



## **An assessment of breeding success in the Dark-bellied Brent Goose *Branta b. bemica* in 1993**

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### SUMMARY

After virtually a complete breeding failure in 1992, the proportion of juvenile Dark-bellied Brent Geese present in Britain in 1993 was 18%, thus revealing a moderate level of breeding success. Between September and December 1993, some 55,937 geese were aged at 15 estuaries in Britain. Average brood size was 2.7 juveniles per pair overall. The number of geese expected to winter in 1993-94 in Britain is predicted to be a minimum of c.95,000. The representativeness of the age ratio methodology is discussed.

### INTRODUCTION AND METHODS

Britain has long been a major wintering area for the Dark-bellied race of the Brent Goose *Branta b. bemica* (Owen et al. 1986) and therefore has a special responsibility for these geese under international legislation (Stroud et al. 1990) and as a Red Data Book Species (Batten et al. 1990). Information is gathered not only about the abundance and distribution of Brent wintering in Britain (e.g. Waters & Cranswick 1993, Cranswick 1993a) but also about population processes based on ringing data (e.g. Ebbinge et al. 1991) and age-ratios (e.g. Ebbinge & St. Joseph 1992, Cranswick 1993b) through which estimations of the annual recruitment and survival can be made.

For the ninth consecutive autumn, the breeding performance of Brents was assessed by experienced voluntary observers. First year (= juvenile) Brent have white edges on the wing coverts which is lacking in older birds. With a telescope and under good light conditions ageing is feasible from 400m. Sample sizes are variable being determined by flock size and field situations. To determine brood size, distinct groups, composed of two or sometimes one adult plus one or more juveniles, recognised, for example, by spatial separation from other birds or a common activity such as walking or swimming together have been regarded as a family. Counts were made between 17 September and 12 December. Observers were asked to note the location, date, time, and habitat for all observations and the sizes of flocks, number aged, total number of juveniles and brood sizes.

### RESULTS

The aged samples are summarised overleaf on a site by site basis (Table 1). Of 243 counts made, seven were made in September, the majority (60%) being recorded in October, with a further 37% in November and one count made in December.

Including multiple observations (e.g. double counts) a total of 101,330 geese were counted and, of these, 55,937 were aged. These contained 10,095 young, a proportion of 18.0%. Geese were aged on 243 occasions at 74 coastal localities within 15 estuarine sites from Humberside to Dorset (Figure 1).

Table 1. Numbers of Dark-bellied Brent Geese counted and aged at 15 British estuaries in autumn 1993. The distribution of flocks across habitats is also shown.

Estuary (see Figure 1)	Counts			No. Localities	Total Count	Total aged	No. young	% Young	Mean Brood size	% Distribution across habitats				
	First	Last	No.							Water	Mud	Marsh	Grass	Cereal
Beaulieu	17 Sep	20 Nov	14	3	3,739	3,121	353	113	3.0	13.7	71.6		14.4	
Blackwater	1 Oct	21 Nov	14	4	14,743	9,665	2,090	21.6	2.9		13.2	0.9	70.9	14.9
Chichester	7 Oct	27 Nov	62	16	16,387	9,667	2,037	21.1	2.6	28.1	5.0	5.8	60.0	1.0
Deben	17 Oct	12 Dec	3	1	2,528	786	261	33.2					100.0	
Exe	26 Sep	8 Nov	3	1	2,045	1,265	154	12.2	2.8		100.0			
Hamford Water	23 Sep	19 Oct	6	1	427	427	186	43.6	2.9		71.2		28.8	
Langstone	10 Oct	18 Nov	47	7	7,650	4,866	1,157	23.8	2.6	8.0	32.9	0.5	58.6	
Medway	15 Nov	15 Nov	1	1	126	126	49	38.9	2.9			100.0		
N W Solent	10 Oct	20 Nov	14	8	3,613	3,139	627	20.0	3.6	40.7	21.6		21.0	16.6
North Norfolk	19 Oct	19 Oct	7	4	2,079	2,079	372	17.9			32.2	11.5	56.3	
Outer Humber	2 Oct	28 Nov	21	7	4,028	4,028	667	16.6	2.3		17.5	82.5		
Poole	11 Oct	11 Nov	4	2	1,200	241	80	33.2	2.8	25.0			75.0	
Stour	19 Sep	17 Nov	14	7	2,561	1,267	180	14.2	3.2		100.0			
Thames	2 Oct	20 Nov	9	2	29,137	7,372	912	12.4	2.9		98.1		1.9	
Wash	1 Oct	24 Nov	24	10	11,067	7,888	970	123	2.7			96.9		3.1
Totals	17 Sep	12 Dec	243	74	101,330	55,937	10,095	18.0	2.7	7.5	43.6	14.2	31.4	3.2

Geese were recorded in one of five habitat types - either water/sea, inter-tidal mud, marsh, grass fields or cereal fields. Sample sizes and locations varied and there was regional variation. However, over 65% were found on the first three categories (representing tidal estuary area, note that water and mud often represent the same

location but are tide dependant). The only areas where geese were found in any number on cereals were the Blackwater and N W Solent.

The distribution across habitat types for 1993 was markedly different to that recorded in 1992 when there were no young present. In 1992 and 1993 approximately the same proportion was found on estuarine water and mud combined (c.50% total in both years), yet the proportion using saltmarsh in 1992 was greater at 38% (compared with only 14% in 1993). Fewer birds (9%) were recorded on grass in 1992 than in 1993 (31%). A better comparison of habitat choice might be to look at 1991 and 1990 when there was 31% and 21% young in flocks. The proportions on each habitat were broadly similar to 1993 (Table 2) although care must be used when interpreting these data since the same areas may not be checked each year. A notable increase in the proportion of birds using grass fields is, however, apparent.

Table 2. Comparison of the proportion of Brent Geese on different habitats at a number of British estuaries (1990-1993)

Year	% young	Water and Mud	Marsh	Grass	Cereal
1990	21.4	59.6	24.2	10.0	6.2
1991	31.2	34.7	29.1	23.4	2.9
1992	0	50.3	38.1	9.2	2.0
1993	18.0	51.1	14.2	31.4	3.2

#### ARE THE AGE COUNTS REPRESENTATIVE?

An assessment of the methodology involved in collecting and analyzing Brent Goose age ratios in Britain is overdue. As a precursor to a formal report on the way in which data is collected and summarised we have taken a brief look at the complete data set for 1993 to assess the role of multiple counting and the number of geese using a site in the resultant estimations of age ratios.

Counters were encouraged to check flocks whenever possible and for sites with multiple records no allowance has been made for possible repeat counting of individuals. The greatest number of counts from one locality was 29 at Langstone Harbour and from one estuarine site being 62 at Chichester Harbour. Thus, some repeat counting of the same geese is probably inevitable. Some evidence for this is available, for example, one pair of geese with nine goslings was recorded twice in Chichester Harbour on dates a month apart. In addition, as we have noted above, the frequency of the proportion of young recorded varies considerably, with, in 1993, no pronounced peak occurring around 18% - the overall proportion of young (see Figure 2). So how representative of the proportion of young in the population are our counts?

Table 3. Estimations of percentage young based on single counts from sites and including the number of Brent Geese regularly wintering at those sites.

Estuary area	% young from all samples (Table 1)	Max sample only from each site	No. young	% young from max sample (a)	5 year mean count (b)	Estimated no. young at site (a*b/100)
Beaulieu	11.3	1,275	149	23.2	1,057	245
Blackwater	21.6	3,914	770	19.7	9,719	1,914
Chichester	22.2	3,113	938	30.1	10,409	3,133
Deben'	33.2	750	25	3.3	1,889	62
Exe	12.2	620	107	17.2	2,361	406
Hamford	43.6	115	78	68	4,629	3,147
Water						
Langstone	23.8	1,715	401	23.4	7,384	1,728
Medway	38.9	126	49	38.9	3,882	1,510
N W Solent	20.0	1,751	284	16.2	3,107	503
North	17.9	1,290	269	20.9	10,351	2,163
Norfolk						
Outer	16.6	1,916	353	18.4	2,688	495
Humber						
Poole	33.2	153	43	28.1	1,125	316
Stour	14.2	901	112	12.4	1,664	206
Thames	12.4	3,310	389	11.8	19,166	2,262
Wash	12.3	2,870	456	15.9	23,016	3,360
Total		21,942 (c)	4,423 (d)		102,447 (f)	21,450 (g)
<b>Mean</b>	<b>18.0</b>			<b>20.16 (e)</b>		<b>20.93 (h)</b>

Notes:

(b) derived from Waters & Cranswick (1993) (e) derived from (dlc\*100)

(h) derived from (glf\*100)

There are several factors to be considered when assessing the proportion of young in flocks of Dark-bellied Brent Geese (e.g. Lambeck 1990). Non-breeding geese tend to arrive earlier in Britain than successful pairs with young. The proportion of young may vary according to geographical wintering area. Brents show a high degree of winter site fidelity and if failure to breed occurs over a part of the breeding range this may be reflected in the number of young present at a particular wintering site. Juveniles tend to be over-represented in the front and adults in the centre of grazing flocks. As a consequence of the flock's structure the composition of temporary sub

flocks can differ greatly. In addition, differences in age ratios are often found between different habitats.

Including repeat counts may have a pronounced impact on estimates of the proportion of young in sample flocks. It is possible to imagine a flock of geese counted only once; of these 4,000 were aged and 800 were found to be juveniles (20%). A second flock of geese, at another site, was checked 10 times; of these 1,000 were aged and (approximately) 400 were found to be young (40%), assuming that the same geese were being checked. By using a single count from each site only, the average proportion of young is  $(4,000 + 1,000) / (800 + 400)$ , giving 24% young. However, include the repeat counts from the second site and the calculation becomes  $(4,000 + (10 \times 1,000)) / (800 + (10 \times 400))$ , giving 34% young.

The sources of error in sampling revealed above will no doubt affect the age ratios obtained. Variability in flock structure can be sufficiently counteracted by taking large samples from the whole of a flock. The other three sources (season, habitat and geographic location) may easily cause systematic biases. A reliable population average is therefore probably adequately made through summing all local counts. Duplicate population appraisals for Brent have been studied and differed by less than 10% (St. Joseph 1982).

In an attempt to check the validity of using repeat counts Table 3 shows the average proportion of young at the 15 estuarine sites already calculated (from Table 1). We include the single maximum sample aged (i.e. excluding all repeat counts from a site) and calculate the percentage young of that single count alone. The mean proportion (20.16%) is similar to the proportion calculated when including multiple counts. We then calculated the number of young expected at a site by including the average winter count from that area (based on a five-year mean from Waters & Cranswick 1993). Thus we estimated the proportion of young overall (20.91 %) allowing for sampling at sites that hold different numbers of geese.

Brent Geese are unusual in that in some years virtually the whole population fails to breed. The three values from Table 3 may be largely coincidental, they are not auto-correlated, yet had they been substantially different (e.g. a calculated value of 10% or 40%) one may have questioned the chosen sampling methods. We therefore suggest that the sampling procedure used at the moment is adequate in estimating age ratios with reasonable confidence. Repeat counts from a single site should be encouraged (whether they are included in the analyses or not) since these add to our understanding of the way in which the proportion of young changes during the winter. A fuller investigation into the methodology of age counts for all geese, and Brent Geese in particular, is required and will be reported on in the future.

## DISCUSSION

The proportion of young present in Britain in 1993 is shown in comparison to the proportion recorded in each year since 1983 in Figure 3. The breeding 'failure' years occurring in 1984, 1986, 1987, 1989 and 1992.

As in the last successful season (1991) there was regional variation. In 1993, this ranged from 11.3% young recorded on the Beaulieu to 43.6% at Hamford Water

although it is worth noting the relatively small sample sizes of geese aged at these sites.

The overall proportion of young present in flocks increased between October (16.4% young) and November (21.7%) as would be expected - non-breeding geese tend to arrive in Britain a little ahead of the successful breeders and their young. However, the average brood size - 2.74 in October (n = 610) and 2.67 in November (n = 323) did not differ significantly between the two months (Ft.933 = 0.544, ns). Most of the pairs recorded with young had either three (26.2%), two (25.5%) or one (21.9%) young with them. Some large broods were recorded too - 22 pairs with six young, four pairs with seven young, one pair with eight young and two pairs with nine young.

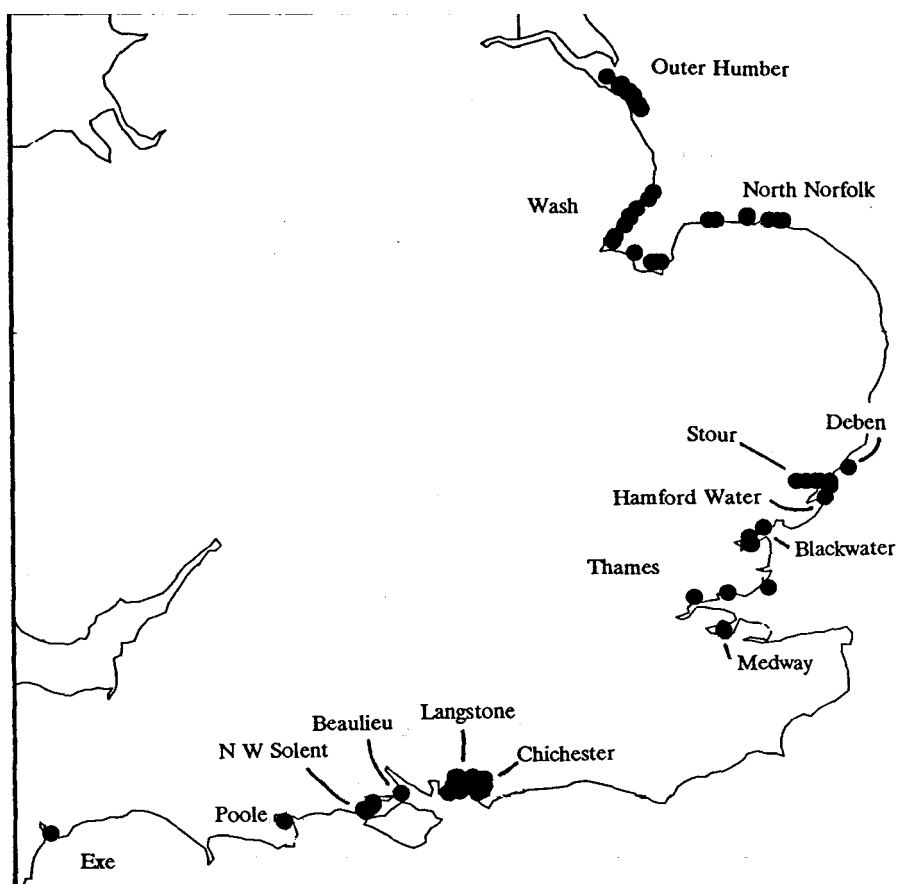


Figure 1. The distribution of 74 coastal localities where Brent Geese were aged in 1993. The 15 estuarine sites referred to in the text are also shown.

There was variation in the frequency of the proportion of young recorded (Figure 2) - thus 44% of the age counts revealed less than 15% young present and yet 20% of the age counts showed greater than 40% young. Note, however, that these values ignore the number of geese aged within each sample. How representative these are is discussed in a later section.

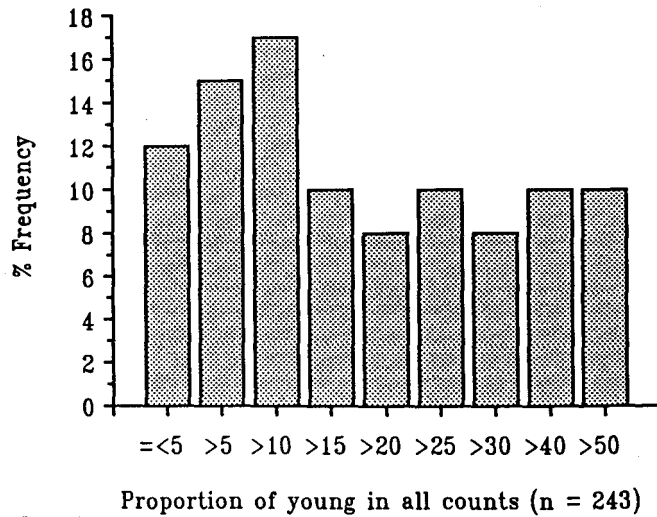


Figure 2. The frequency of the proportion of young recorded in Brent Goose age counts

The poor breeding success in 1992 was recorded for most other high latitude and Arctic breeding geese that wintered in Britain in 1992/93. Greenland Barnacle Geese (4%), Svalbard Barnacle Geese (5%), Greenland White-fronted Geese (4%) and European White-fronted Geese (6%) all appear to have had a poor breeding year (Mitchell & Cranswick 1993). Early indications from autumn age counts of other goose species indicate that 1993 was a more, productive year for other species too (e.g. Pink-footed Geese 17% young).

The world population of Dark-bellied Brent Geese numbered 245,590 in 1992-93 (Rose & Taylor 1993), and the maximum British count from the Wetland Bird Survey (Waters & Cranswick 1993) was 97,033. Assuming an average of 15% annual mortality (Summers & Underhill 1991) and 18% productivity in 1993 revealed by this study, the 1993-94 world figure should remain stable at c.245,000. In recent years 40-60% of these have been present in British estuaries at peak (Salmon & Fox 1991) and thus the mid-winter 1993-94 count in Britain may well see a minimum of c.95,000 using British estuaries.

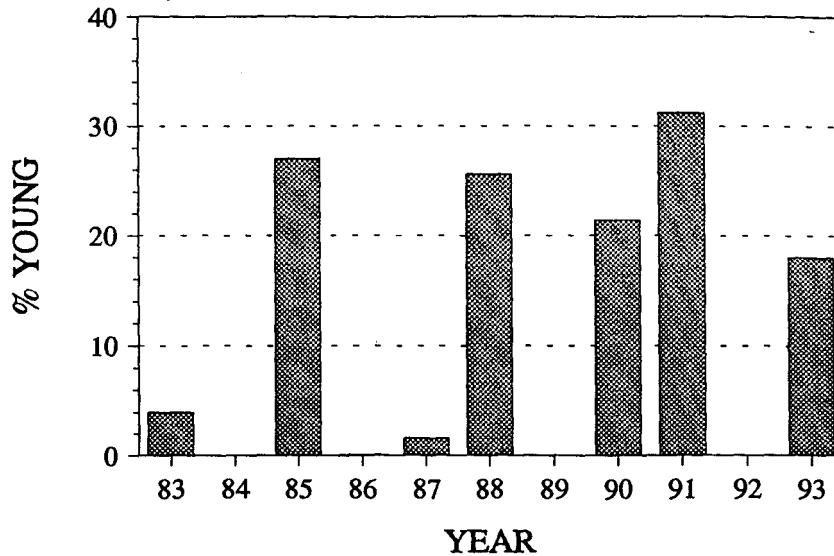


Figure 3. The proportion of young Brent Geese recorded in Britain in 1983-1993.

Information from the continent confirms our findings. An estimate of breeding success from The Netherlands indicated 17.7% young in October (B. Ebbinge in litt.). Unfortunately comparative data from Denmark is no longer collected (A.D. Fox in litt) largely due to sampling biases associated with the timing of the passage.

Of interest, are the findings of Andrew St Joseph and Dr Barwolt Ebbinge who visited the islands north of the Taimyr peninsula off the Siberian coast. Surveys of clutch sizes revealed a mean brood size of less than three on the southern group of islands near the mainland whilst those some 150km further north had a mean clutch size of 4.3. At neither site were there significant numbers of lemmings or Arctic Foxes and based on these data Mr. St.Joseph predicted a good breeding season assuming average gosling survival.

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