an egg on 29-30 June 1991 and 3-5 July in 1992 and 1993 just prior to the main fledging time for the presence or absence of a large chick. The clutch size is always one egg, hence breeding success is easily determined.

3.3 Weights of chicks

Chicks in a series of about 30 burrows dispersed across the main colony were weighed every 4 days until near fledging when weighings were made daily. Peak weight attained (usually 7-10 days prior to fledging) and fledging weight were taken as indices of growth.

3.4 Food and feeding of chicks

Adult puffins carry loads of fish held in the bill back to their chicks. Food samples were obtained by mist-netting adults during June and July and collecting, counting, weighing, identifying and measuring (total length) the fish in loads dropped by these birds Nets were moved frequently so as to minimize disturbance. Annual mean values of the energy values of fish loads were calculated using length-weight and length-energy values relevant to the fish species in the area.

On several days each summer, the numbers of loads of fish taken to numbered burrows in front of a permanent hide were recorded by C. Wernham and a team of helpers taking 2 hr watches to cover all the hours of daylight.

3.5 Proportion of immatures

Puffins can confidently be assigned to one of three age groups based on the development of the beak; (a) adults which have probably bred (more than 2 bill grooves), (b) immatures (less than 2 grooves) and (c) intermediates (2 grooves which are probably sexually mature but may not have bred.

Tests in previous years showed that such categorisation can be made safely using a high-powered telescope mounted on a stout tripod. Large samples of birds were so aged on days when large numbers of puffins were ashore during the first half of July.

A winter-plumaged puffin with a very dusky face

A one-year old puffin with a very narrow beak

3.6 Moult of adults

The states of plumage (to record the presence of unmoulted dark winter face feathers) of samples of adults were recorded in early April 1991 and 1992 and in late March 1993.

3.7 Adult survival

Estimates of the annual over-winter survival came from resightings of breeding puffins colour-ringed in previous years. Such estimates are minimal (as some surviving adults will have been overlooked). The figures for the most recent years must, therefore, be treated with caution.

3.8 Mate and nest-site fidelity

A series of burrows in front of one of the main study hides was permanently staked in 1990 and as many as possible of the adults were colour-ringed by C. Wernham as part of her Ph.D. work. The subsequent occupants of these burrows and the pairings of these birds, and their breeding success are now followed annually.

For convenience Tables are grouped together at the end of the text, although data are compared with these from past years in the Results section.

4 RESULTS AND COMPARISONS WITH PAST DATA

4.1 Population

4.1.1 Counts of Isle of May population

The 1992 burrow count was 20,106. This compared with 18,628 in 1989 and 3064 in 1975 (Table 1). Although there had been an apparent increase since 1989 the mean rate of 2.5% p.a. was low compared to 8% p.a. 1984-89 and 17% p.a. 1975-84.

The checks of assessment of our estimates of which burrows were occupied were:

	Classified as occupied		Classified as unoccupied	
Area	**Correct**	**Wrong**	**Correct**	**Wrong**
Rona	42	5	11	2
Burrian	33	6	10	2
Lady's Bed	34	5	10	1
Horse Hole	33	4	9	4
Total	142	20	40	9

Thus, the total count of 20,100 could be interpreted as 18700 burrow-owning pairs. Probably there has been little change in numbers since 1989.

4.1.2 Monitoring counts

The 1991 monitoring count was very slightly (1.4%) down on the 1990 count and the 1992 count was again lower (by 4% of the 1991 count) (Table 2). In contrast the 1993 total was 13% up on that in 1992 and this increase balanced the small annual decreases 1989-92. The population is now stable which contrasts vividly with the 19% p.a. increase during the 1970s and 1980s (Figure 2).

The monitoring plots were delimited in 1972 and, given the seven-fold increase in the numbers of burrows counted in them between 1973 and 1989, it is possible that there is now no room for more burrows. It is difficult to be objective about whether an area can or cannot hold any more puffin burrows,

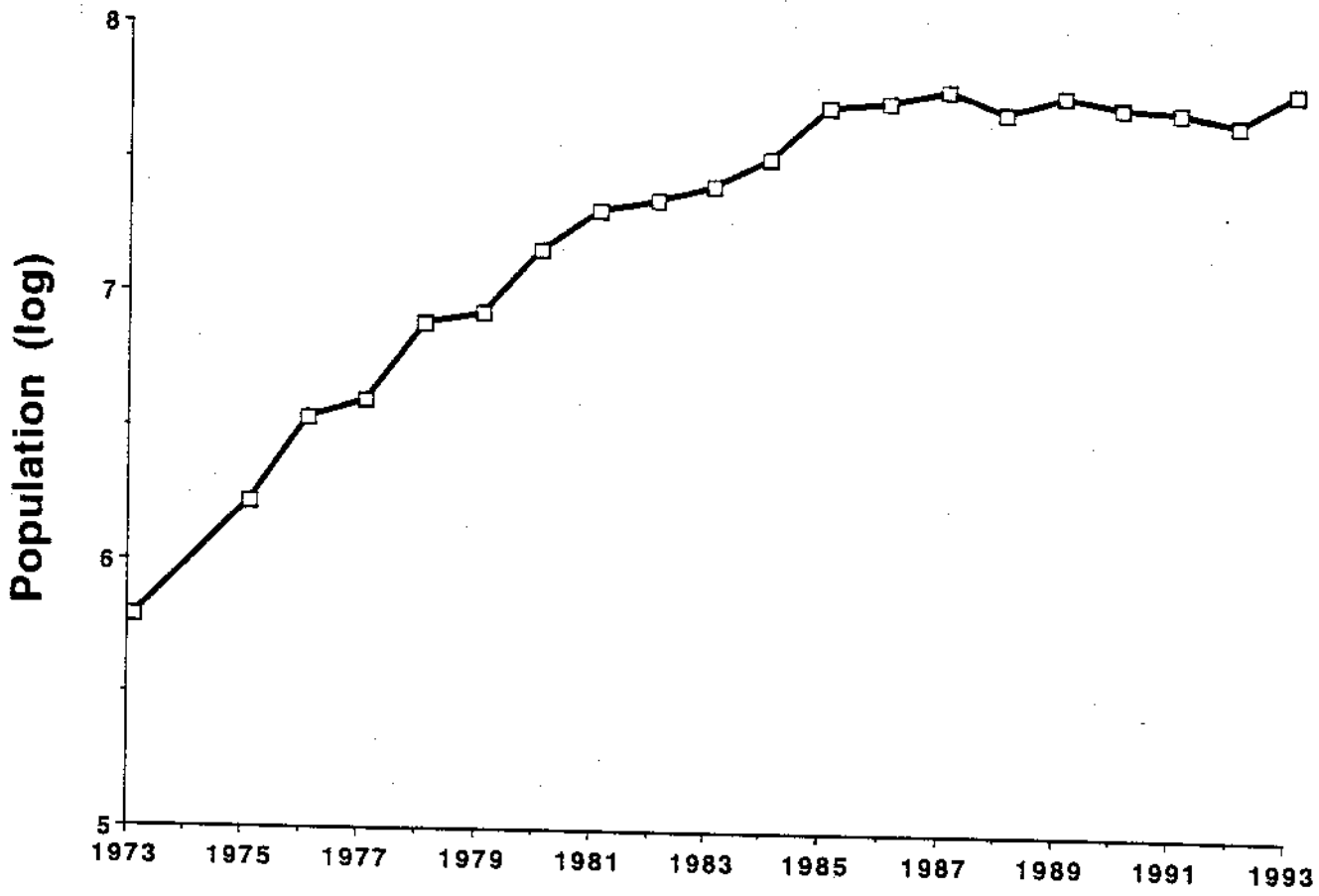

Figure 2. Annual counts of occupied puffin burrows in monitoring plots on the Isle of May 1973-93.

but superficially there appears to be room for more burrows in all plots.

There was highly significant correlation ($r = 0.96$, $n = 5$, $P<0.01$) between the total island counts and the monitoring count for the five years when a total and monitoring count had been made (Figure 3) which suggests that the quadrats were representative of the whole colony.

4.2 Breeding

4.2.1 Timing

The first fish seen being carrried by an adult to a burrow in 1991, 1992 and 1993 were in 21 May, 17 May and 20 May, respectively. Given an incubation period of 41 days, these dates indicate that the first eggs would have been laid about 6-10 April, which is normal for the Isle of May but much earlier than elsewhere in the puffin's range. Breeding ended very late in 1993 with very latest chicks not leaving until the start of September.

4.2.2 Success

Breeding successes in 1990 and 1991 were 0.78 and 0.87 young fledged per burrow, respectively (Table 3). These maintained the typically high breeding success of Isle of May puffins (Figure 4). Success was lower (0.69) in 1993. The reason for this was not obvious.

4.3 Weights of chicks

In 1991, the mean peak weight of 22 young was 315.4 g (SE 5.7) and the fledging weight of 22 was 271.4 g (SE 5.8). In 1992 the corresponding figures for 35 and 33 chicks were 307.1 g (SE 5.4) and 264.2 g (SE 5.8). In 1993 the figures for 36 chicks were 301.1 g (SE 4.4) and 262.1 g (SE 3.3).

There has been a gradual linear decline in both the annual peak and fledging weights of chicks since annual weighing of chicks started in 1974. This decline has been particularly marked in the fledging weights where it has averaged 1.6 g per year (Figure 5).

4.4 Food and feeding of chicks

In 1991 and 1992, young were fed mainly small sandeels *Ammodytes sp* about 6-7 cm long - that is fish which had hatched early in the same year (the O-group of fishery biologists). The only other species to contribute significantly to the diet were herring *Clupea harengus* and saithe *Pollarchius virens* (Tables 4 & 5). Sandeels made up 87 and 86% of the diet by weight in the two years, Clupeidae (herring and sprat *Sprattus*

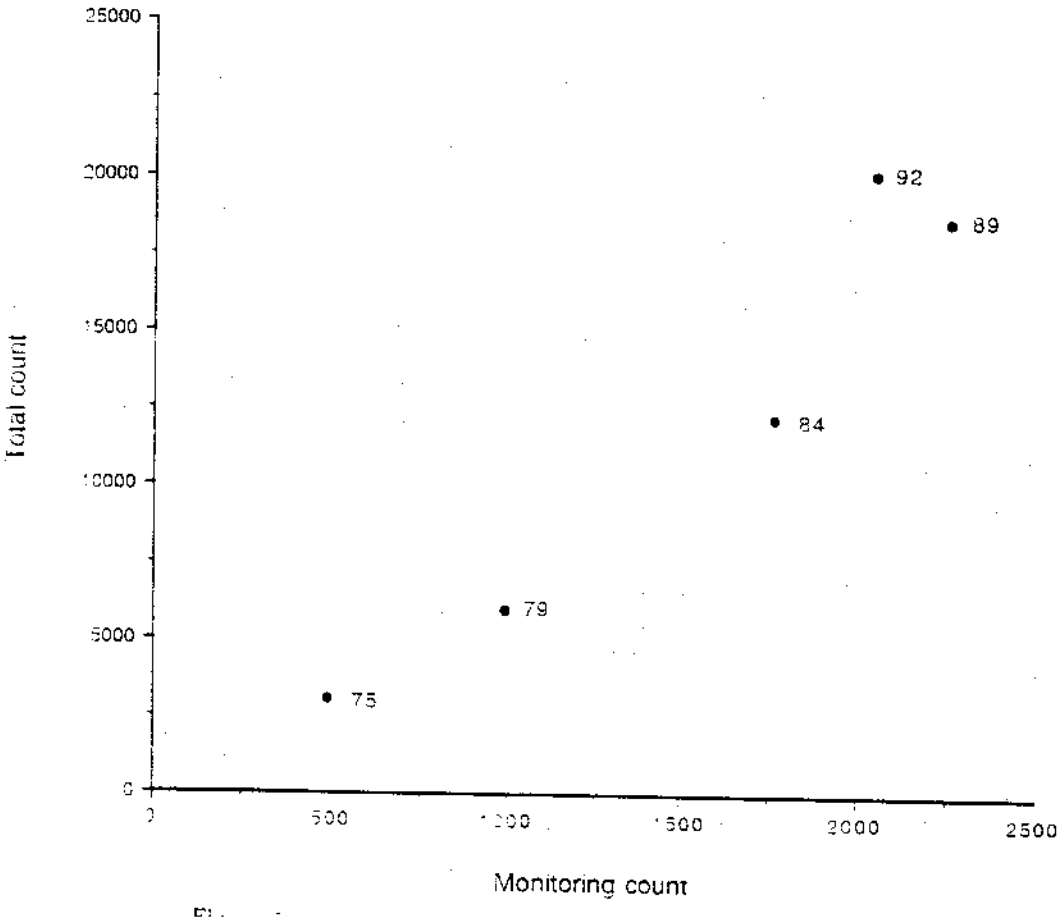

Figure 3. The relationship between total population counts and monitoring counts for the five years when both counts were made.

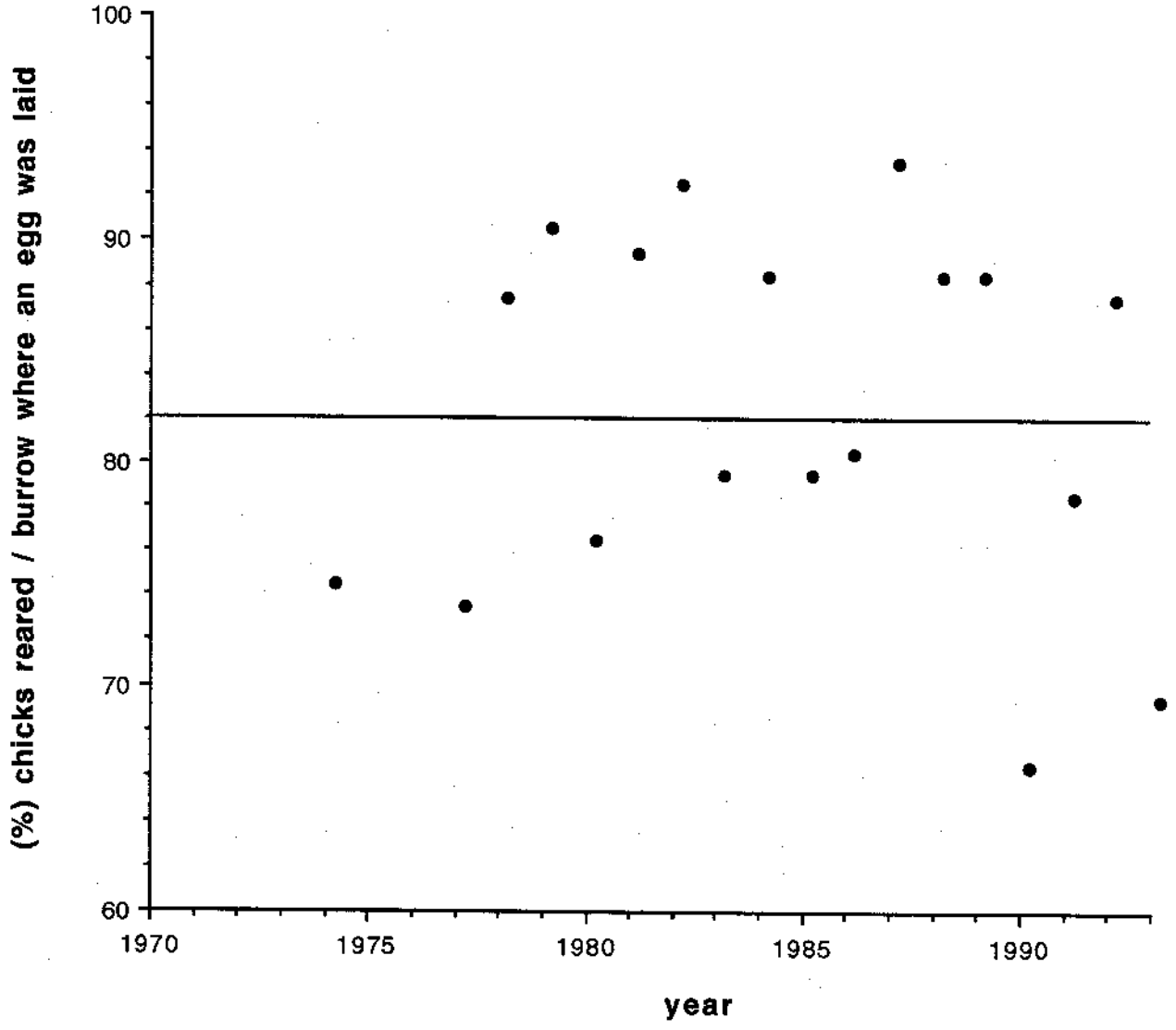

Figure 4. Breeding success of puffins 1974-93.

Puffin with many small sandeels

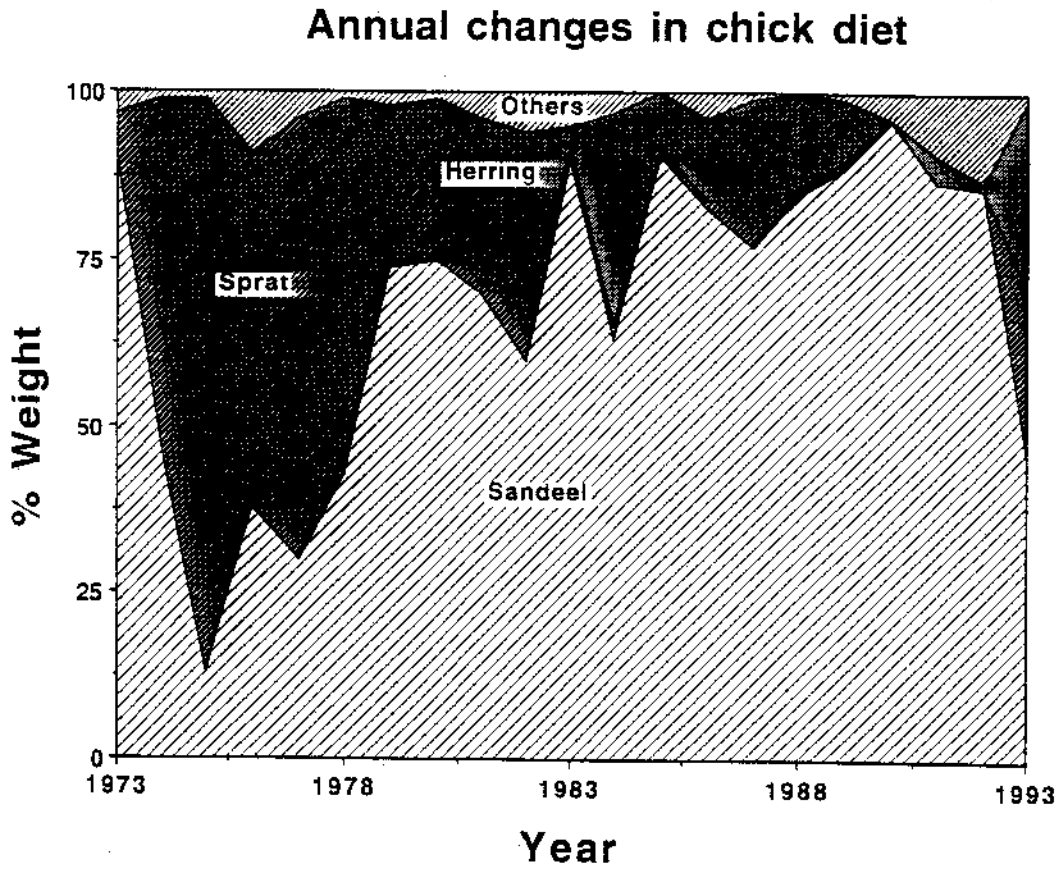

Figure 6. Diet of young puffins on the Isle of May, 1973-93.

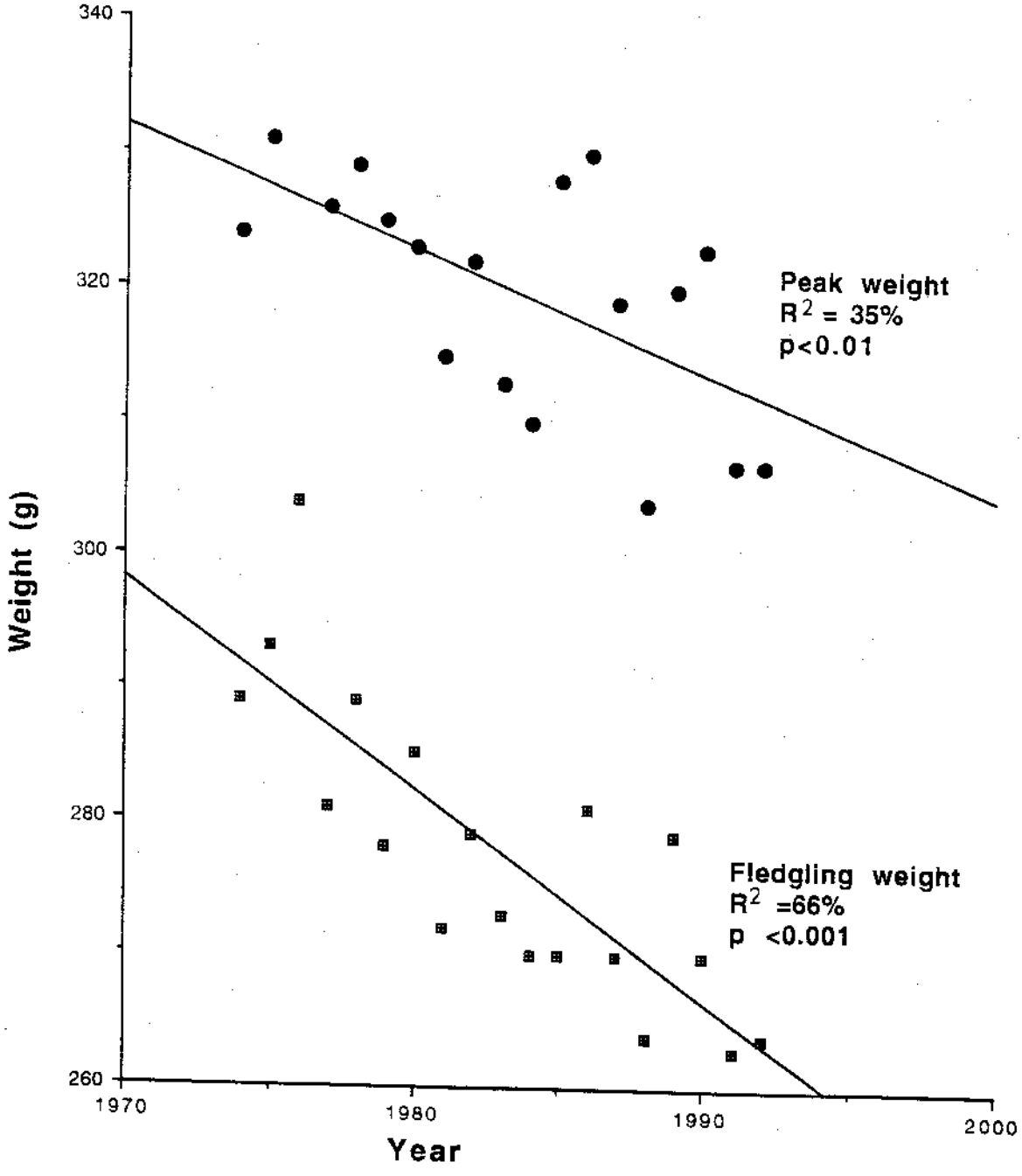

Figure 5. Annual mean peak and fledging weights of puffin chicks, 1973-93. In both cases, there is a significant linear decline with year.

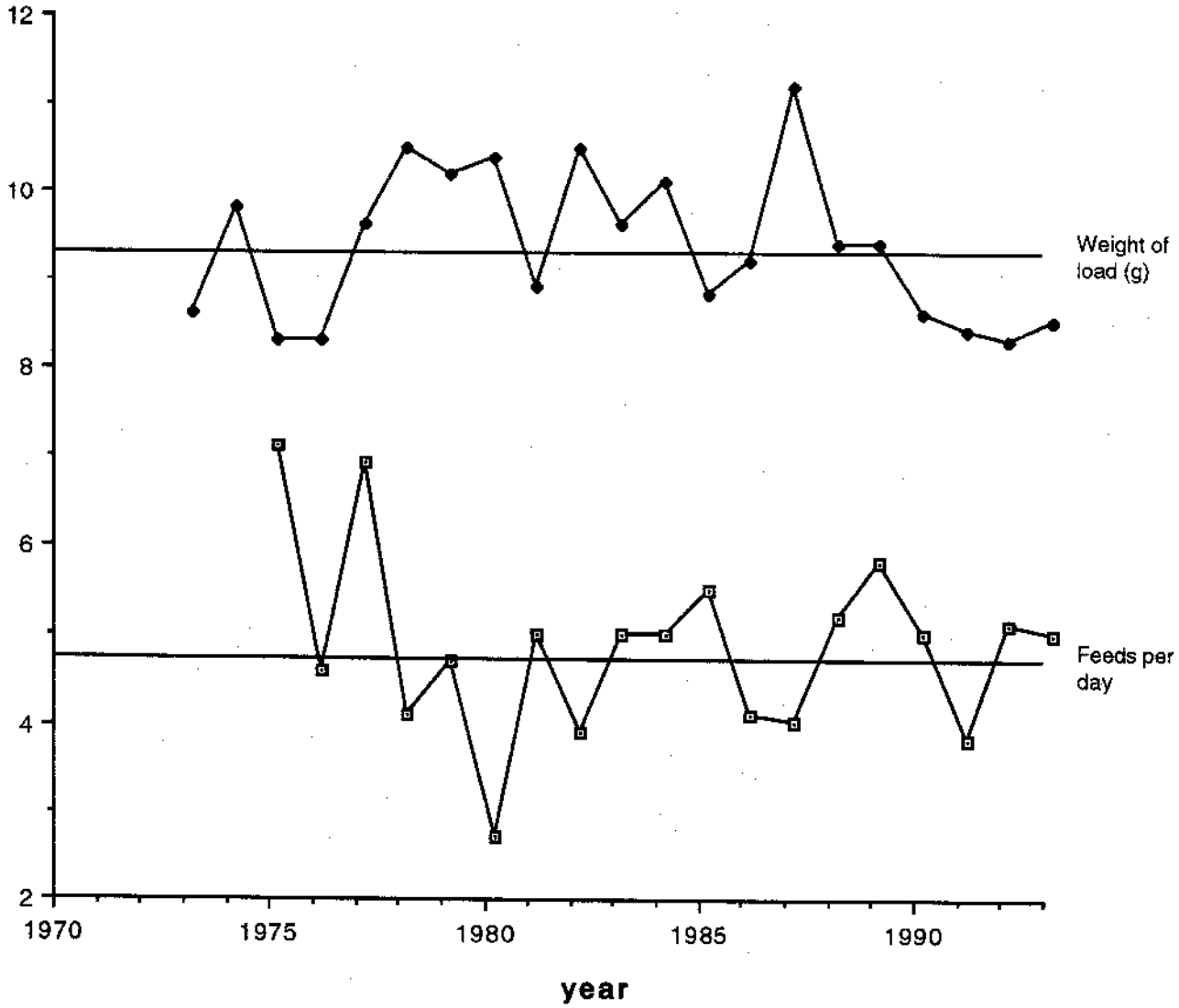

Figure 7. The annual mean meal load size (g. of fish) and daily feeding frequency of puffin chicks (1973-93).

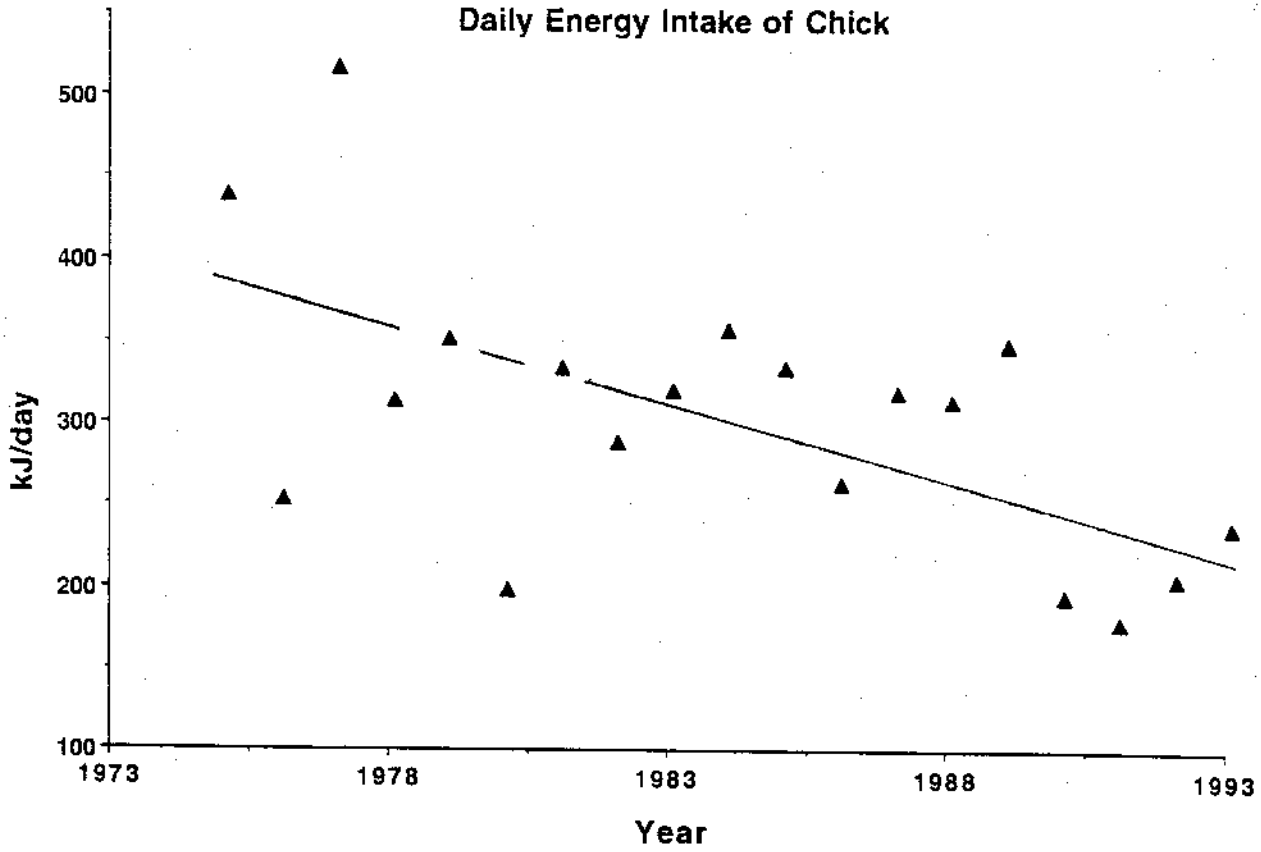

Figure 8. Calculated energy intake of young puffins, 1974-93. There is a significant decline (averaging 9 kJ per day) over the period (R^2 = 30%, P<0.02).

sprattus) 4 and 1%. In only 3 years (1973, 1983 and 1985) of the 20 years for which we have data have Clupeidae made up less of the diet (Figure 6). This has important consequences as Clupeidae, especially sprat, have a high calorific density whereas the species which have replaced them, mainly Gadidae, are poor food value.
The situation was somewhat different in 1993 as 30% of the fish were small herring (Table 6). As, on average, these herring were much heavier than the sandeels, they contributed 53% of the diet by weight. This season guillemots also brought in a high proportion of Clupeidae for their chicks.

The mean weights of a load of fish brought to a chick was 8.3 ± SE 0.3 g (n = 127) and 8.2 ± 0.4 g (n = 126), and 8.4 g ± 0.3 g (n = 217) in 1991, 1992 and 1993, respectively. Chicks received, on average more feeds per day in 1992 (5.0, n = 15 days of watches) and 1993 (4.9, n = 3 days) than in 1991 (3.7, n = 7 days; see Tables 4 & 6).

Analysis of the feeding data are being made by C. Wernham but generally 1991, 1992 and 1993 appeared to be typical years (Figure 7). However, when the mass of fish eaten by a chick is converted into energy terms it is apparent (Figure 8) that over the last 20 years there has been a gradual and significant decline in the daily energy intake of chicks. This is presumably responsible for the similar gradual decline in the weights of chicks (earlier).

4.5 Proportion of immatures in the population

In July 1991 11.2% of the 2412 birds examined were immature, in 1992 the figure was 8.6% of 3553 (Table 7). Although higher than the annual estimates in 1985-88, these figures are well below those of 15-37% recorded between 1977 and 1982 (Table 8). In 1993, the proportion of immatures in early July was low but by the end of the second week it had increased to 33%; the overall 1993 average was 21%.

4.6 Moult of adults

Adults have a complete moult, during which they are flightless, in the late winter. During this moult the face lightens as the dark winter feathers are replaced by pale summer ones. Occasionally a bird retains winter feathers; this does not prevent it breeding. In the last 1980's, the proportion retaining some winter feathers in the spring reached 27%, which suggested that birds might be having difficulty in completing their moult during the winter. The pattern has changed again, and in 1992 only a single bird out of 544 examined closely had any dark feathers (Table 9). The significance (if any) of these changes is unclear.

4.7 Adult survival

Of 229 colour-ringed adults known to be alive in 1990, 177 (77.3%) survived to 1991. Comparable survival figures for 1991-1992 were 267 (91.4%) of 292. During the summer of 1993 it was difficult to see the legs (and hence the colour-rings) of puffins as the grass grew exceptionally long. At the main study site (Little Hide) we cut the grass, which improved matters considerably. This was not possible at Colm Hole, so the results from here must be treated with caution. Survival at Little Hole was 89% (204/229 survived) whereas at Colm Hole it was only 62% (42/68). These figures will both be underestimates of true survivals as not all birds alive are recorded every year, some probably because they do not return, others because they are overlooked. Thus any estimate of survival will improve in subsequent years as some of the missing birds are recorded.

Survival of adults at Little Hole has been significantly higher than that of birds at Colm Hole for the last two years (Table 10) but not earlier in the study. I am worried that as most important work (return of immatures, studies of divorce and burrow retention) in now undertaken at Little Hole we do not have sufficient time to do justice to the birds at Colm Hole. I may decide to abandon this area.

Although annual survival in recent years has been undoubtedly much lower than it had been in the 1970s (Figure 9), the problems involved in allowing for missing birds make it difficult to say by how much. During the coming year attempts will be made to overcome this using recently developed (maximum likelihood) models.

Many of the colour-ringed adults are now of known sex (Table 11) and it is now possible to test for differences in the survival rates of the sexes. There are none (!) (Table 12). Some of our marked birds are now at least 25 years old and in a few years our new study using permanently marked burrows will enable us to follow the performance of these old birds and compare it with that of much younger individuals.

4.8 Mate and site fidelity

In anticipation of BP Exploration funding. C. Wernham marked 62 burrows in 1990, many of which had colour-ringed birds breeding in them. In 1991 and 1992 we followed 95 such burrows. At the end of 1993, 92 of these burrows had both adults colour-ringed, and 7 others had just one. Details of matings and burrow occupancy are given in Table 13.

4.8.1 Mate fidelity

At the end of the 1990 season there were 37 pairs where both adults were colour-ringed, in 1991 25 birds bred with the same mates, and three birds bred with different mates even though their original mates were still present in the colony (i.e. a divorce rate of 3/28 = 11%). In the remaining nine pairs, one

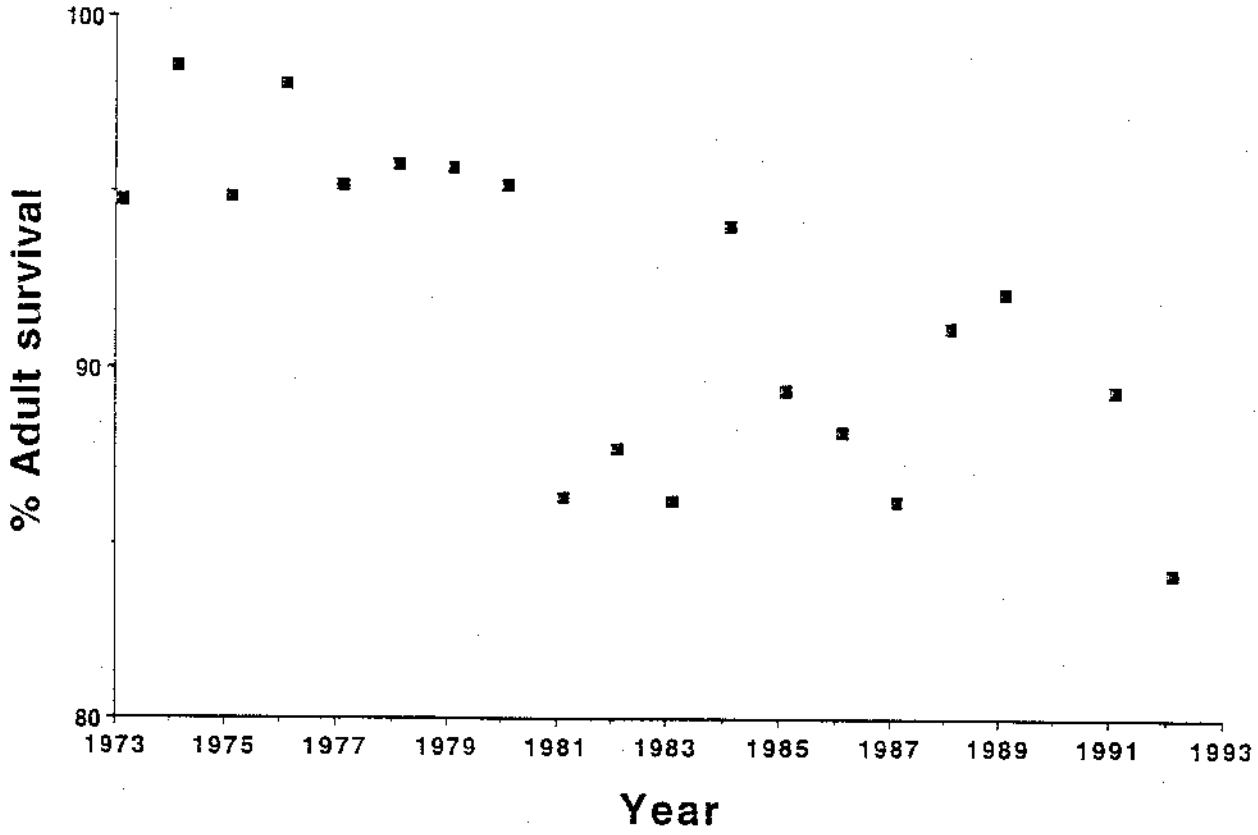

Figure 9. Annual survival rates of breeding puffins 1973-93. The year shown on the x-axis is the first year (e.g. 1973 = survival 1973-1974). The latest estimate is minimal as some birds not seen could will be still alive.

bird had disappeared.

Of 36 new pairs in 1991, 31 remained the same in 1992, divorce occurred in four (11%) and in one a bird had disappeared. Of 24 pairs which remained together from 1990 to 1991 which could be followed again in 1992, 21 pairs remained unchanged, one pair divorced and in two pairs one bird did not return.

Of 18 new pairs in 1992, 17 (95%) remained the same in 1993 and one divorced (5%). Of the 60 pairs in 1992 which had bred together previously, 50 (84%) remained the same, five (8%) divorced and five birds (8%) took new mates when their original mates had failed to return.

Pooling years and using each pair only the first year we followed it, there were eight divorces from 81 pairs (10%). Using all possible pair-years the divorce rate was 9% (14/158).

Unsuccessful pairs were no more likely to divorce than were pairs which reared a chick. Between 1990 and 1991 3 (12%) of 25 successful pairs divorced whereas all three unsuccessful pairs remained together. Between 1991and 1992 the figures were four divorces (9%) among 47 successful pairs and 2(12%) from 19 unsuccessful pairs. The figures for 1992-93 were one divorce (3%) from 39 successful pairs and three (9%) from 33 unsuccessful pairs.

4.8.2 Site fidelity

Birds usually re-used their previous burrow:-

	1990-91	1991-92	1992-93	Total
Both pair members in same burrow in Year II as in Year 1	21	56	61	138
Both pair members to different burrows in Year II	4	4	6	14
Divorce				
Male in same burrow, Female elsewhere	2	2	0	4
Female in same burrow, Male elsewhere	0	3	3	6
Both separately to new burrows	1	1	3	5

	1990-91	1991-92	1992-3	Total
Male disappeared				
Female in same burrow	3	2	2	7
Female in different burrow	1	0	0	1
Female disappeared				
Male in same burrow	4	1	1	6
Male in different burrow	1	0	1	2
Unsexed disappeared				
Mate in same burrow	0	0	1	1
	37	69	78	184

Most detailed observations were made 1990-92. Then of the 8 instances where pairs moved together to new burrows, 3 pairs moved from accessible nest boxes to deep natural burrows, 3 moved to deep burrows from shallow natural burrows. In one instance a pair moved at the end of the season after breeding had been unsuccessful and the final case involved a pair which moved after the 1990 season and returned to their previous burrow in 1992. In all cases the new burrow was either unoccupied the previous season or both the owners had disappeared (1 case).

4.9 Immature survival

Each year 1989-1992, young raised in burrows in the main study area were marked with both numbered and colour-rings. The colour-rings were a year specific colour (green in 1991, blue in 1992) and each had a unique two-letter combination engraved on it. Such colour rings can be read at a considerable distance and will allow us to follow the survival of these birds without having to catch them.We also hope to get information on their occurrence at other colonies (Appendix 1).

Seven of these chicks have been recorded dead away from the Isle of May:

EN04215	1989 chick	
	23 Feb 1990	Dead on beach, Noord-Holland 52°28′N 4°38′E 622 km; 236 days
EN04042	1989 chick	
	9 Nov 1990	Shot, near Nolsoy, Faeroes 61°59′N 6°49′W 689 km, 506 days

EN96495	1990 chick 9 Nov 1990	Shot, Nolsoy, Faeroes 61°59'N 6°40'W 684 km, 146 days
ER44025	1990 chick 14 Jan 1991	Dead among many other dead puffins, Holm, Orkney 303 km, 202 days
ER44157	1990 chick 9 Feb 1991	Dead among many other dead puffins, Scapa Bay, Orkney, 308 km, 229 days
ER44042	1990 chick 1 Jun 1990	Dead, Druridge Bay, Northumberland 118 km, 218 days
ER45283	1991 chick 3 Apr 1992	Oiled, Hartlepool 187 km, 282 days

The main aim of the colour-ringing was to document (a) the survival of these birds and (b) determine the extent of inter-colony movement. To date 86 individuals have been recorded back on the Isle of May.

Year chicks ringed	No.	No. seen in			Total individuals seen
		1991	1992	1993	
1989	172	0	28	30	44
1990	146	1	11	19	26
1991	150	-	0	16	16
1992	168	-	-	0	0

This total included 26% of the 1989 chicks, 18% of the 1990-chicks and 11% of the 1991-chicks. None have yet bred, but several were attempting to obtain burrows. This is as expected since most puffins do not breed until they are five years old.

There is every reason to suppose that this project will be successful in measuring the survival of these chicks to breeding age.

4.10 Population dynamics

Previous analyses of the long-term data set had shown that the Isle of May puffin population increase started to slow down about 1987 and this coincided with an approximate doubling of the over-winter mortality which correlated with a collapse of the North Sea sprat stocks (Figure 10).

The data presented in the preceding sections can be used to calculate theoretical rates of population change for Puffins on the Isle of May which can be compared with the trends shown by the annual counts of occupied burrows.

The study period was divided into three pairs; first, the steady increase phase up to 1981, second, the period of slower increase and stability from 1981-88 and third, the most recent years (1989-93). Two calculations of theoretical population changes were made for each period (below). These used the proportion of young reared and calculated to have survived to breeding age based on: (a) just those returning to the Isle of May, and (b) including those that emigrated (assuming that emigration was balanced by equal immigration). These figures were obtained earlier in the study.

The calculations of changes in a population of 1000 burrows holding pairs for the three period were:

		1973-81		1982-8		1989-93	
		(a)	(b)	(a)	(b)	(a)	(b)
i	Chick production	0.84		0.84		0.78	
ii	Proportion of pairs laying	0.90		1.00		1.00	
iii	Chicks fledged per 1000 pairs	756		840		780	
iv	Survival of young to breeding age	28%	52%	18%	33%	18%	33%
v	Number of young surviving to breeding age (iii x iv)	212	393	151	277	140	257
vi	Adults dying	80	80	172	172	173	173
vii	Surplus (v-vi)	132	313	-11	105	-33	84
viii	Calculated annual increase of population	+7%	+6%	-1%	+5%	-2%	+4%

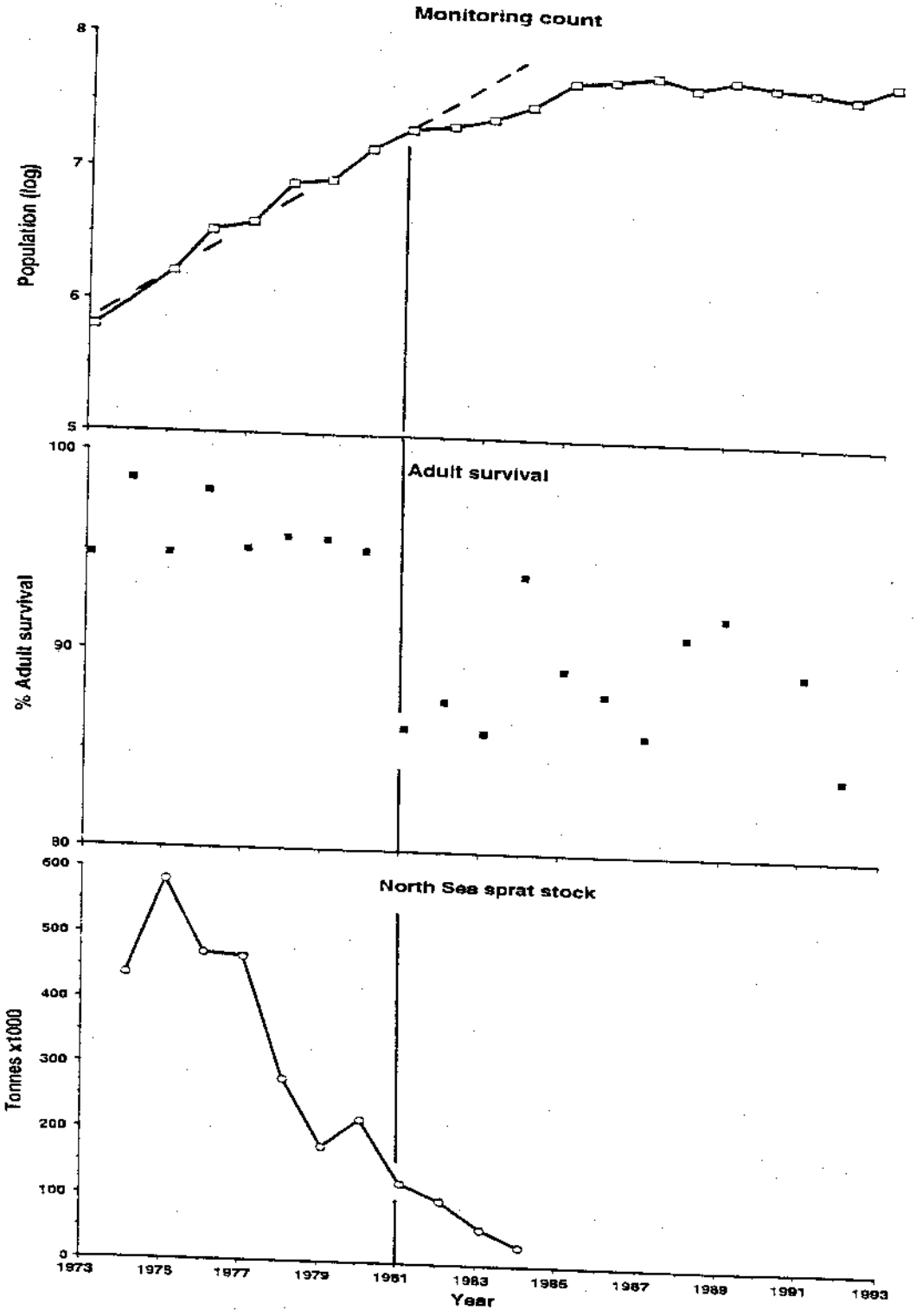

Figure 10. Timing of cessation of population increase of Isle of May puffins, reduction in adult survival and sprat stocks in the North Sea.

Between 1973 and 1981 the numbers of Puffins on the Isle of May could have increased by either (a) 7 per cent p.a. or (b) 16 per cent p.a.. The observed increase in the number of burrows from 1973 to 1981 averaged 19 per cent p.a. which suggests that there net immigration. Between 1982 and 1988, numbers should have either (a) decreased by 1 per cent p.a. or (b) increased at 5 per cent p.a.. In fact the number of burrows incresed between 1982 and 1984 and then stabilized. This could have been due to fewer birds coming from other colonies, but the data for immature survival for this period are limited so it may well be that survival of birds reared on the Isle of May is lower than suggested by the results from the 1978 cohort.

Between 1989 and 1993 the calculated annual population change should have been somewhere between a 4 percent increase (b) and a two per cent decrease (a). In fact the population increased by an average of 0.8% per annum. This calculation is of necessity rather speculative as it relies heavily on the survival to breeding age estimates obtained 15 years ago. The current project is aimed mainly at getting more relevant recent data. The proportion of immatures in the population in 1991 and 1992 suggested that survival of young birds had indeed been reduced; however the doubling of the proportion present in 1993 points to at least one age-class, possibly that of 1990, having survived quite well. The available evidence suggests that the population should remain more-or-less stable.

4.11 Ingested Elastic and other Artifacts over a 24-year Period

In 1969-70 the numbers of puffins nesting in Britain and Ireland were found to be much reduced compared to previous years. Coincidentally, lengths of elastic were recovered from the stomachs of puffins shot off Norway or found dead in eastern Britain, and the ingestion of such pollutants was considered a possible causative factor in the decline of the puffin. This section reports on artifacts in the stomachs of puffins in the North Sea between 1969 and 1992.

The puffins examined were of two types. The first of these included dead birds found washed ashore or blown inland along the British North Sea coast (191 birds). Most of these individuals died during the winter and early spring. The birds were grouped by bill characters into first-year, immature (2-3 years old) and adult (older, and potentially old enough to breed). The second puffin type included apparently healthy adults found freshly dead after attack by predators, collision with obstacles or having been killed (under licence) for pesticide residue analyses at the Isle of May, Firth of Forth (124 birds), the Atlantic coast colonies of St Kilda (17 birds), and the Shiant Islands (12 birds) in the Western Isles. Ringing recoveries and morphological studies indicate that most birds washed ashore in winter on North Sea coasts come from the East British and South Norwegian population. The two types of adult puffins from the North Sea should, therefore, be broadly comparable.

The stomach (including the proventriculus) was removed, turned inside-out and thoroughly flushed in running water. All remains present were collected and examined under a binocular microscope. Birds were sexed by dissection but as there

were no detectable differences in the occurrence of artifacts, results from the two sexes were pooled. Data were grouped into three- or four-year periods to coincide with the main periods of field activity on the Isle of May.

Artifacts were found in 42 (13.3%) of the stomachs from 315 North Sea birds.

	Found dead				**Killed**			
	First year Artifact		**Immature Artifact**		**Adult Artifact**		**Adult Artifact**	
Period	**present**	**absent**	**present**	**absent**	**present**	**absent**	**present**	**absent**
1969-72	2[1]	1	0	1	4	4	no records	
1973-76	0	2	0	2	2	25	0[1]	27
1977-80	0	2	1	1	0	9	3(1)	21
1981-84	3[2]	2	3[2]	6	2(1)	26	4(1)	33
1985-87	no records		no records		no records		1	18
1990-92	1(1)	9	1	19	3[1]	52	0(1)	13
Combined total	**10**	**16**	**7**	**29**	**13**	**116**	**12**	**112**

Thirty stomachs contained elastic, seven (numbers in square brackets) incuded cylindrical tablet-shaped "plastic" granules and five stomachs (in round brackets) contained nylon and other synthetic thread. As noted by other workers, puffins swallow elastic of a range of types (from elastic bands 7 mm across to thin threads, apparently from rotted garments), various colours (red, black, white) and a range of lengths (1-20 cm). Most puffin stomachs contained only a few short elastic fragments, but two from dead birds held cylindrical balls (10 x 40 mm) of tangled black elastic and another four puffin stomachs contained elastic bands. There was a similar wide variety among the types of nylon encountered, and one stomach from a bird found dead contained a 30 x 10 mm ball of black thread. In the three birds discussed above with large elastic or thread balls in their stomachs, approximately half of the space in the stomach was filled with the artifacts and it is probably that these would have interfered with digestion. The "plastic" granules encountered in numbers varying from 1 to 20 per stomach were 1-3 mm in diameter.

There was no significant difference between the frequency of occurrence of artifacts in apparently healthy adults from the Isle of May and those found dead elsewhere, indicating that the ingestion of elastic or other pollutants was unlikely to be the cause of death (Table 1, $\chi^2 = 0.01$, n.s.).

Such a heterogenous data set as this makes it difficult to assess temporal changes. Pooling all the adult samples into three equal time periods (1969-76, 1977-84 and 1985-92) suggests a gradual decline in the frequency of occurrence of artifacts (11%, 9%, 6%), but differences between the groups of years were not statistically significant ($\chi^2 = 1.61$, n.s.).

Among birds found dead, the occurrence of artifacts varied significantly with age ($\chi^2 = 13.8$, $P<0.01$)), with the frequency being higher in first-year birds (38%) compared with immature puffins (19%) and adults (10%. Puffins eat a wide variety of small fish and marine invertebrates and presumably they mistake elastic, nylon and other artifacts for their normal prey. The higher frequency of occurence of artifacts among younger birds could therefore be due to this age group being less adept at distinguishing such items from genuine prey. In contrast to some other seabirds such as gulls, cormorants and albatrosses that regularly produce pellets containing indigested food remains, puffins and other auks normally appear to digest their food completely. Artifacts might therefore be expected to accumulate in the stomach throughout the lifetime of an individual. However, results from this study do not provide any clear evidence of such an accumulation over time. Hence, it appears that while the chances of swallowing artifacts are higher in young birds, they can be ingested at any time. Once in the stomach, artifacts may eventually break down sufficiently to be passed out through the gut, or possibly are regurgitated.

The numbers of pairs of puffins breeding on the Isle of May increased on average by 19% *per annum* between 1973 and 1981 (when the frequency of artifacts was relatively high) and remained stable between 1985 and 1992 (when the frequency was lower). Similar population changes appear to have occurred throughout the North Sea during this time. It is therefore unlikely that ingested artifacts have had a serious impact on puffin numbers.

5 ACKNOWLEDGMENTS

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6 PUBLICATIONS ON PUFFINS IN 1991-93

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Table 1 Counts of occupied puffin burrows on the Isle of May on 25-29 April 1992 compared to counts in 1975, 1984 and 1989.

Area	1975	1984	1989	1992
Kirkhaven to Colm Hole	345	1518	2458	2525
Colm's Hole to Low Light				
Quadrat	144	378	570	612
Rest	968	2408	3522	4530
TOTAL	1112	2786	4092	5142
Holyman's Road (West side)				
South of Colm's Hole	40	561	1068	1078
North of Colm's Hole	63	347	517	414
Low Light to Tarbet	75	380	795	497
Tarbet (south)	0	0	0	19
Rona				
East quadrats	34	165	211	233
West quadrats	19	46	80	70
Rest	496	2360	2946	3015
TOTAL	549	2571	3237	3318
North Ness	160	225	371	286
North Plateau				
Horse Hole quadrat	147	609	656	556
Bishop's Cove quadrat	76	163	79	169
North of Three Tarn	83	1193	1698	2531
South of Three Tarn incl. Mill Door	10	182	226	590
TOTAL	316	2147	2659	3846
South Plateau				
Pilgrim's Haven to Loch	23	105	394	389
Loch Sides	c.10	c.100	c.150	246
TOTAL	33	205	544	635
South Horn	9	15	c.100	150
Maidens	5	2	0	0
Ardcarron	113	274	635	530
Lady's Bed	244	1180	2152	1620
East Braes	0	0	0	20
Horse Hole to Altarstanes	0	0	0	20
St Andrew's Well	0	0	0	6
GRAND TOTAL	**3064**	**12211**	**18628**	**20106**

The 1992 count was made by S. Wanless, C. Wernham, J. Calladine and M.P. Harris

Table 2. Annual counts of apparently Occupied Burrows in permanently staked quadrats on the Isle of May. (a) is the main long-term area, (b) includes areas added in eroded* or newly-colonized+ areas.

	Location	Area (m^2) Total	Excluding rock	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993
(a)	Rona (W)	800	400	19	22	18	24	30	27	34	36	33	46	46	37	54	65	103	59	55	70	101
	Rona (E)	400	360	34	51	102	130	142	117	148	140	163	165	201	189	233	222	211	213	253	233	205
	Horse Hole	2000	1600	147	173	146	268	208	324	400	416	430	609	633	600	663	550	656	721	620	556	569
	Bishop's Cove	1024	768	57	67	75	99	106	155	177	159	155	163	203	172	198	205	79	126	195	169	197
	Lady's Bed	1450	1450	35	53	100	124	146	217	264	263	267	266	342	333	393	353	412	251	280	306	333
	Burrian	1200	1050	144	179	192	235	215	286	289	353	399	378	552	580	558	568	570	686	632	612	740
	Holyman	396	337	53	78	81	78	147	130	146	144	152	141	165	113	190	150	229	116	105	105	169
Monitoring Total				**489**	**623**	**714**	**958**	**994**	**1256**	**1458**	**1511**	**1599**	**1768**	**2141**	**2024**	**2289**	**2113**	**2260**	**2172**	**2140**	**2051**	**2313**
(b)	North Ness eroded ridge*	400		76	43	76	90	71	73	82	91	79	66	87	104	81	66	63	61	44	74	68
	North Ness eroded bank*	1000		77	78	111	107	95	92	92	103	103	91	66	88	85	103	98	94	92	86	98
	Rona Seals*	1125	900								135	108	109	131	136	179	151	151	156	150	149	152
	North Plateau (a)+												4	6	5	8	9	13	14	17	19	20
	(b)+												12	10	19	13	40	49	44	40	53	59

Table 3. Breeding success (chicks present at start of fledging period/number of burrows where an egg was known to have been laid) of puffins in 1991, 1992 and 1993. Area details of the 1991 count were lost in the arson attack but 50 burrows were initially marked in each area.

	Area	Successful	Total laid	
1991	**Total**	136	174	**0.78**
1992	Lady's Bed	37	46	**0.80**
	Kettle	41	49	**0.84**
	Rona	42	44	**0.95**
	Burrian	40	45	**0.89**
	Total	**160**	**184**	**0.87±0.03**
1993	Lady's Bed	29	45	**0.64**
	Kettle	26	42	**0.62**
	Rona	41	53	**0.77**
	Burrian	31	42	**0.74**
	Total			**0.69±0.04**

Table 4 Food and feeding frequency of young puffins on the Isle of May in 1991.

	Food	Sample	Mean	S.E.
a)	Load weight (g)	127	8.3	0.34
b)	Fish/load	127	7.6	0.43
c)	Numbers and lengths of fish (mm)			
	Sandeels *Ammodytes* sp.	826	70.3	0.65
	Herring *Clupea harengus**	52	56.2	1.32
	Rockling probably *Gaidropsarus ciliata*	6	36.3	1.2
	Saithe *Pollarchius virens*	38	58.0	1.4
	Cod *Gadus morhua*	4	59	7.0
	Unidentified Gadidae	2	62,72	
	Squid	1	57	

* includes some unidentifiable small Clupediae

Feeding frequency

3 June	33	5.5 ± 2.7
9 June	38	4.6 ± 2.5
16 June	39	5.4 ± 2.4
23 June	41	2.2 ± 1.8
29 June	33	4.5 ± 2.7
7 July	25	0.7 ± 1.2
15 July	16	3.2 ± 2.2
Mean		**3.7**

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

(2) Puffin feeding frequencies were from watches organised by C. Wernham

Table 5 Food and feeding frequency of young puffins on the Isle of May 1992.

	Food	Sample	Mean	S.E.
a)	Load weight (g)	126	8.2	0.4
b)	Fish/load	126	6.7	0.4
c)	Numbers and lengths of fish (mm)			
	Sandeels *Ammodytes* sp.	670	71.3	0.9
	Herring *Clupea harengus**	9	64.3	4.3
	Rockling probably *Gaidropsarus ciliata*	73	42.6	1.0
	Saithe *Pollarchius virens*	76	42.6	0.9

Feeding frequency

(a)	16 June	14	3.1 ± 0.7
	25 June	17	1.8 ± 0.4
	5 July	21	5.1 ± 1.8
	13 July	22	3.7 ± 0.4
	18 July	21	5.4 ± 1.0
	22 July	20	6.6 ± 0.7
	27 July	16	10.4 ± 2.2
	31 July	14	8.1 ± 1.1
	4 August	13	5.5 ± 1.2
	8 August	9	4.8 ± 1.3
(b)	13 June	20	4.7 ± 0.6
	21 June	20	4.1 ± 1.7
	27 June	20	4.3 ± 1.9
	8 July	20	3.0 ± 0.5
	16 July	11	4.5 ± 1.1
	Mean		**5.0**

Notes (1) Based on all-day watches by observers taking 2-3 hr shifts.
(2) Puffin feeding frequencies were from watches organised by C. Wernham.
(3) Puffin (b) is an area not watched in previous years.

Table 6. Food and feeding frequency of young puffins on the Isle of May in 1993.

	Food	Sample	Mean	S.E.
a)	Load weight (g)	217	8.4	0.3
b)	Fish/load	217	6.9	0.3
c)	Numbers and lengths of fish (mm)			
	Sandeels *Ammodytes* sp.	849	62.1	0.6
	Herring *Clupea harengus**	370	64.5	0.3
	Saithe *Pollarchius virens*	6	50.5	1.5
	Squid	1	35	

* includes some unidentifiable small Clupediae

Feeding frequency

16 June	53	4.8 ± 0.3
8 July	54	4.8 ± 0.3
13 July	22	5.0 ± 0.4
Mean		**4.9**

Notes (1) Based on all-day watches by observers taking 2-3hr shifts

(2) Puffin feeding frequencies were from watches organised by C. Wernham

Table 7. Proportion of immature puffins among puffins standing at colonies on the Isle of May in 1991, 1992and 1993.

	Number of bill grooves							
	Immature						Adult	%
	0	trace	½/¾	1	1½	1¾	2 or more	Immatures
1991								
11 June	0	0	13	15	14	13	701	6.0
17 June	0	0	7	7	12	18	399	9.9
30 June	0	0	5	1	1	10	122	12.3
1 July	0	1	12	13	22	36	585	12.6
2 July	4	2	17	13	18	20	422	14.9
6 July	0	0	39	22	25	19	1020	9.3
7 July	0	0	3	4	0	1	114	6.6
Total in July	4	3	71	52	65	76	2141	11.2
1992								
2 July	0	0	3	1	13	2	220	7.9
3 July	0	3	6	5	10	7	610	4.8
5 July	1	5	10	4	15	14	391	11.1
7 July	0	4	13	12	32	30	1180	7.1
9 July	0	3	11	6	14	6	245	14.0
11 July	3	2	6	13	17	10	406	11.1
15 July	1	5	3	2	14	1	192	11.9
Total in July	5	22	52	43	115	70	3244	8.6
1993								
6 July	0	6		1	5		112	9.7
7 July	0	2		8	13		109	6.8
8 July	1	12		8	40		459	11.7
10 July	3	46		20	54		331	27.1
11 July	1	19		11	11		102	29.2
12 July	3	48		24	21		198	32.7
13 July	0	26		29	37		336	21.5
Total in July	8	159		101	181		1647	21.4

Table 8. Proportion of immatures among puffins present at the colony 1 - 15 July each year 1976-93.

		Total Number	
	Year	**Total up to 15 July**	**% immature**
Mist-netted	1976	676	12
	1977	491	15
	1978	739	28
	1979	277	22
	1980	380	37
	1981	527	15
	1982	753	15
	1983	503	22
	1984	502	14
	1985	101	5
	1986	317	10
	1987	94	0
	1988	47	0
	1989	238	17
Telescope observations	1989	1107	15
	1991	2141	11
	1992	3244	9
	1993	3743	21.4

Note: An immature was defined as any puffin with less than two completely developed bill-grooves.

Table 9. Proportions of puffins examined prior to the breeding season which showed traces of winter plumage.

Year	Date	Total examined	No. with traces of winter	% Winter
1973	9 - 11 April	160	0	0
1974	23 March - 10 April	440	1	<1
1975	21 March - 10 April	539	1	<1
1976	21 - 30 March	240	0	0
1977	30 March - 10 April	345	0	0
1978	29 March - 6 April	328	0	0
1979	1 - 11 April	107	2	2
1980	31 March - 6 April	314	0	0
1981	3 - 11 April	704	6	<1
1982	27 March - 10 April	885	10	1
1983	4 - 10 April	239	13	5
1984	2 - 5 April	171	2	1
1985	5 April	105	2	2
1988	27 March	287	77	27
1989	25 - 27 March	816	6	<1
1991	late March	?	?	very few
1992	7 April	544	1	<1
1993	22-25 March	604	8	1.3

Note: no observations were made in 1986 and 1987

Table 10. Survival of adult puffins at the two main study areas.

Year	Colm Hole		Little Hide	
	n	% survived	*n*	% survived
1984-5	107	97.2	70	95.7
1985-6	92	95.7	75	92.0
1986-7	104	92.3	72	88.9
1987-8	98	84.7	64	90.6
1988-9	84	94.0	61	90.1
1989-90	111	84.7	64	78.1
1990-1	81	75.3	148	78.3
1991-2*	83	84.3	209	94.2
1992-3*	68	(61.8+)	229	89.0
Mean		85.5%		88.6%

Note: Estimate for the areas significantly different (χ^2-test, $P<0.01$).

Table 11. Details of colour-ringed puffins on the Isle of May in 1982-93.
The columns are:-

Bird number
Ring number
Colours on left leg (zzz = missing, BTO = number)
Colours on right leg
Sub-colony
Sex (if known)
Next columns = 1982, 1983, ... 1993
* = seen
1 = seen at Colm
Other numbers = burrow number at Little Hide

24	EJ70998	BLU-BTO	YEL-RED	COLM	?	1	1	1	-	-	-	-	1	-	1
92	EB21655	RED-RED	RED-BTO	COLM	?	1	-	1	1	1	1	-	-	-	-
93	EB21223	RED-GRN	RED-BTO	COLM	F	1	-	1	1	1	1	1	1	1	1
94	EB32183	BLK-RED	RED-BTO	COLM	?	1	1	1	-	-	-	-	-	-	-
95	EB21986	BLK-WHI	RED-BTO	COLM	?	1	1	1	1	1	-	-	-	-	-
96	EJ08410	BLK-BLU	RED-BTO	COLM	?	-	-	1	1	1	1	1	1	1	-
97	EB98409	WHI-BLU	RED-BTO	COLM	?	1	1	1	1	1	1	1	-	1	1
98	EB21966	WHI-WHI	RED-BTO	COLM	F	1	1	1	1	1	1	1	1	1	-
99	EB32698	YEL-GRN	RED-BTO	COLM	M	1	1	1	1	1	1	1	-	-	-
00	EB21888	YEL-YEL	RED-BTO	COLM	M	1	1	1	1	1	1	-	1	-	-
01	EB32692	RED-BTO	RED-WHI	COLM	M	1	1	1	1	1	1	1	1	1	-
02	EB89709	RED-BTO	GRN-BLU	COLM	M	1	1	1	1	-	-	-	-	-	-
03	EB89700	RED-BTO	BLU-RED	COLM	F	1	1	-	-	-	-	-	1	-	-
04	EB29645	RED-BTO	BLK-BLK	COLM	F	1	-	1	1	-	1	1	-	1	-
05	EB89723	RED-BTO	WHI-RED	COLM	M	1	1	-	-	-	-	-	1	1	-
06	EB29258	RED-BTO	YEL-RED	COLM	M	1	1	1	1	-	-	-	-	-	-
07	EB32683	RED-BTO	YEL-WHI	COLM	F	1	-	1	-	-	-	-	-	-	-
08	EB21417	RED-BTO	GRN-YEL	COLM	?	-	1	1	-	-	-	-	-	-	-
09	EB21743	RED-YEL	BLU-BTO	COLM	?	1	-	1	1	1	1	1	1	-	1
10	EB21751	BLU-BLK	BLU-BTO	COLM	?	1	1	-	-	-	-	-	-	1	1
11	EB21737	BLU-YEL	BLU-BTO	COLM	F	-	1	1	1	1	1	-	1	1	-
12	EB21455	GRN-BLK	BLU-BTO	COLM	?	1	1	1	1	1	1	1	1	1	1
13	EB21452	GRN-WHI	BLU-BTO	COLM	F	1	1	1	1	-	-	-	1	LIT	-
14	EB21684	BLK-GRN	BLU-BTO	COLM	M	1	1	1	1	1	1	-	1	-	-
15	EB89736	BLU-BTO	RED-RED	COLM	M	1	1	1	1	1	1	-	1	-	1
16	EB94725	BLU-BTO	RED-BLU	COLM	M	1	-	-	-	-	-	-	-	-	-
17	EJ42110	BLU-BTO	RED-BLK	COLM	F	1	-	1	1	1	1	1	1	1	-
18	EB87138	BLU-BTO	RED-WHI	COLM	F	1	1	1	1	1	1	1	-	-	-
19	EJ71006	BLU-BTO	RED-YEL	COLM	M	1	1	1	1	1	1	1	1	1	1
20	EB50353	RED-RED	GRN-BTO	COLM	?	-	-	1	1	1	1	1	-	-	-
21	EB32633	RED-BLU	GRN-BTO	COLM	M	1	1	1	1	1	1	1	-	-	-
22	EB21234	BLU-BLK	GRN-BTO	COLM	F	1	1	1	1	1	1	1	1	1	1
23	EB32646	BLU-YEL	GRN-BTO	COLM	?	1	-	1	1	-	-	-	-	-	-
24	EB18537	GRN-RED	GRN-BTO	COLM	F	1	1	1	-	1	-	-	-	-	-
25	EJ78434	GRN-GRN	GRN-BTO	COLM	?	1	1	1	-	-	1	-	-	-	-
26	EB32644	GRN-BLK	GRN-BTO	COLM	M	1	1	-	-	-	-	-	-	-	-
27	EB18596	GRN-WHI	GRN-BTO	COLM	F	1	1	1	1	1	1	-	1	-	1
28	EB32645	BLK-RED	GRN-BTO	COLM	F	1	1	1	1	1	1	1	-	-	-
29	EB32657	BLK-GRN	GRN-BTO	COLM	F	1	1	1	1	1	-	1	1	-	-
30	EB32667	WHI-BLU	GRN-BTO	COLM	M	1	1	1	1	-	-	-	-	-	-
31	EJ42108	WHI-WHI	GRN-BTO	COLM	?	1	1	1	1	1	1	-	-	-	-
32	EB29002	WHI-YEL	ZZZ-BTO	COLM	?	1	-	1	1	1	1	1	1	1	1
33	EB32654	YEL-BLU	GRN-BTO	COLM	F	1	1	1	1	1	-	-	-	-	-
34	EB79712	YEL-BLK	GRN-BTO	COLM	?	1	1	1	1	1	1	-	1	1	-
35	EB83493	YEL-WHI	GRN-BTO	COLM	?	1	1	1	1	1	-	-	-	LIT	-
36	EB98240	YEL-YEL	GRN-BTO	COLM	?	1	1	1	1	1	1	-	1	1	1
37	EJ83696	BLU-RED	GRN-BTO	COLM	?	-	-	1	1	1	1	1	-	-	-
38	EB98810	WHI-GRN	GRN-BTO	COLM	?	1	-	1	1	-	-	-	-	-	-
39	EB29006	GRN-BTO	RED-RED	COLM	?	1	1	1	1	-	-	-	-	-	-
40	EJ42201	GRN-BTO	RED-WHI	COLM	F	-	1	-	-	-	-	-	-	-	-
41	EB29208	GRN-BTO	RED-YEL	COLM	M	1	1	1	1	1	1	1	1	-	1
42	EB32647	GRN-BTO	GRN-BLK	COLM	F	1	1	-	-	1	-	1	1	1	1
43	EB32642	GRN-BTO	BLK-RED	COLM	M	1	1	1	-	-	-	-	-	-	-
44	EB29004	GRN-BTO	WHI-RED	COLM	?	1	1	1	1	1	-	1	-	-	-
45	EB32651	GRN-BTO	WHI-BLK	COLM	M	1	1	1	1	1	1	1	-	-	1
46	EB29007	GRN-BTO	WHI-ORN	COLM	?	1	1	1	1	-	-	-	-	-	-
47	EB29008	GRN-BTO	YEL-RED	COLM	?	1	1	-	-	-	-	-	-	-	-
48	EB32241	RED-YEL	LIM-BTO	COLM	F	1	1	1	1	1	1	1	1	-	1
49	EB94961	LIM-BTO	LIM-GRN	COLM	F	1	1	1	1	1	1	-	-	-	-
50	EN00383	RED-GRN	BLK-BTO	COLM	?	-	-	1	1	1	1	1	1	1	1
51	EB81755	RED-BLU	BLK-BTO	COLM	?	1	1	1	-	-	1	-	1	1	-
52	EJ70499	RED-YEL	BLK-BTO	COLM	?	1	1	1	-	-	-	-	-	-	-

30	EB21679	RED-BLK	GRN-BTO	COLM	?	-	-	-	1	-	1	1	-	-	-
31	EB21658	RED-YEL	GRN-BTO	COLM	?	-	-	-	1	1	1	1	-	-	-
34	EN03652	RED-BTO	RED-YEL	COLM	?	-	-	-	-	1	1	-	1	1	-
35	EN03654	YEL-BTO	WHI-RED	COLM	?	-	-	-	-	1	1	1	1	1	1
36	EN03658	YEL-BTO	WHI-GRN	COLM	?	-	-	-	-	1	1	1	1	1	1
37	EB81166	RED-BTO	RED-WHI	COLM	?	-	-	-	-	1	1	-	1	1	-
38	EJ71914	RED-BTO	GRN-RED	COLM	?	-	-	-	-	1	-	-	-	-	-
39	EJ98875	RED-BTO	RED-GRN	COLM	?	-	-	-	-	1	-	1	-	-	-
41	EN04038	RED-WHI	LIM-BTO	COLM	?	-	-	-	-	-	1	1	-	-	-
42	EN04039	RED-BLU	LIM-BTO	COLM	?	-	-	-	-	-	1	1	-	1	1
43	EN04040	RED-GRN	LIM-BTO	COLM	?	-	-	-	-	-	1	1	1	1	-
44	EN04041	RED-BLK	LIM-BTO	COLM	?	-	-	-	-	-	1	-	-	-	-
45	EN04046	RED-LIM	LIM-BTO	COLM	?	-	-	-	-	-	1	1	1	1	1
46	EN04048	BLU-RED	LIM-BTO	COLM	?	-	-	-	-	-	1	1	1	1	1
47	EJ11877	RED-RED	LIM-BTO	COLM	?	-	-	-	-	-	1	1	-	-	-
48	EN04050	BLU-BLU	LIM-BTO	COLM	?	-	-	-	-	-	1	1	1	1	1
49	EJ11594	RED-YEL	LIM-BTO	COLM	?	-	-	-	-	-	1	1	-	-	-
50	EJ08412	BLU-WHI	LIM-BTO	COLM	?	-	-	-	-	-	1	1	-	-	-
51	EN04053	YEL-RED	LIM-BTO	COLM	M	-	-	-	-	-	1	-	-	-	-
52	EN04057	YEL-BLK	LIM-BTO	COLM	?	-	-	-	-	-	1	1	-	1	1
53	EN04058	YEL-GRN	LIM-BTO	COLM	?	-	-	-	-	-	1	1	-	-	-
54	EN04061	BLU-YEL	LIM-BTO	COLM	?	-	-	-	-	-	1	1	1	1	-
55	EN04063	BLU-WHI	LIM-BTO	COLM	?	-	-	-	-	-	1	1	1	1	1
56	EN04064	BLU-BLK	LIM-BTO	COLM	?	-	-	-	-	-	1	1	-	1	1
57	EB21970	YEL-BLU	LIM-BTO	COLM	?	-	-	-	-	-	1	1	-	-	-
58	EN04065	WHI-RED	LIM-BTO	COLM	?	-	-	-	-	-	1	1	1	1	1
59	EN04070	WHI-GRN	LIM-BTO	COLM	?	-	-	-	-	-	1	-	-	-	-
60	EN04072	WHI-BLU	LIM-BTO	COLM	?	-	-	-	-	-	1	1	1	-	1
61	EN04074	WHI-YEL	LIM-BTO	COLM	?	-	-	-	-	-	1	1	1	-	1
62	EN04075	WHI-BLK	LIM-BTO	COLM	?	-	-	-	-	-	1	1	1	-	-
63	EN04076	GRN-RED	LIM-BTO	COLM	?	-	-	-	-	-	1	-	1	1	1
64	EB13038	WHI-WHI	LIM-BTO	COLM	?	-	-	-	-	-	1	1	1	1	1
65	EN02932	GRN-BLU	LIM-BTO	COLM	?	-	-	-	-	-	-	1	-	1	-
65	EN02932	GRN-BLU	LIM-BTO	COLM	?	-	-	-	-	-	1	-	1	1	1
66	EJ78220	WHI-LIM	LIM-BTO	COLM	?	-	-	-	-	-	1	1	1	1	1
67	EB81135	GRN-GRN	LIM-BTO	COLM	?	-	-	-	-	-	1	1	1	1	1
68	EJ70067	GRN-WHI	LIM-BTO	COLM	?	-	-	-	-	-	1	1	-	-	1
69	EN04078	GRN-YEL	LIM-BTO	COLM	?	-	-	-	-	-	1	1	1	1	1
70	EN04082	LIM-RED	LIM-BTO	COLM	?	-	-	-	-	-	1	-	1	-	1
71	EB81132	GRN-BLK	LIM-BTO	COLM	?	-	-	-	-	-	1	1	1	-	-
72	EJ82643	GRN-LIM	LIM-BTO	COLM	?	-	-	-	-	-	1	1	1	1	1
1	EJ84275	RED-WHI	RED-BTO	LIT	?	1	1	1	1	1	1	-	-	-	-
2	EB67819	RED-YEL	RED-BTO	LIT	?	1	-	-	-	-	-	-	-	-	*
3	EB94460	BLU-RED	RED-BTO	LIT	F	1	-	-	-	-	1	-	-	-	-
4	EJ70573	BLU-GRN	RED-BTO	LIT	F	1	1	1	1	1	1	*	-	-	-
5	EB29834	BLU-BLK	RED-BTO	LIT	M	1	1	1	1	1	1	-	*	199	199
6	EB87249	BLU-BLU	RED-BTO	LIT	M	1	1	-	-	-	-	-	-	-	*
7	EB21005	GRN-RED	RED-BTO	LIT	M	1	1	1	-	-	-	-	-	-	-
8	EB81545	GRN-BLU	RED-BTO	LIT	M	1	1	1	1	1	-	62	62	62	81
9	EB87250	GRN-GRN	RED-BTO	LIT	?	1	-	-	-	-	-	-	*	*	-
10	EJ82013	GRN-BLK	RED-BTO	LIT	F	1	1	1	1	-	1	107	107	107	150
11	EB67822	GRN-WHI	RED-BTO	LIT	M	1	1	-	-	-	-	-	-	-	-
12	EJ84479	GRN-YEL	RED-BTO	LIT	F	1	1	1	1	1	1	*	68	68	68
13	EJ84512	BLK-YEL	RED-BTO	LIT	?	1	1	1	-	-	-	-	-	-	-
14	EJ11088	WHI-YEL	RED-BTO	LIT	?	1	1	1	1	-	-	-	-	-	COL
15	EJ78925	WHI-GRN	RED-BTO	LIT	M	1	1	1	1	1	1	133	133	133	153
16	EB21152	YEL-BLK	RED-BTO	LIT	F	1	1	-	-	-	-	-	-	-	-
17	EB13120	YEL-YEL	RED-BTO	LIT	M	1	1	1	-	-	-	-	-	*	-
18	EJ70575	RED-BTO	RED-BLU	LIT	F	1	1	-	-	-	-	-	-	-	-
19	EJ84501	RED-BTO	RED-BLK	LIT	?	1	1	-	-	-	-	-	-	-	-
20	EB21821	RED-BLU	BLU-BTO	LIT	?	1	-	-	-	-	-	-	-	-	-
21	EB21241	BLU-RED	BLU-BTO	LIT	?	1	1	-	1	1	1	*	-	-	-
22	EJ70568	BLK-BLU	BLU-BTO	LIT	M	1	1	1	-	1	1	-	*	*	*

3	EB21789	YEL-RED	BLU-BTO	LIT	?	1	1	1	-	1	-	-	-	-	-
5	EB79759	BLU-GRN	GRN-BTO	LIT	M	1	1	1	-	-	1	-	*	*	-
6	EB13292	GRN-BLU	GRN-BTO	LIT	M	1	-	1	1	1	-	-	-	-	-
7	EB13183	GRN-YEL	GRN-BTO	LIT	F	1	1	-	-	-	1	-	-	-	-
8	EJ71160	GRN-RED	BLU-WHI	LIT	?	-	1	1	1	1	1	-	-	-	-
9	EB32065	GRN-BTO	GRN-WHI	LIT	M	1	1	1	1	-	-	-	-	-	-
0	EB29867	RED-RED	BLK-BTO	LIT	?	-	-	-	-	-	-	-	223	223	223
0	EB21536	GRN-BTO	BLK-WHI	LIT	M	1	1	1	1	1	1	-	-	-	-
1	EJ70159	GRN-BTO	BLK-YEL	LIT	F	1	1	1	1	1	-	-	-	-	-
2	EJ42217	GRN-BTO	WHI-GRN	LIT	M	1	1	1	1	1	1	*	98	98	98
3	EB32088	GRN-BTO	YEL-WHI	LIT	M	1	1	1	1	1	1	*	-	-	-
4	EB94894	LIM-BTO	BLU-RED	LIT	M	1	1	1	1	1	1	*	*	*	*
5	EB94893	LIM-BTO	BLU-BLK	LIT	F	1	-	1	1	1	1	-	*	*	-
6	EB94954	LIM-BTO	BLK-WHI	LIT	M	1	-	1	1	1	1	*	*	*	*
7	EJ11047	RED-BLK	BLK-BTO	LIT	M	-	1	1	1	1	1	109	109	109	-
8	EB32853	RED-WHI	BLK-BTO	LIT	F	-	1	1	1	1	1	109	109	109	109
9	EB87245	BLU-BLK	BLK-BTO	LIT	?	1	1	1	1	1	1	*	-	*	-
0	EJ77756	WHI-RED	BLK-BTO	LIT	?	-	1	1	1	-	-	-	-	*	-
1	EJ70591	WHI-WHI	BLK-BTO	LIT	M	-	1	1	1	1	1	97	97	97	97
2	EJ77974	WHI-WHI	BLK-BTO	LIT	?	-	1	1	1	1	1	*	*	-	*
3	EB29751	WHI-YEL	BLK-BTO	LIT	F	-	1	1	1	1	1	86	-	-	-
4	EJ83917	YEL-RED	BLK-BTO	LIT	?	-	1	1	1	1	1	-	*	*	*
5	EB67536	YEL-GRN	BLK-BTO	LIT	?	-	1	1	-	-	-	-	-	*	-
7	EJ43329	YEL-YEL	BLK-BTO	LIT	?	-	1	1	-	-	-	140	-	-	-
8	EN02054	BLK-BTO	RED-BLU	LIT	F	-	1	1	1	1	1	*	58	58	58
9	EJ77919	BLK-BTO	RED-BLK	LIT	F	-	1	1	1	1	1	11	11	11	11
0	EN02051	BLK-BTO	RED-YEL	LIT	M	-	1	1	1	-	1	61	61	61	88
1	EJ43280	BLK-BTO	WHI-RED	LIT	M	-	1	1	1	1	1	*	169	169	169
2	EJ77074	BLK-BTO	WHI-YEL	LIT	?	1	-	-	-	1	-	-	-	-	-
3	EJ70186	RED-BLU	WHI-BTO	LIT	F	1	1	1	1	1	1	141	*	*	-
4	EB13146	RED-WHI	WHI-BTO	LIT	?	1	-	-	-	-	-	-	-	-	-
5	EB13230	RED-YEL	WHI-BTO	LIT	F	1	1	1	1	-	-	-	-	-	-
6	EB13187	BLU-YEL	WHI-BTO	LIT	?	1	-	-	1	-	1	-	-	-	-
7	EB21022	GRN-BLK	WHI-BTO	LIT	?	1	1	1	1	1	1	-	-	-	-
8	EB32095	WHI-BLK	WHI-BTO	LIT	?	1	1	1	1	1	1	-	-	-	-
9	EB13260	YEL-WHI	WHI-BTO	LIT	?	1	1	1	-	-	-	-	-	-	-
0	EB79803	YEL-YEL	WHI-BTO	LIT	F	1	1	1	1	1	1	94	94	94	94
1	EB67485	WHI-RED	WHI-BTO	LIT	M	-	-	1	1	-	1	-	*	188	188
2	EB67493	WHI-BTO	RED-BLU	LIT	?	1	1	1	1	-	1	-	-	-	-
3	EN00177	WHI-BTO	BLK-BLK	LIT	?	1	1	1	1	1	-	-	-	-	-
4	EJ82572	RED-RED	YEL-BTO	LIT	?	-	-	1	1	1	-	-	*	-	-
5	EB89794	RED-BLK	YEL-BTO	LIT	M	1	1	1	-	-	-	-	-	-	-
6	EB21336	GRN-RED	YEL-BTO	LIT	?	1	1	1	-	-	-	-	-	-	-
7	EB13235	GRN-BLU	YEL-BTO	LIT	M	1	1	1	-	-	1	-	-	-	-
8	EJ70179	BLU-BLU	YEL-BTO	LIT	?	1	1	-	-	-	-	-	*	-	-
9	EJ43277	BLU-YEL	YEL-BTO	LIT	?	1	1	1	1	1	1	*	*	189	189
0	EJ82556	BLK-RED	YEL-BTO	LIT	M	1	1	1	-	-	1	*	236	236	236
1	EB98684	BLK-BLU	YEL-BTO	LIT	M	1	1	1	1	1	1	*	43	43	43
2	???????	BLK-YEL	YEL-BTO	LIT	?	1	1	1	1	-	-	-	-	-	*
3	EJ82035	WHI-RED	YEL-BTO	LIT	M	1	1	1	1	1	1	-	-	-	-
4	EB32246	YEL-BLU	YEL-BTO	LIT	M	-	-	1	1	1	1	111	111	111	111
5	EB89802	YEL-GRN	YEL-BTO	LIT	M	-	-	1	1	1	1	144	144	144	144
6	EB29293	YEL-WHI	YEL-BTO	LIT	M	1	1	1	1	1	-	-	-	-	-
7	EJ70209	YEL-BTO	RED-GRN	LIT	M	1	-	-	-	-	-	-	-	-	-
8	EB89772	YEL-BTO	RED-YEL	LIT	F	1	1	1	1	1	-	73	-	-	-
9	EN00264	YEL-BTO	GRN-GRN	LIT	?	1	1	1	1	1	1	*	*	-	-
0	EN02058	YEL-BTO	RED-WHI	LIT	?	-	1	1	1	1	1	*	-	-	-
1	EJ71149	YEL-BTO	BLK-BLU	LIT	F	1	1	1	1	1	1	-	-	-	-
2	EB21148	GRY-YEL	BRN-BTO	LIT	?	1	1	1	1	1	1	-	*	*	*
3	EB13098	GRY-ORN	BRN-BTO	LIT	?	1	-	1	-	-	-	-	-	-	-
4	EB13138	RED-YEL	ZZZ-BTO	LIT	F	1	1	1	1	1	1	-	*	*	-
5	EB13199	BLU-BLU	ORN-BTO	LIT	M	-	1	1	-	-	1	-	*	-	-
6	EB21228	BLU-WHI	ORN-BTO	LIT	M	1	1	-	-	-	-	-	-	-	-

37	EB13236	GRN-GRY	ORN-BTO	LIT	M	1	-	1	-	-	-	-	-	-	-
38	EB13201	BLK-ORN	ORN-BTO	LIT	F	1	1	1	1	1	1	*	*	-	*
39	EB13118	YEL-RED	ORN-BTO	LIT	?	1	1	1	1	-	-	-	-	-	-
)0	EB13210	ORN-BLU	ORN-BTO	LIT	M	1	1	-	1	1	-	*	-	-	-
)1	EB13276	GRY-BLU	ORN-BTO	LIT	?	-	1	-	-	-	-	-	-	-	-
22	EJ84040	RED-WHI	GRN-BTO	LIT	?	-	-	-	1	1	1	*	223	223	-
23	EJ11491	BLU-RED	GRN-BTO	LIT	F	-	-	-	1	-	1	56	56	56	56
24	EN02879	GRN-BTO	RED-GRN	LIT	F	-	-	-	1	1	1	144	144	144	144
25	EB21100	BRN-BTO	YEL-WHI	LIT	?	-	1	-	1	-	-	-	-	-	-
26	EB21608	RED-RED	BLU-BTO	LIT	?	1	-	-	1	-	-	-	-	-	-
27	EN03061	YEL-BTO	WHI-BLU	LIT	?	-	-	-	-	1	1	-	*	-	-
28	EJ11664	YEL-BTO	WHI-YEL	LIT	?	-	-	-	-	1	1	*	-	-	-
29	EB21210	YEL-BTO	WHI-WHI	LIT	?	-	-	-	-	1	1	-	-	-	-
30	EN03677	YEL-BTO	YEL-RED	LIT	F	-	-	-	-	1	1	87	87	87	87
31	EN03681	YEL-BTO	YEL-WHI	LIT	F	-	-	-	-	1	1	133	133	133	153
32	EN03687	YEL-BTO	YEL-GRN	LIT	F	-	-	-	-	1	1	31	31	*	*
33	EN03690	YEL-BTO	YEL-BLU	LIT	?	-	-	-	-	1	1	-	-	-	-
10	EB67593	WHI-BLU	222-222	LIT	M	1	1	1	1	1	1	*	*	70	*
73	EN96460	RED-BTO	RED-RED	LIT	M	-	-	-	-	-	-	93	93	93	93
74	EN96461	RED-BTO	RED-LIM	LIT	F	-	-	-	-	-	-	91	88	91	91
75	EN96462	RED-BLU	YEL-BTO	LIT	M	-	-	-	-	-	-	115	115	115	115
76	EN96463	RED-YEL	YEL-BTO	LIT	M	-	-	-	-	-	-	50	40	40	37
77	EN96464	RED-WHI	YEL-BTO	LIT	M	-	-	-	-	-	-	89	89	-	-
78	EN96465	RED-LIM	YEL-BTO	LIT	M	-	-	-	-	-	-	108	108	108	108
79	EN96466	GRN-YEL	YEL-BTO	LIT	M	-	-	-	-	-	-	116	116	116	116
30	EN96467	BLU-RED	YEL-BTO	LIT	M	-	-	-	-	-	-	11	11	11	11
31	EN96468	RED-BTO	GRN-GRN	LIT	M	-	-	-	-	-	-	10	10	10	10
32	EN96469	RED-BTO	GRN-WHI	LIT	M	-	-	-	-	-	-	6	6	COL	COL
33	EN96470	RED-BTO	GRN-BLK	LIT	M	-	-	-	-	-	-	32	32	NB	237
34	EN96471	RED-BTO	GRN-LIM	LIT	M	-	-	-	-	-	-	86	86	86	114
35	EN96472	RED-BTO	BLU-GRN	LIT	M	-	-	-	-	-	-	141	-	-	-
36	EN96473	RED-BTO	BLU-WHI	LIT	M	-	-	-	-	-	-	76	74	74	-
37	EN96474	RED-BTO	BLU-YEL	LIT	M	-	-	-	-	-	-	132	130	130	130
38	EN96475	RED-BTO	BLU-BLK	LIT	M	-	-	-	-	-	-	113	136	136	136
39	EN96476	RED-BTO	YEL-GRN	LIT	F	-	-	-	-	-	-	116	116	116	116
)0	EN96477	RED-BTO	YEL-YEL	LIT	F	-	-	-	-	-	-	*	83	83	121
)1	EN96478	RED-BTO	YEL-LIM	LIT	F	-	-	-	-	-	-	97	97	97	97
)2	EN96479	LIM-BLK	YEL-BTO	LIT	M	-	-	-	-	-	-	149	-	-	-
)3	EN96481	RED-BTO	WHI-YEL	LIT	F	-	-	-	-	-	-	102	102	102	102
)4	EN96482	RED-BTO	WHI-WHI	LIT	M	-	-	-	-	-	-	53	53	-	-
)5	EN96483	RED-BLK	BLU-BTO	LIT	F	-	-	-	-	-	-	89	89	89	89
)6	EN96484	RED-BTO	WHI-LIM	LIT	F	-	-	-	-	-	-	161	161	161	161
)7	EN96485	RED-BTO	BLK-RED	LIT	?	-	-	-	-	-	-	*	*	*	*
)8	EN96486	BLU-BLU	BLU-BTO	LIT	F	-	-	-	-	-	-	149	141	141	141
)9	ER44009	BLU-WHI	BLU-BTO	LIT	F	-	-	-	-	-	-	113	136	136	136
)0	ER44010	RED-BTO	BLK-YEL	LIT	F	-	-	-	-	-	-	153	118	118	118
)1	ER44011	RED-BTO	BLK-LIM	LIT	M	-	-	-	-	-	-	153	118	118	118
)2	EB81044	RED-GRN	YEL-BTO	LIT	F	-	-	-	-	-	-	115	115	115	115
)3	EJ71879	GRN-GRN	YEL-BTO	LIT	F	-	-	-	-	-	-	110	110	113	113
)4	EJ82553	GRN-LIM	YEL-BTO	LIT	F	-	-	-	-	-	-	132	130	130	130
)5	EJ67389	BLU-BLK	YEL-BTO	LIT	F	-	-	-	-	-	-	14	-	-	-
)6	EJ78782	YEL-BLK	YEL-BTO	LIT	M	-	-	-	-	-	-	54	54	54	53
)7	EJ78887	YEL-LIM	YEL-BTO	LIT	M	-	-	-	-	-	-	102	102	102	102
)8	EB87142	BLU-LIM	YEL-BTO	LIT	F	-	-	-	-	-	-	128	128	128	128
)9	EJ10648	WHI-WHI	YEL-BTO	LIT	F	-	-	-	-	-	-	70	67	67	67
)0	EJ82671	WHI-LIM	YEL-BTO	LIT	M	-	-	-	-	-	-	83	83	83	121
)1	EB94319	BLK-GRN	YEL-BTO	LIT	F	-	-	-	-	-	-	76	-	-	-
)2	EJ11682	BLK-WHI	YEL-BTO	LIT	?	-	-	-	-	-	-	28	-	-	-
)3	EJ71990	BLK-BLK	YEL-BTO	LIT	F	-	-	-	-	-	-	50	40	40	*
)4	EJ77180	BLK-LIM	YEL-BTO	LIT	F	-	-	-	-	-	-	54	54	54	53
)5	EB67608	LIM-RED	YEL-BTO	LIT	F	-	-	-	-	-	-	10	10	10	10
)6	EB67445	LIM-GRN	YEL-BTO	LIT	M	-	-	-	-	-	-	67	67	67	67
)7	EB32200	LIM-BLU	YEL-BTO	LIT	F	-	-	-	-	-	-	130	-	-	-

45	EJ10644	LIM-BLU	LIM-BTO	LIT	F	-	-	-	-	-	-	-	21	21	21
46	EB67953	BLU-YEL	RED-BTO	LIT	F	-	-	-	-	-	-	-	112	112	-
47	EN01152	BLK-RED	LIM-BTO	LIT	M	-	-	-	-	-	-	-	122	122	122
48	EB89627	WHI-BLK	RED-BTO	LIT	F	-	-	-	-	-	-	-	174	174	174
49	EJ70240	BLK-BLK	GRN-BTO	LIT	M	-	-	-	-	-	-	-	135	135	135
50	EN02057	GRN-BTO	WHI-WHI	LIT	F	-	-	-	-	-	-	-	*	NB	*
51	EB21231	BLU-LIM	LIM-BTO	LIT	F	-	-	-	-	-	-	-	206	206	206
52	EH14932	LIM-GRN	LIM-BTO	LIT	M	-	-	-	-	-	-	-	174	174	174
53	EB29679	BLK-RED	BLK-BTO	LIT	F	-	-	-	-	-	-	-	190	190	190
54	EJ10575	BLU-BLK	WHI-BTO	LIT	M	-	-	-	-	-	-	-	112	112	112
55	EJ70185	WHI-BLK	BLU-BTO	LIT	M	-	-	-	-	-	-	-	164	164	164
56	EB32206	LIM-LIM	LIM-BTO	LIT	M	-	-	-	-	-	-	-	78	78	78
57	EJ78162	WHI-BTO	GRN-BLU	LIT	?	-	-	-	-	-	-	-	125	125	124
58	EN00587	LIM-WHI	RED-BTO	LIT	F	-	-	-	-	-	-	-	213	213	213
59	EN04208	GRN-LIM	GRN-BTO	LIT	M	-	-	-	-	-	-	-	204	204	204
60	ER44039	RED-BTO	LIM-GRN	LIT	M	-	-	-	-	-	-	-	126	121	125
61	ER44634	WHI-BTO	YEL-BLU	LIT	M	-	-	-	-	-	-	-	64	64	70
62	EJ71173	YEL-BTO	BLK-YEL	LIT	M	1	-	1	-	1	1	*	-	-	-
63	ER45434	WHI-BTO	BLK-RED	LIT	?	-	-	-	-	-	-	-	-	*	-
64	ER45737	WHI-YEL	BLU-BTO	LIT	F	-	-	-	-	-	-	-	-	55	55
65	ER45769	WHI-BTO	GRN-LIM	LIT	F	-	-	-	-	-	-	-	-	176	176
66	ER45770	LIM-WHI	WHI-BTO	LIT	F	-	-	-	-	-	-	-	-	80	80
67	ER45773	YEL-LIM	LIM-BTO	LIT	M	-	-	-	-	-	-	-	-	160	160
68	ER45791	LIM-WHI	BLU-BTO	LIT	F	-	-	-	-	-	-	-	-	122	122
69	ER45792	YEL-BLK	WHI-BTO	LIT	M	-	-	-	-	-	-	-	-	25	25
70	ER45810	LIM-BLU	WHI-BTO	LIT	M	-	-	-	-	-	-	-	-	69	69
71	ER45877	GRN-BTO	YEL-YEL	LIT	F	-	-	-	-	-	-	-	-	69	69
72	ER46044	GRN-BTO	YEL-BLK	LIT	F	-	-	-	-	-	-	-	-	84	84
73	ER46207	WHI-BTO	WHI-YEL	LIT	M	-	-	-	-	-	-	-	-	123	123
74	ER46209	LIM-LIM	BLK-BTO	LIT	M	-	-	-	-	-	-	-	-	84	84
75	ER46247	WHI-BTO	RED-LIM	LIT	F	-	-	-	-	-	-	-	-	76	76
76	ER45248	WHI-BTO	WHI-GRN	LIT	M	-	-	-	-	-	-	-	-	60	60
77	EJ43212	YEL-BLU	WHI-BTO	LIT	F	-	-	-	-	-	-	-	-	15	15
78	EB67438	BLK-BLU	LIM-BTO	LIT	M	-	-	-	-	-	-	-	-	55	55
79	EB67712	YEL-BLK	BLU-BTO	LIT	M	-	-	-	-	-	-	-	-	176	176
80	EB81015	YEL-YEL	LIM-BTO	LIT	M	-	-	-	-	-	-	-	190	190	190
81	EB67553	BLU-GRN	BLK-BTO	LIT	F	-	-	-	-	-	-	-	-	25	25
82	EB84362	YEL-LIM	RED-BTO	LIT	F	-	-	-	-	-	-	-	-	165	165
83	EB67419	BLU-LIM	GRN-BTO	LIT	M	-	-	-	-	-	-	-	-	15	15
84	EJ84276	BLK-BLU	WHI-BTO	LIT	M	-	-	-	-	-	-	-	-	213	213
85	EN01176	YEL-BLU	BLK-BTO	LIT	F	-	-	-	-	-	-	-	-	171	171
86	EJ58928	LIM-GRN	BLU-BTO	LIT	M	-	-	-	-	-	-	-	-	76	76
87	EJ77186	GRN-LIM	WHI-BTO	LIT	F	-	-	-	-	-	-	-	-	9	9
88	ER45834	BLK-YEL	BLU-BTO	LIT	F	-	-	-	-	-	-	-	-	228	228
89	EJ82014	YEL-YEL	BLU-BTO	LIT	M	-	-	-	-	-	-	-	-	6	6
90	EB81038	RED-BTO	LIM-LIM	LIT	M	-	-	-	-	-	-	-	44	44	*
91	ER46587	BLU-LIM	RED-BTO	LIT	F	-	-	-	-	-	-	-	-	123	123
92	EH19526	WHI-BLK	GRN-BTO	LIT	?	-	-	-	-	-	-	-	-	*	*
93	ES15238	BLK-GRN	BLK-BTO	LIT	M	-	-	-	-	-	-	-	-	-	155
94	ES15239	BLK-LIM	RED-BTO	LIT	M	-	-	-	-	-	-	-	-	-	44
95	ES15240	LIM-BTO	LIM-YEL	LIT	M	-	-	-	-	-	-	-	-	-	54
96	ES15241	WHI-WHI	BLU-BTO	LIT	F	-	-	-	-	-	-	-	-	-	188
97	ES15247	BLK-YEL	GRN-BTO	LIT	M	-	-	-	-	-	-	-	-	-	37
98	ES15248	LIM-BTO	YEL-RED	LIT	F	-	-	-	-	-	-	-	-	-	112
99	ES15249	LIM-BTO	YEL-YEL	LIT	M	-	-	-	-	-	-	-	-	-	30
00	ES15250	LIM-BTO	GRN-GRN	LIT	F	-	-	-	-	-	-	-	-	-	14
01	ES15331	RED-BLK	WHI-BTO	LIT	M	-	-	-	-	-	-	-	-	-	21
02	ES15372	LIM-BTO	WHI-RED	LIT	M	-	-	-	-	-	-	-	-	-	89
03	ES15375	RED-LIM	RED-BTO	LIT	?	-	-	-	-	-	-	-	-	-	224
04	ES15378	LIM-BTO	WHI-YEL	LIT	F	-	-	-	-	-	-	-	-	-	64
05	ES15379	BLU-WHI	BLK-BTO	LIT	?	-	-	-	-	-	-	-	-	-	124
06	ES15380	BLU-LIM	WHI-BTO	LIT	M	-	-	-	-	-	-	-	-	-	64
07	EJ42127	RED-GRN	GRN-BTO	LIT	?	-	-	-	-	-	-	-	-	-	131

18	EJ70232	LIM-YEL	YEL-BTO	LIT	M	-	-	-	-	-	-	110	110	113	113
19	EJ82641	LIM-WHI	YEL-BTO	LIT	F	-	-	-	-	-	-	140	*	-	-
20	EB67448	RED-BTO	BLU-LIM	LIT	M	-	-	-	-	-	-	91	88	91	91
21	EB81328	RED-BTO	YEL-BLU	LIT	M	-	-	-	-	-	-	130	*	-	-
22	EB32514	RED-BTO	YEL-BLK	LIT	M	-	-	-	-	-	-	128	-	-	-
23	EJ83799	BLK-BTO	YEL-WHI	LIT	F	-	1	1	1	1	1	93	93	93	93
24	EB98408	RED-BTO	WHI-BLU	LIT	?	-	-	-	-	-	-	94	-	-	-
25	EJ82933	LIM-LIM	YEL-BTO	LIT	F	-	-	-	-	-	-	60	60	60	60
26	EB32328	RED-GRN	BLU-BTO	LIT	F	-	-	-	-	-	-	62	62	62	81
27	EJ70223	RED-BTO	WHI-BLK	LIT	M	-	-	-	-	-	-	31	31	*	31
28	EB67744	RED-LIM	BLU-BTO	LIT	M	-	-	-	-	-	-	163	163	163	163
29	EJ83600	RED-WHI	BLU-BTO	LIT	?	-	-	-	-	-	-	4	132	132	132
30	EJ82557	BLU-GRN	BLU-BTO	LIT	?	-	-	-	-	-	-	136	-	-	-
31	EJ71820	RED-BTO	BLK-BLU	LIT	F	-	-	-	-	-	-	135	135	135	135
32	EJ10630	YEL-WHI	LIM-BTO	LIT	M	-	-	-	-	-	-	1	1	1	232
33	EB67973	BLU-LIM	BLU-BTO	LIT	?	-	-	-	-	-	-	83	-	-	-
34	EJ70231	YEL-BLU	BLU-BTO	LIT	M	-	-	-	-	-	-	104	104	9	9
35	EB21227	YEL-GRN	BLU-BTO	LIT	M	-	-	-	-	-	-	56	56	56	56
36	EB98310	GRN-LIM	BLU-BTO	LIT	F	-	-	-	-	-	-	163	-	-	-
37	EJ77009	GRN-GRN	BLU-BTO	LIT	?	-	-	-	-	-	-	44	*	*	*
38	EB67429	GRN-RED	BLU-BTO	LIT	F	-	-	-	-	-	-	53	-	-	-
39	EB81198	GRN-BLU	BLU-BTO	LIT	F	-	-	-	-	-	-	111	111	111	111
40	EB67905	GRN-YEL	BLU-BTO	LIT	M	-	-	-	-	-	-	14	14	14	14
41	EJ71933	BLK-RED	BLU-BTO	LIT	F	-	-	-	-	-	-	104	104	104	104
42	ER44024	RED-BTO	LIM-RED	LIT	M	-	-	-	-	-	-	73	73	73	73
43	ER44267	RED-BTO	LIM-BLU	LIT	M	-	-	-	-	-	-	48	48	48	48
44	ER44269	WHI-BLU	BLU-BTO	LIT	F	-	-	-	-	-	-	6	6	6	6
45	ER44282	YEL-WHI	BLU-BTO	LIT	F	-	-	-	-	-	-	*	126	126	126
46	ER44283	RED-LIM	LIM-BTO	LIT	?	-	-	-	-	-	-	*	-	-	-
47	ER44286	RED-BTO	LIM-WHI	LIT	M	-	-	-	-	-	-	*	179	179	179
48	ER44287	GRN-BTO	RED-BLU	LIT	F	-	-	-	-	-	-	*	1	1	-
49	ER44288	GRN-BTO	BLU-RED	LIT	?	-	-	-	-	-	-	*	-	-	-
50	ER44290	GRN-BTO	BLU-YEL	LIT	?	-	-	-	-	-	-	*	*	*	-
51	ER44292	GRN-BTO	BLU-BLU	LIT	?	-	-	-	-	-	-	*	*	*	-
52	ER44293	GRN-BTO	BLU-GRN	LIT	?	-	-	-	-	-	-	*	-	-	-
53	ER44295	GRN-BTO	BLU-BLK	LIT	?	-	-	-	-	-	-	*	-	-	-
54	ER44298	GRN-BTO	BLU-WHI	LIT	?	-	-	-	-	-	-	*	-	-	-
55	ER44300	GRN-BTO	GRN-BLU	LIT	?	-	-	-	-	-	-	*	-	*	-
56	EJ77135	BLK-BLK	BLU-BTO	LIT	F	-	-	-	-	-	-	61	61	61	88
57	EB29832	BLK-WHI	BLU-BTO	LIT	?	-	-	-	-	-	-	*	*	*	-
58	EJ84832	WHI-RED	BLU-BTO	LIT	?	-	-	-	-	-	-	*	-	-	-
59	EJ85403	WHI-GRN	BLU-BTO	LIT	?	-	-	-	-	-	-	*	-	-	*
60	EB67390	LIM-RED	BLU-BTO	LIT	?	-	-	-	-	-	-	*	-	-	-
61	EB67531	LIM-BLU	BLU-BTO	LIT	?	-	-	-	-	-	-	81	*	NB	*
62	EN00107	BLU-BLU	WHI-BTO	LIT	F	-	-	-	-	-	-	*	73	73	73
63	ER44551	GRN-BTO	GRN-GRN	LIT	?	-	-	-	-	-	-	*	*	*	-
64	ER44553	GRN-BTO	GRN-LIM	LIT	?	-	-	-	-	-	-	*	123	NB	*
65	ER44554	GRN-BTO	LIM-RED	LIT	?	-	-	-	-	-	-	*	-	-	-
66	ER44556	GRN-BTO	LIM-BLU	LIT	?	-	-	-	-	-	-	*	*	*	-
67	ER44557	WHI-LIM	BLU-BTO	LIT	?	-	-	-	-	-	-	*	-	*	*
68	ER44558	GRN-BTO	LIM-GRN	LIT	F	-	-	-	-	-	-	121	121	121	125
69	ER44559	GRN-BTO	LIM-LIM	LIT	?	-	-	-	-	-	-	*	*	*	*
70	ER44562	GRN-BTO	LIM-BLK	LIT	M	-	-	-	-	-	-	*	145	145	145
71	ER44563	GRN-BTO	LIM-WHI	LIT	M	-	-	-	-	-	-	*	156	NB	140
72	ER44563	GRN-BTO	BLK-BLU	LIT	?	-	-	-	-	-	-	*	-	-	-
73	ER44565	GRN-BTO	WHI-BLU	LIT	?	-	-	-	-	-	-	*	-	-	-
74	ER44566	GRN-BTO	WHI-WHI	LIT	?	-	-	-	-	-	-	*	-	-	-
75	ER44567	WHI-BTO	RED-GRN	LIT	?	-	-	-	-	-	-	*	*	*	-
76	ER44568	WHI-BTO	WHI-BLK	LIT	?	-	-	-	-	-	-	96	*	*	*
77	ER44569	WHI-BTO	RED-BLK	LIT	?	-	-	-	-	-	-	*	*	*	*
78	ER44570	WHI-BTO	BLU-RED	LIT	?	-	-	-	-	-	-	*	*	*	-
79	ER44572	WHI-BTO	BLU-BLU	LIT	F	-	-	-	-	-	-	*	*	160	160
80	ER45033	RED-BLU	RED-BTO	LIT	F	-	-	-	-	-	-	-	156	NB	155

1	ER45034	YEL-RED	RED-BTO	LIT	F	-	-	-	-	-	-	-	236	236	236
2	ER45038	RED-BTO	LIM-YEL	LIT	M	-	-	-	-	-	-	-	228	228	228
3	ER45039	RED-BTO	LIM-BLK	LIT	M	-	-	-	-	-	-	-	141	141	141
4	ER45040	GRN-BTO	RED-LIM	LIT	M	-	-	-	-	-	-	-	16	16	16
5	ER45041	GRN-BTO	YEL-GRN	LIT	F	-	-	-	-	-	-	-	154	OUT	OUT
6	ER45042	WHI-BTO	YEL-WHI	LIT	M	-	-	-	-	-	-	-	68	68	68
7	ER45043	WHI-BTO	GRN-WHI	LIT	F	-	-	-	-	-	-	-	43	43	43
8	ER45044	GRN-BTO	BLK-GRN	LIT	M	-	-	-	-	-	-	-	151	151	151
9	ER45045	WHI-BTO	WHI-BLU	LIT	F	-	-	-	-	-	-	-	151	151	151
0	ER45046	WHI-BTO	WHI-RED	LIT	M	-	-	-	-	-	-	-	128	128	128
1	ER45047	RED-BLK	RED-BTO	LIT	M	-	-	-	-	-	-	-	171	NB	127
2	ER45049	WHI-BTO	WHI-WHI	LIT	M	-	-	-	-	-	-	-	121	126	126
3	ER45050	WHI-BTO	RED-YEL	LIT	M	-	-	-	-	-	-	-	58	58	58
4	ER44583	GRN-BTO	BLK-BLK	LIT	F	-	-	-	-	-	-	-	125	125	*
5	ER45084	GRN-GRN	BLK-BTO	LIT	M	-	-	-	-	-	-	-	127	171	171
6	ER44598	WHI-BTO	WHI-LIM	LIT	F	-	-	-	-	-	-	-	194	194	194
7	ER44612	BLK-BLK	RED-BTO	LIT	F	-	-	-	-	-	-	-	86	86	86
8	ER44620	GRN-BTO	BLK-LIM	LIT	M	-	-	-	-	-	-	-	64	64	OUT
9	ER44621	GRN-BTO	BLU-LIM	LIT	M	-	-	-	-	-	-	-	117	117	117
0	ER44626	WHI-BTO	BLK-WHI	LIT	F	-	-	-	-	-	-	-	163	163	163
1	ER44626	GRN-BTO	WHI-YEL	LIT	F	-	-	-	-	-	-	-	44	44	44
2	ER44628	GRN-BTO	WHI-LIM	LIT	F	-	-	-	-	-	-	-	70	70	70
3	ER44629	LIM-BLK	BLK-BTO	LIT	M	-	-	-	-	-	-	-	94	94	94
4	ER44638	BLU-RED	BLK-BTO	LIT	F	-	-	-	-	-	-	-	134	134	134
5	ER44649	WHI-BTO	GRN-RED	LIT	F	-	-	-	-	-	-	-	48	48	48
6	ER44650	GRN-LIM	RED-BTO	LIT	M	-	-	-	-	-	-	-	75	*	75
7	ER44956	WHI-BTO	BLU-GRN	LIT	M	-	-	-	-	-	-	-	134	134	134
8	ER44957	BLU-BLU	BLK-BTO	LIT	M	-	-	-	-	-	-	-	80	80	80
9	ER44960	BLK-BLK	BLK-BTO	LIT	F	-	-	-	-	-	-	-	114	114	114
0	ER44961	YEL-GRN	GRN-BTO	LIT	M	-	-	-	-	-	-	-	179	179	-
1	ER44965	BLU-GRN	WHI-BTO	LIT	F	-	-	-	-	-	-	-	204	204	204
2	ER44971	BLU-WHI	WHI-BTO	LIT	M	-	-	-	-	-	-	-	206	206	206
3	ER44975	GRN-GRN	WHI-BTO	LIT	F	-	-	-	-	-	-	-	185	185	*
4	ER44982	GRN-WHI	WHI-BTO	LIT	F	-	-	-	-	-	-	-	16	16	16
5	ER44986	LIM-LIM	RED-BTO	LIT	F	-	-	-	-	-	-	-	120	OUT	*
6	ER44987	WHI-BTO	BLK-GRN	LIT	M	-	-	-	-	-	-	-	120	OUT	*
7	ER45089	LIM-LIM	GRN-BTO	LIT	F	-	-	-	-	-	-	-	175	*	226
8	ER45090	WHI-BTO	BLK-YEL	LIT	M	-	-	-	-	-	-	-	175	*	226
9	ER45414	YEL-WHI	RED-BTO	LIT	M	-	-	-	-	-	-	-	185	185	*
0	ER45415	WHI-BTO	YEL-YEL	LIT	?	-	-	-	-	-	-	-	224	-	-
1	EB89953	WHI-LIM	WHI-BTO	LIT	M	-	-	-	-	-	-	-	107	107	150
2	EJ10631	BLU-GRN	LIM-BTO	LIT	M	-	-	-	-	-	-	-	165	165	165
3	EB81274	RED-LIM	GRN-BTO	LIT	M	-	-	-	-	-	-	-	29	29	29
4	ER44432	BLU-BLU	GRN-BTO	LIT	F	-	-	-	-	-	-	-	75	*	237
5	EJ77139	LIM-BLU	GRN-BTO	LIT	M	-	-	-	-	-	-	-	161	161	161
6	EJ82670	BLK-LIM	WHI-BTO	LIT	F	-	-	-	-	-	-	-	80	-	-
7	EJ71152	WHI-RED	GRN-BTO	LIT	M	-	-	-	-	-	-	-	27	27	27
8	EN01165	BLK-WHI	GRN-BTO	LIT	F	-	-	-	-	-	-	-	164	164	164
9	EN02926	ZZZ-BTO	WHI-WHI	LIT	F	-	-	-	-	-	-	-	171	169	169
1	EJ82610	BLK-BLK	WHI-BTO	LIT	M	-	-	-	-	-	-	-	154	OUT	-
2	EH19506	BLU-WHI	GRN-BTO	LIT	F	-	-	-	-	-	-	-	106	106	30
3	EB98913	YEL-RED	GRN-BTO	LIT	F	-	-	-	-	-	-	-	45	*	39
4	EJ70689	BLK-BLU	GRN-BTO	LIT	?	-	-	-	-	-	-	-	131	*	*
5	EB98889	WHI-RED	RED-BTO	LIT	F	-	-	-	-	-	-	-	78	78	78
6	EJ71793	BLK-BLK	LIM-BTO	LIT	M	-	-	-	-	-	-	-	106	106	104
7	EJ82669	GRN-RED	BLK-BTO	LIT	F	-	-	-	-	-	-	-	108	108	108
8	EJ77219	BLK-WHI	LIM-BTO	LIT	M	-	-	-	-	-	-	-	45	45	39
9	EB67609	BLU-WHI	RED-BTO	LIT	F	-	-	-	-	-	-	-	29	29	29
0	EN02925	WHI-BTO	GRN-GRN	LIT	F	-	-	-	-	-	-	-	27	27	27
1	EB89620	GRN-YEL	BLK-BTO	LIT	M	-	-	-	-	-	-	-	194	194	194
2	EB67713	GRN-BLK	BLK-BTO	LIT	?	-	-	-	-	-	-	-	23	23	*
3	EJ70207	YEL-BLU	RED-BTO	LIT	?	-	-	-	-	-	-	-	30	-	-
4	EJ77977	LIM-RED	RED-BTO	LIT	F	-	-	-	-	-	-	-	145	145	145

08	EJ10645	TRI-ZZZ	LIM-BTO	LIT		?	-	-	-	-	-	-	-	-	-	223
09	EB21713	WHI-WHI	WHI-BTO	LIT		F	-	-	-	-	-	-	-	-	-	127
10	EB98226	BLU-YEL	BLK-BTO	LIT		F	-	-	-	-	-	-	-	-	-	54
11	ER44983	WHI-BLU	YEL-BTO	LIT		F	-	-	-	-	-	-	-	-	-	232
12	ER45420	BLK-GRN	RED-BTO	LIT		?	-	-	-	-	-	-	-	-	-	138
13	ER44431	GRN-LIM	BLK-BTO	LIT		F	-	-	-	-	-	-	-	-	-	179

Table 12. Survival of adult male and adult female puffins.

	Males		Female	
Year	**n**	**% survival**	**n**	**% survival**
1984-5	49	96.1	41	100
1985-6	47	94.0	38	92.6
1986-7	45	91.8	38	95.0
1987-8	35	85.3	36	90.0
1988-90	31	93.9	36	92.3
1989-1	32	84.2	32	88.9
1990-1	53	88.3	56	84.8
1991-2	97	93.2	96	95.2
1992-3	100	91.7	94	87.0
Mean		91.0		91.7

Note: None of the annual differences in survival were significant (χ^2 or Fisher Exact tests)

Table 13. Pairings of breeding puffins in permanently staked burrows at Little Hide, 1990-1993. Each number refers to an individually colour-ringed adult (see listing of ring numbers and combinations). UR = bird without a colour-ring. ? = burrow difficult to see but birds from the previous year definitely not there. —— = outside the system that year. Number underlined are newly colour-ringed birds. Leuc. = leucistic individual

	1990	1991	1992	1993
1	332 x UR	332 x 348	332 x 348	unoccupied
4	329 x UR	collapsed		
6	282 x 344	282 x 344	489 x 344	489 x 344
9	——	——	487 x 334	487 x 334
10	281 x 315	281 x 315	281 x 315	281 x 315
11	280 x 49	280 x 49	280 x 49	280 x 49
14	305 x 340	UR x 340	UR x 340	500 x 340
15	——	——	483 x 477	483 x 477
16	——	384 x 414	384 x 414	384 x 414
21	——	445 x UR	445 x UR	445 x 501
23	——	442 x UR	442 x UR	UR?
25	——	——	469 x 481	469 x 481
27	——	427 x 440	427 x 440	427 x 440
28	312 x UR	UR x UR	UR x UR	?
29	——	423 x 439	423 x 439	423 x 439
30	——	443 x UR	?	499 x 432
31	327 x 232	327 x 232	?	327 x UR
32	283 x UR	283 x UR	?	UR x ?
37	——	——	?	276 x 497
40	pair in 50	276 x 313	276 x 313	
43	——	71 x 387	71 x 387	71 x 387
44	337 x UR	490 x 401	490 x 401	494 x 401
45/39	——	438 x 433	?	438 x 433
48	343 x UR	343 x 405	343 x 405	343 x 405
50	276 x 313	UR x UR	UR x UR	UR x UR
53	294 x 338	294 x UR	? unoccupied	306 x 314
54	306 x 314	306 x 314	306 x 314	495 x 510
55	——	UR x UR	464 x 478	464 x 478
56	335 x 223	335 x 223	335 x 223	335 x 223
58	——	393 x 48	393 x 48	393 x 48
60	325 x UR	325 x UR	325 x 476	325 x 476
61	50 x 356	50 x 356	50 x 356	unoccupied
62	8 x 326	8 x 326	8 x 326	unoccupied
64	UR x UR	398 x 461	398 x 461	504 x 506
65	——	UR x UR	?	
67	316 x UR	316 x 307	316 x 307	316 x 307
68	——	386 x 12	386 x 12	386 x 12
69	——	UR x UR	470 x 471	470 x 471
70	240 x 309	240 x 402	240 x 402	461 x 402
73	342 x	342 x 362	342 x 362	342 x 362
74	——	286 x UR	286 x UR	286?x ?

	1990	1991	1992	1993
75	———	406 x 424	?	406 x ?UR
76	286 x 311	UR x UR	486 x 475	486 x 475
78	———	456 x 435	456 x 435	456 x 435
80	UR x UR	408 x 426	408 x 446	408 x 446
81	361 x UR	unoccupied	unoccupied	326 x 8
83	310 x 333	310 x 290	310 x 290	unoccupied
84	———	———	474 x 472	474 x 472
86	284 x 43	284 x 397	284 x 397	?UR x 397
87	230 x UR	230 x UR	230 x UR	230 x UR
88	unoccupied	320 x 274	occupied (to 91)	50 x 356
89	277 x 295	277 x 295	UR x 295	502 x 295
90	———	UR x UR	UR x UR	UR ? UR
91	320 x 274	(at 88)	320 x 274	320 x 274
93	273 x 323	273 x 323	273 x 323	273 x 323
94	324 x 60	403 x 60	403 x 60	403 x 60
96	———	378 x UR	unoccupied	
97	41 x 291	41 x 291	41 x 291	41 x 291
98	———	32 x UR	32 x UR	32 x UR
102	307 x 293	307 x 293	307 x 293	307 x 293
104	334 x 341	334 x 341	341 x no partner	341 x 436
106	———	436 x 432	Both ? divorced	UR x UR
107/150	421 x 10	421 x 10	421 x 10	421 x 10
108	278 x UR	278 x 437	278 x 437	278 x 437
109	37 x 38	37 x 38	37 x 38	UR x 38
110	318 x 303	318 x 303	unoccupied (to 113)	
111	74 x 339	74 x 339	74 x 339	74 x 339
112	———	454 x 446	454 x 446	454 x 498
113	288 x 299	unoccupied (to 136)	318 x 303	318 x 303
114	———	409 x UR	409 x UR	409 x 284
115	275 x 302	275 x 302	275 x 302	275 x 302
116	279 x 289	279 x 289	279 x 289	279 x 289
117	———	399 x UR	399 x UR	399 x UR
118	unoccupied	301 x 300	301 x 300	301 x 300
120	UR x UR	416 x 415	unocc/pair outside	unocc.
121	368 x UR	368 x 392	368 x 460	290 x 310
122	———	447 x UR	447 x 468	447 x 468
123	———	———	473 x 491	473 x 491
124	———	———	———	457 x 505
125	———	457 x 394	457 x 394	368 x 460
126	460 x UR	460 x 435	392 x 345	392 x 345
127	———	395 x UR	?	509 x 391
128	322 x 308	390 x 308	390 x 308	390 x 308
130	321 x 317	287 x 304	287 x 304	287 x 304
131	———	434 x UR	?	507 x UR
132	287 x 304	329 x UR	329 x UR	329 x UR
133	15 x 231	15 x 231	15 x 231	unoccupied
134	———	407 x 404	407 x 404	407 x 404

	1990	1991	1992	1993
135	331 x UR	331 x 449	331 x 449	331 x 449
136	330 x UR	288 x 299	288 x 299	288 x 299
140	47 x 319	unoccupied	unoccupied	371 x UR
141	285 x 53	383 x 298	383 x 298	383 x 298
144	75 x 224	75 x 224	75 x 224	75 x 224
145	UR x UR	370 x 444	370 x 444	370 x 444
151	———	388 x 389	388 x 389	388 x 389
153	300 x 301	unocc/to 118	unoccupied	15 x 231
154	———	431 x 385	unoccupied/outside	
155	———	———	———	493 x 380
156	———	371 x (380) NB	UR x (380) NB	unoccupied
160	———	?	467 x 379	467 x 379
161	296 x UR	296 x 425	296 x 425	296 x 425
163	328 x 336	328 x 400	328 x 400	328 x 400
164	———	455 x 428	455 x 428	455 x 428
165	———	422 x UR	422 x 482	422 x 482
169	———	51 x UR	51 x 429	51 x 429
171	———	391 x 429	395 x 485	395 x 485
174	———	452 x 448	452 x 448	452 x 448
175	———	418 x 417	unocc./to 219 area	unoccup.
176	———	UR x UR	479 x 465	479 x 465
179	———	410 x 347	410 x 347	513 x 347
188	———	———	61 x UR	61 x 496
189	———	———	69 x ?	69 x LEUC
190	———	453 x 480	453 x 480	453 x 480
194	———	441 x 396	441 x 396	441 x 396
199	———	———	5 x UR	5 x UR
204	———	411 x 459	411 x 459	411 x 459
206	———	412 x 451	412 x 451	412 x 451
213	———	458 x UR	458 x 484	458 x 484
223	———	30 x 222	30 x 222	30 x 508
226	———	(175)	together nr 219	418 x 417
228	———	382 x UR	382 x 488	382 x 488
232	———	———	———	332 x 511
236	———	70 x 281	70 x 281	70 x 281
237	———	———	———	283 x 424