GREENLAND WHITE-FRONTED GEESE IN IRELAND 1986/87

A Progress Report

D.W. Norriss and H.J. Wilson

Office of Public Works

Wildlife Service

1987

GREENLAND WHITE-FRONTED GEESE IN IRELAND 1986/87

SUMMARY

Overall the Irish population has shown no appreciable change from last year, although there was an average breeding season. The Wexford flock has declined when an increase was expected. The Rest of Ireland spring census total has shown a small clearcut increase for the first time. White-front flocks are gradually becoming less dispersed but a move to intensively farmed land is no longer apparent. Changes in flock size have been shown to be related to a combination of disturbance levels and susceptibility to disturbance.

INTRODUCTION

This was the fifth winter survey of the Greenland White-fronted Goose and, as in the previous winter, three synchronised counts of Irish flocks outside Wexford were undertaken in November, February and March. In Wexford regular monthly counts were conducted at the same time as those on Islay.

Controlled goose shooting was reopened in Wexford in 1985/86, but the moratorium continued to protect the small flocks in the rest of the country. This regional solution to management was criticized for several reasons and the Minister, for what was then the Department of Fisheries and Forestry, decided goose conservation would, on balance, be best served by again protecting the subspecies totally for the 1986/87 season. Only in Iceland is the Greenland White-fronted goose now a legal quarry species and this is reflected this year in fewer ringing returns from marked geese; three recoveries were received, two of which were geese shot in Iceland.

CENSUS RESULTS

Last winter age censuses at Wexford were conducted on the 25 November and 29 January while the autumn and spring international censuses were held on the 22-26 November and 28 March - 1 April with a further national census on 14-18 February.

Breeding success

The % young in the Wexford flock in January was 16.6%, close to the long-term mean (Table 4). The autumn census produced a slightly lower estimate since a larger proportion of families were concentrated on stubbles where they are difficult to age comprehensively. Mean brood sizes were 3.43 and 3.92 respectively.

Figures for the Rest of Ireland flocks were 14.4% and 2.48.

Wexford

As in previous years, counts were synchronised in Wexford and Islay, and Wexford counts were replicated on the same day.

The mean winter count (mean of all counts from mid-November to mid-April) has decreased by 4.7% since 1985/86, from 7960 to 7588 (Table 1). Changes in numbers do not follow the pattern of previous winters, where apart from one major influx in December/ January, successive counts have been fairly consistent from mid-November on. In addition, counts have been considerably more variable in the 1986/87 season than in previous winters. An analysis of variance was made to see if the means of same-day counts differed significantly between any of the count dates from mid-December until the end of the season (continuing immigration is normal until at least mid-December). Count means on different dates did not differ significantly ($F_{4,5} = 3.66$, $P > 0.05$). In other words, there was no apparent influx of geese into Wexford after mid-December and the particularly variable counts last winter are presumably due to rather higher disturbance levels than normal which resulted in less settled behaviour by the geese and less accurate censusing.

A decline in flock numbers was unexpected as recruitment in 1986 (Table 4) was close to the long-term mean. During the first three years of the FWS survey, when recruitment was also close to the long-term mean, flock size increased annually by about 600 (Wilson and Norriss 1985), so that the 'shortfall' in Wexford is the observed decline plus the expected increase, in round terms about 1,000 geese. A corresponding increase has not been detected elsewhere in the winter range (Table 3) and the reasons for the Wexford decline are at present unclear.

Rest of Ireland

The spring census total in 1987 was 4106 (Table 2), a 4.3% increase from spring 1986. This figure exceeds the maximum population estimate of 1984/85 and Fig. 1 shows there has been a clearcut increase among these flocks for the first time.

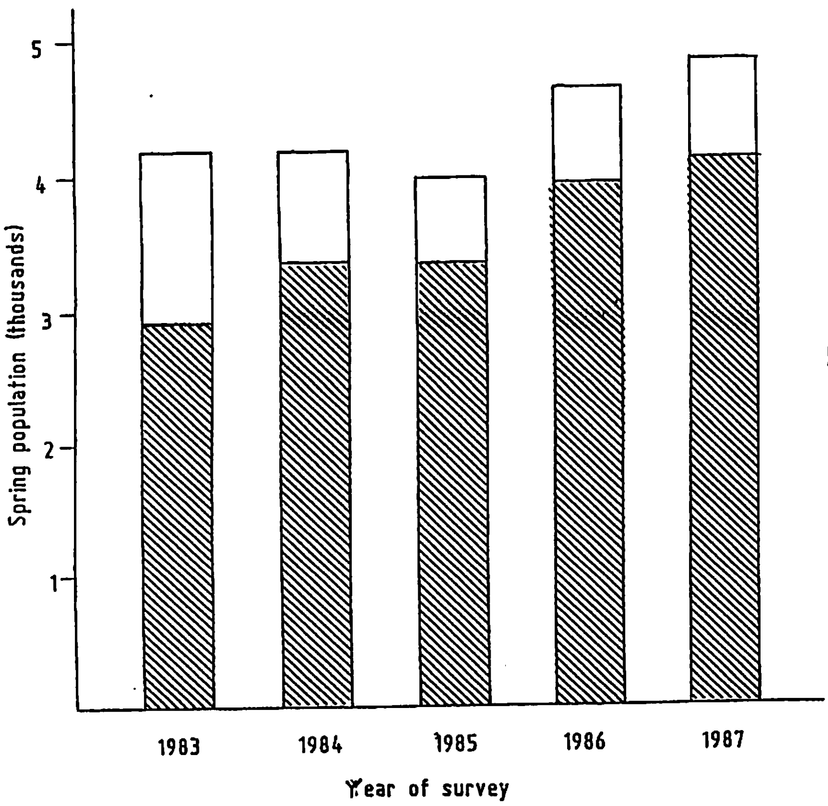

Fig 1. Spring census totals (hatched) and maximum population estimates (open) of Greenland White-fronted geese for Rest of Ireland, 1983-87 (revised 1986).

Most flocks have been stable or increased slightly since the previous winter. However, two have shown large changes that cannot be accounted for solely by mortality and recruitment and where either counting efficiency has changed or there has been a major net movement between flocks.

In the first instance, a co-ordinated ground count of the bogland birds in SW Mayo involved Tony Fox and David Stroud of GWGS from Britain and was highly successful. This flock's bogland range is vast and they are split into a large number of smaller mobile flocks which have always posed survey problems. Our highest counts to date had resulted from complementary air and ground counts. On this occasion thirteen flocks were counted totalling 275-306 geese. This is an increase of at least 100 on previous maxima. While it is not matched by any significant declines in adjacent bogland flocks, the numbers during the count are felt by local Department staff to have been exceptionally high and the possibility of temporarily inflated numbers cannot be ruled out.

The second atypical flock is at Sheskinmore, Co. Donegal, where numbers have fluctuated irregularly between two levels over the past five winteres, flock size varying by about 200 geese. The flock was present at the lower level throughout the 1986/87 season. Coverage was good and geese were unlikely to have been missed but only some of this variation may be accounted for by corresponding changes in other flocks in Co. Donegal.

Small flocks were also seen twice for short periods outside their normal range. A family party of seven or eight whitefronts stayed for four weeks in January with a flock of Whooper swans at the Kilcoole marshes (O 31 07) on the coast south of Dublin. A second family were seen briefly W of Mountmellick on the headwaters of the R. Barrow (N 43 09). The area held a flock of whitefronts until the late 1950's (Ruttledge and Ogilvie 1979) but these geese may well have been stragglers from the adjacent Little Brosna or R. Nore flocks.

31% of the spring census total has been estimated, compared to a normal 10 to 15%. This was almost entirely due to three large flocks being largely or wholly missed during the census period but for which there were already good counts during the winter. None of the flocks have shown much within-winter variation in numbers in previous seasons and we conclude there was probably little loss of accuracy in the spring census figure.

Flooding was widespread throughout the country in November; on the Shannon floods lasted until December and were one of the highest in living memory. The restriction in feeding areas might have exposed geese to greater levels of disturbance had it not been for fears of eating wildfowl contaminated by radiation from Chernobyl. Noticeably reduced wildfowling activity was reported from several parts of the country and some goose flocks became most predictable as a result of low disturbance levels.

NUMERICAL TRENDS AND CHANGES IN DISTRIBUTION

All population segments, British included, have increased as a result of protection (Table 3). When the total population is plotted against year the best fit of the regression line is provided by the untransformed data ($Y = -3,503,554 + 1775X$, $r = 0.9930$); in other words the population has shown a linear increase since 1982/83. There has been no decrease in the annual rate of recruitment and the slowing of the growth rate is mainly a consequence of the reintroduction of shooting in Wexford in 1985/86.

Relative sizes of the population segments wintering in Wexford, Islay and in the Rest of Britain and Rest of Ireland have changed little in this comparatively short period (Fig. 2). Islay and Wexford have shown the most significant changes, Islay increasing from 20.8% to 27.9% of the total spring count between 1982/83 and 1986/87 with comparable decreases in the proportion of geese in Wexford. This is not simply a displacement of birds from Ireland to Scotland. In part the increasing proportion of birds on Islay resulted from more thorough coverage (Stroud and Fox 1985) while the decline in Wexford was due to the reintroduction of shooting in 1985/86. However, the trend has continued after the standardisation of the counting technique in Islay and the protection of geese in Wexford and other factors are evidently involved. So far agricultural conflict on Islay has been avoided since the whitefronts are dispersed and favour the wetter, less intensively farmed areas of the island (Stroud 1986). However, 61% of the total population in winter is now concentrated in the two largest flocks at Islay and Wexford.

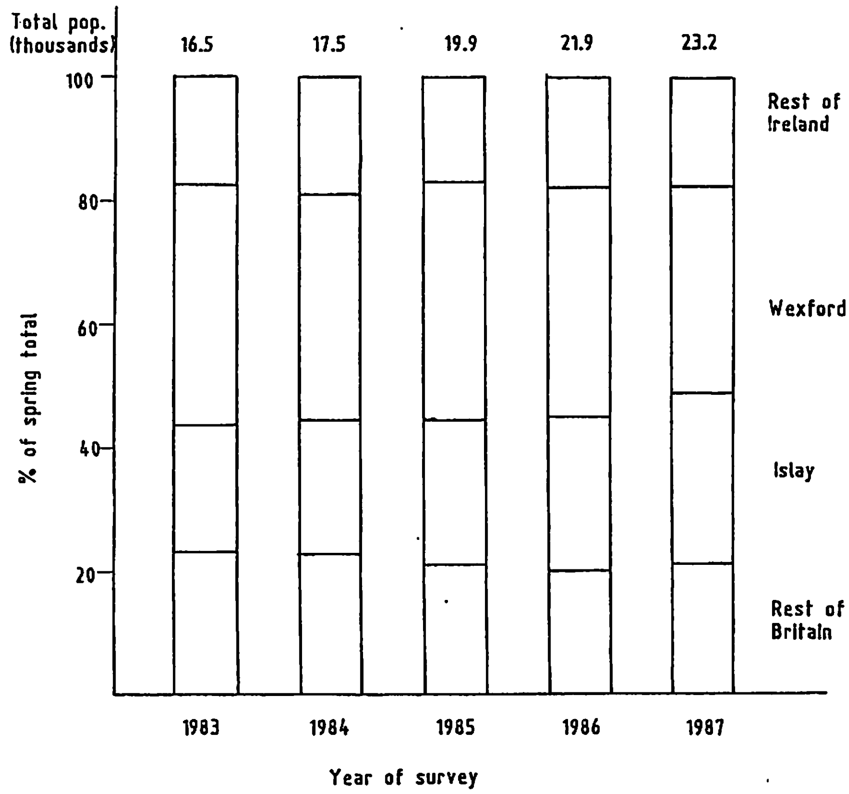

Fig 2. Numbers and relative sizes of Greenland White-fronted goose population segments in Ireland, Wexford, Islay, and Scotland in spring, 1983-87.

A similar trend is apparent among Irish flocks outside Wexford. Declines are commonest amongst smaller Irish flocks (Wilson and Norriss 1984) and the same has also been found in Scotland (Stroud 1986). These declines have continued amongst some Irish flocks up to the present, with one presumed flock extinction since 1982/83 (in the Inny Valley, Co. Kerry where no whitefronts have been recorded for the past two winters). At the same time the survey has not recorded the establishment of any new flocks. No proportional increase is apparent in the flocks using intensively managed farmland (10% V. 34% on all other habitats combined) and no such sustained habitat moves by individual flocks were recorded. So, although geese are not continuing to move to better agricultural land, at least not appreciably in the last five years, flocks are slowly becoming fewer and larger.

Conservation policy should continue to try to ensure the survival of all flocks, if possible, on the habitats in which they evolved. A broad base provides the greatest range of management options for conservation as well as serving scientific and aesthetic interests in the bird.

DISTURBANCE

Ruttledge and Ogilvie (1979) gave habitat loss, particularly from drainage and bog exploitation, as the single most important factor causing a decline of Irish Greenland whitefront flocks outside Wexford between the 1950's and 1970's, a view modified by Owen (1978) who proposed that increased agricultural disturbance following drainage was the important factor.

To see whether changes in flock size are influenced by disturbance levels, we analysed disturbance data from survey site visit cards. These data involved recording, for the duration of the observation, the length of time geese were present, the number and type of disturbances and whether disturbed geese left the site. The area of a feeding site is defined by any number of observations or field signs of geese within 1 km of each other.

The level of disturbance experienced by a flock and the frequencies of energy-expensive flights necessitated by moving to new feeding sites will be a function of both the disturbance rate and the degree to which the number and size of the feeding sites within a flock's range buffer geese from disturbance. All these elements can be quantified by a disturbance index (P_S/R) for each site, where P_S is the probability of geese staying at a feeding site after a disturbance and R is the disturbance rate. A disturbance was included in the analysis only when it caused geese to take flight and where there was an observed cause of the incident. Disturbances caused by observers were excluded from the calculation of disturbance rates. The index was summed for each site within a flock's range for which an arbitrary figure of more than five disturbances were observed and at which geese were present for more than 5% of the total time observed at all sites. The summed total gave a disturbance index for each flock, although insufficient data were available for all flocks. Better ranges, where feeding sites are large and geese are well buffered from disturbance, are represented by higher index values.

Fig. 3 relates the changes in maximum flock size of 18 flocks in the Rest of Ireland between 1982/83 and 1984/85 to their

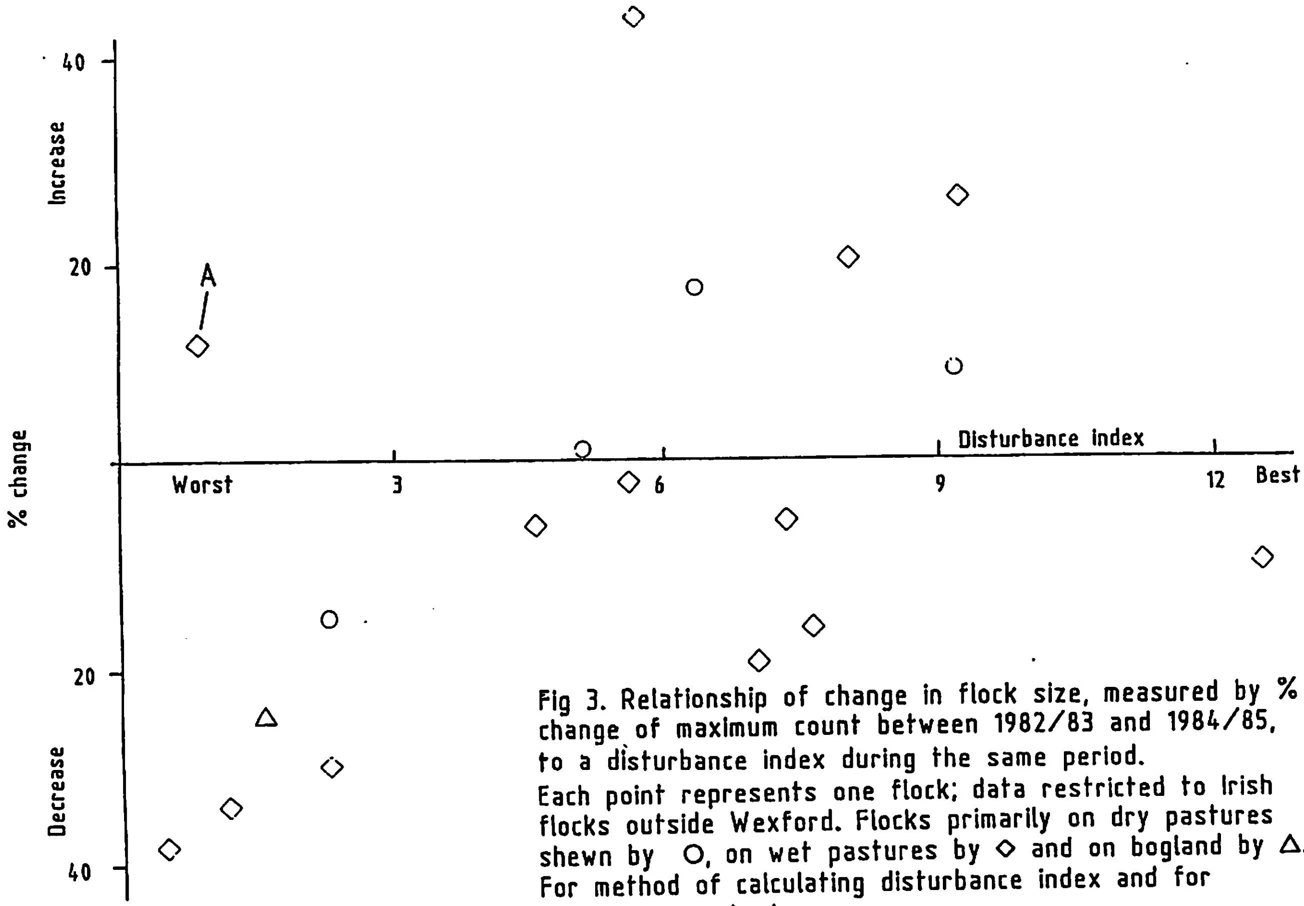

Fig 3. Relationship of change in flock size, measured by % change of maximum count between 1982/83 and 1984/85, to a disturbance index during the same period. Each point represents one flock; data restricted to Irish flocks outside Wexford. Flocks primarily on dry pastures shewn by O, on wet pastures by ◇ and on bogland by △. For method of calculating disturbance index and for statistics see text.

disturbance indices. Change in flock size was significantly correlated to the disturbance index (r_s = 0.4985, d.f. = 16, $P < 0.05$, Spearman's rank correlation). However, the relationship was considerably affected by one flock with an unusually low disturbance index value (flock A in fig. 3).

Several feeding sites of this flock became known since the period on which this analysis is based and one or more major feeding sites remain undiscovered to judge by the frequency with which this flock has been missed during counts. Thus its disturbance index is underestimated. When this flock is excluded from the analysis, a significantly improved correlation of change in flock size and disturbance index results (r_s = 0.6275, d.f. = 15, $P < 0.01$).

The disturbance index value of the intercept of the regression line for a particular change in flock status provides a quantified management objective. However, there are two unrelated problems with fitting a regression line. The first is the non-normal distribution of both sets of data. In both instances the points represent means of three years data and the points themselves can be assumed to be normally distributed about the x and y axes. Secondly, the correlation is not described by a straight line, but the number of points are too few to define their distribution and make the appropriate transformation. For practical purposes, the regression equation was repeatedly calculated as flocks of increasing disturbance index value were added one by one. The estimate of the required intercept that is most accurate and economic is given by the regression line with the steepest slope and narrowest confidence limits. This was % change in flock status = 39.784 + 7.415X (± 2.396, 95% confidence limits), n = 8.

Disturbance-mediated declines may be caused by increased mortality, reduced breeding success or emigration of flock members, or by any combination of these, but we are unable to distinguish between these possibilities. It might be expected that significant levels of disturbance would affect breeding performance by reducing condition, but there was no correlation between disturbance index and recruitment rate for each flock, expressed as a % of the winter mean (Spearman's rank correlation coefficient = 0.0, d.f. = 9, n.s). However, the lack of an observed relationship does not mean that disturbance levels have no effect on subsequent recruitment since successful breeders might redistribute themselves between winters so that such a pattern would be masked. There is some indication from age counts that a redistribution of families does in fact happen, locally at least (unpublished data), but data on movements of marked birds are so far too limited to draw any conclusions.

Tables 5 and 6 show that agricultural disturbance levels are much higher on dry grasslands, whether semi-natural or reseeds, than on wet grasslands and callows. Drier soils have a larger proportion of arable land and more frequently support outwintered stock, whereas wet grasslands in winter are generally too fragile for stock or machinery. Farming activities are primarily responsible for a three-fold increase in overall disturbance rate between wet and dry grasslands. If disturbance levels in most flocks are already as critical as the data in Fig. 3 suggest, the observed increase strongly supports the contention by Owen (1978) that heightened agricultural activity following drainage is a major cause of flock declines and desertions.

At first the higher overall disturbance levels on dry grassland seem at odds with the general trend of Greenland whitefronts to move to more intensively farmed areas. But on these areas field and farm sizes are larger and public access tends to become restricted. Goose flocks are often either protected, even though the primary motive may be stock protection, or shooting is managed and disturbance limited. Protected geese respond less frequently and less intensely to disturbances and they habituate fairly quickly to farming disturbance. Thus a shift in feeding area to incorporate extensive farmland can give a higher disturbance index even without reduced levels of agricultural disturbance. In fact significantly lower levels of disturbance were recorded from estates and naturally protected islands than from other farms in the 'dry grassland' category (Table 6), largely because milking herds are usually overwintered in sheds and such agricultural activity as there is on the fields is often mechanised. Ruttledge and Ogilvie (1979) described how Greenland whitefronts in Scotland have moved to farmland in Scotland when feeding ranges contained large estates but most Irish flocks have been partially or wholly constrained from leaving traditional bogland areas by the small size and high disturbance levels on alternative grassland areas. By the same token the flocks most threatened by drainage will be those with a number of small feeding sites, particularly where an arterial drainage scheme affects several sites simultaneously. This relationship between drainage, food resource dispersion and disturbance also helps to explain the higher extinction rates of Irish flocks with comparatively small, dispersed feeding sites (Table 7). Of the eight Irish flocks which became extinct since the 1950's (estimated from the number and distribution of deserted sites), four were affected by drainage (Ruttledge and Ogilvie 1979).

Table 5 shows that the shooting component of disturbance rates is of similar absolute value in dry and wet grasslands but is of greater relative importance in wet grasslands. On average shooting caused a quarter of all wet grassland disturbances, but in good wildfowling areas it could be much more important. We suspect the combination of heavy shooting pressure with small feeding sites in wet grasslands was responsible for the near desertion by four flocks in Co. Clare by 1981/82 and for their subsequent rapid recolonisation since the shooting moratorium was introduced (Wilson and Norriss 1984).

Values of P_S and R are least for flocks on blanket bog, the opposite extreme to flocks on large intensively farmed areas. Observations were made on the more accessible bogland sites (Table 6), so are probably overestimated. Geese on blanket bog feed by probing in the wettest, softest, ground. These are usually discrete patches from <0.1 ha to 10 ha or more in size and are widely dispersed throughout the feeding range. We have recorded up to twenty-six blanket bog feeding sites for one flock. Although habitat loss is severe on bogland at present, there is good reason, with one exception of the flock in the Bog of Erris, Co. Mayo, to think it is not yet at a critical level for geese. Although there are no estimates of carrying capacity, renewal rates of food species etc., there are examples in each of the flocks' ranges where gross disturbance, usually by forestry, has been accommodated within a feeding range by a shift in bogland feeding area. Like the habitat threats posed by drainage, a more immediate danger than loss of feeding sites comes from the increased disturbance levels when a bogland area is opened up.

Since the value of P_S is so low they are dependent on a continuing low mean disturbance rate. Therefore effective conservation of bogland geese will require large areas of their feeding range to remain remote and undisturbed. The case for extensive bogland conservation has already been made on botanical grounds by Ryan and Cross (1984) and for breeding waders in Scotland by Stroud et al (1987).

TRAPPING AND RESIGHTING OF MARKED GEESE

In 1986/87 96 Greenland whitefronts, 3 pinkfooted geese and 1 greylag were trapped in four sessions on the Wexford Slobs during a six-week period from the end of October to mid December. Geese were caught by firing cannon-nets over plots of unharvested barley or prebaited stubbles.

Observations of geese neck-banded in Wexford have shown no sustained behavioural changes associated with marking and no gross effects on survivorship with Darvic materials are recorded in the literature (Owen 1980) but the possible effects of collars on the ability to form pair-bond remains untested and demand discretion in the proportion of a flock that are neck-banded. We had hoped to catch and neck-band small numbers in two flocks outside Wexford. In the end, 13 geese were caught, all in the Midlands. This is the first successful attempt to catch geese elsewhere in Ireland and has proven to be a more difficult task with a different set of problems to Wexford.

Once again small numbers of neck-collared birds of Wexford origin have been widely scattered elsewhere in the wintering range - in four Irish and five Scottish flocks. Unfortunately even neck-collars are proving a problem to read in some circumstances outside Wexford and at least 50% of individuals were unidentified. A similar proportion of Greenland-ringed leg band resightings were read (4 out of 9); many thanks to all those thwarted and otherwise, who provided observations of marked geese.

ACKNOWLEDGEMENTS

Our grateful appreciation to all who have contributed to the counts and the resighting of Darvic markers.

D. Allen, P. Behan, R.J. Bleakley, K. Blehein, V. Breslin, J. Byrne, D. Cabot, J. Carroll, P. Cosgrove, D. Cotton, D. Devlin, E. Doran, D. Duggan, T. Durkan, M.J. Feehan, J. Flynn, P. Foley, J. Gatins, J. Greene, M.J. Hackett, P.J. Hall, B. Haran, S. Heery, J. Hennigan, S. Hession, G. Higgins, J.J. Higgins, D. Hogan, B. Kilroy, L. Lenihan, M. Lohan, G. Luke, R. Lundy, Mr. P. McDonnell, D.J. McLaughlin, D. McMahon, J. Magee, O. Merne, E.A. Meskill, A. Molloy, J. Moore, P. Morgan, C. Murphy, G. Murphy, B. Nelson, P. O'Connell, T. O'Connell, B. O'Connor, T. O'Donoghue, M. O'Sullivan, P. O'Sullivan, P.J. O'Sullivan, A. Prins, M. Ridgeway, D. Scott, R. Sheppard, D. Silke, K. Stanfield, D. Stanley, M. Sweeney, R. Tottenham, P. Vaughan, P.B. Waldron, E. Wallace, A. Walsh, P.J. Warner, and to C. Murphy, R. Nairn and N. Sharkey for administrative help.

Many thanks also to E. Bignal, S. Bignal, , N. Easterbee, T. Fox, G. Jackson, M. Ogilvie, S. Percival, P. Reynolds, L. Still and D. Stroud for information on counts and neck- collared geese in Scotland and Iceland. We are also particularly grateful to M. Owen and T. Fox of The Wildfowl Trust, Slimbridge for organising the entry of the resighting data on computer. P. Dowding kindly gave statistical advice.

REFERENCES

Owen, M. (1978). The Greenland White-fronted Goose - the case for protection. Unpubl. mss, Wildfowl Trust. 3 pp.

Owen, M. (1980). Wild Geese of the World. B.T. Batsford, London.

Ryan, J.B. & Cross, J.R. (1984). The conservation of peatlands in Ireland. Proc. of the 7th Int. Peat Cong. 1: 388-406.

Ruttledge, R.F. & Ogilvie, M.A. (1979). The past and current status of the Greenland White-fronted Goose in Ireland and Britain. Irish Birds 1(3): 293-363.

Stroud, D.A. (1983). Greenland White-fronted Geese in Great Britain; 1982/83. GWGS, Aberystwyth. 14 pp.

Stroud, D.A. (1984). Greenland White-fronted Geese in Great Britain; 1983/84. GWGS, Aberystwyth. 12 pp.

Stroud, D.A. (1985). Greenland White-fronted Geese in Great Britain; 1984/85. GWGS, Aberystwyth. 12 pp.

Stroud, D.A. (1986). Greenland White-fronted Geese in Great Britain; 1985/86. GWGS, ABerystwyth. 20 pp.

Stroud, D.A. and Fox, A.D. (1985). A conspectus of information relevant to the conservation of the Greenland White-fronted Goose (Anser albifrons flavirostris) in the British Isles. GWGS. Aberystwyth. 17 pp.

Stroud, D.A., Reed, T.H., Pienkowski, M.W. & Lindsay, R.A. (1987). Birds, bogs and forestry: the peatlands of Caithness and Sutherland. Report of the Nature Conservancy Council, Peterborough.

Wilson, H.J. and Norriss, D.W. (1984). Progress report of the all-Ireland Greenland White-fronted Goose Census and FWS Research Project for 1983/84. Internal report of the Forest and Wildlife Service, Dublin. 17 pp.

Wilson, H.J. and Norriss, D.W. (1985). The Greenland White-fronted Goose in Ireland, 1982/83 to 1984/85: a report on its status, distribution and the impact of shooting. Internal report of the Forest and Wildlife Service, Dublin. 39 pp.

TABLE 1: Counts of Greenland White-fronted Geese in Co. Wexford, 1986/87.

DATE	WEXFORD SLOBS	CAHORE	TOTAL
24.11	6956	-	6956
24.11	7109	-	7109
9.12	5981	0	5981
9.12	6943	0	6943
15.12	8339	-	8339
15.12	7981	-	7981
22.1	7236	69	7305
22.1	7833	69	7902
16.2	8769	0	8769
16.2	8395	0	8395
9.3	7460	35	7495
9.3	7975	35	8010
30.3	7272	0	7272
30.3	7780	0	7780

Mean of all counts 7588

TABLE 2: Regional summary of peak monthly counts and censuses, 'Rest of Ireland' 1986/87.

	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.
Donegal/Derry	485	62	142	616	236	762
N. Central	196	109	224	25	17	239
Mayo	217	32	200	94	215	212
Connemara	337	275	0	151	30	336
Corrib/Galway	200	144	266	267	137	279
Clare/Limerick	87	36	83	182	143	175
Shannon Head	408	90	141	362+	386+	641+
Midlands	445	-	30	370	-	63
Middle Shannon	598	387	817	981	396	840
South Midlands	70	70	134	63	70	70
South West	142	101	117	115	153	182
TOTAL	3185			3226+		4106+

TABLE 3: Autumn and spring census totals of Greenland White-fronted Geese 1982/83 to 1986/87. British figures were revised slightly for spring and autumn 1985 and spring 1986 as some additional counts were received. Totals for British counts in 1986/87 are provisional. British data in Tables 3 and 4 from Stroud (1983, 1984, 1985, 1986 and in prep.)

	Spring 1983	Autumn 1983/84	Spring 1983/84	Autumn 1984/85	Spring 1984/85	Autumn 1985/86	Spring 1985/86	Autumn 1986/87	Spring 1986/87
Wexford	6363	4758	6267	6097	7590	7930	7940	7033	7780
Rest of Ireland	2896	2879	3344	3030	3361	3565	3928	3185	4106
Britain	7282	8188	7926	9490	~~8952~~ 8997	11026	10015	~~10952~~ 10,809	~~11357~~ 11,385
TOTAL	16541	15825	17537	18617	~~19903~~ 19948	22521	21883	~~21170~~ 21,027	~~23243~~ 23,271

TABLE 4: Age counts and frequency distribution of brood sizes for Wexford, Rest of Ireland and Britain, 1986/87.

Date and Location	Total Aged	% Juvs.	Mean brood size (n)	Brood Size 1	2	3	4	5	6	7	Calculated totals of Young	Families
Wexford												
25.11.86	3090	14.6	3.92 (75)	3	12	18	15	16	6	3[1]		
29. 1.87	5046	16.6	3.43 (201)	8	43	70	40	22	11	6[2]	1260	367
Rest of Ireland	2270	14.4	2.48 (94)	25	23	31	7	7	1	0	591	238
Britain	4850	10.6	2.74 (162)	46	31	40	25	9	6	5		

1 Two broods of 8

2 Single brood of 8

TABLE 5: Variation by habitat in the type, importance (top row, % occurrence) and rate (bottom row, no./hr.) of disturbance of Greenland White-fronted Geese during and after the shooting season. Data for individual sites in 'Rest of Ireland' flock ranges, 1982/83 to 1984/85.

	ARRIVAL - 31 JANUARY					1ST FEBRUARY - DEPARTURE				
Disturbance due to:	Farming	Shooting	Aircraft	Other	n Total	Farming	Shooting	Aircraft	Other	n Total
Dry grasslands	56% 0.29/hr	10 0.05	15 0.07	19 0.10	41 0.51[a]	49% 0.25/hr	3 0.02	12 0.06	36 0.18	33 0.51[a]
Wet grass-land/callows	48% 0.08/hr	22 0.04	10 0.02	20 0.03	40 0.17	32% 0.05/hr	16 0.03	26 0.045	26 0.045	19 0.17
Blanket bog	22% 0.02/hr	11 0.01	0 0.0	67 0.05	9 0.08	50% 0.04/hr	0 0.0	25 0.02	25 0.02	4 0.08

Footnote: [a] As there was no significant difference in disturbance rates during and after the shooting season, the mean rate of disturbance for the winter has been used in calculations (above).

TABLE 6: The probability of disturbed geese staying at a feeding site (P_S) and the disturbance rate (R), (means with 95% confidence limits), in different habitats. Data for individual sites in 'Rest of Ireland' flock ranges, 1982/83 to 1984/85.

Habitat	P_S	R (no./hr)
Dry grasslands	0.258 ± 0.235 n = 5	0.509 ± 0.235 n = 14
Wet grasslands and callows	0.275 ± 0.146 n = 12	0.171 ± 0.077 n = 20
Islands and areas of limited access	0.567 ± 0.436 n = 3	0.074 ± 0.064 n = 7
Blanket bog	0.093 ± 0.111 n = 4	0.079 ± 0.068 n = 7

TABLE 7: The number of Scottish and Irish Greenland White-fronted Goose flocks that have become extinct since the 1950's and the number currently extant. The number of extinct Irish flocks has been estimated from data on the number and distribution of deserted haunts, compiled by Ruttledge and Ogilvie (1979).

	Extinct		Extant
Source	Ruttledge & Ogilvie	GWGS & FWS	GWGS & FWS
Period	1950's - 1979	1979-1987	1987
Scotland	0	2	?
Ireland	7	1	32