

A Conspectus of information relevant to the conservation of the
Greenland White-fronted Goose (Anser albifrons flavirostris)
in Britain and Ireland

A submission by the Greenland White-fronted Goose Study

1. INTRODUCTION

- I.1 The Greenland White-fronted Goose Study is a non-profit making research organisation initiating and co-ordinating studies of this race of geese in Britain and on the breeding grounds in Greenland.
- I.2 In 1979, the study group organised a comprehensive study of the geese on their breeding grounds in west Greenland with a follow-up expedition in summer 1984 when further ecological studies were undertaken.
- I.3 Since autumn 1982 the group has co-ordinated regular counts of the geese on their wintering grounds in Wales, England and Scotland in conjunction with simultaneous counts organised by the Forest and Wildlife Service in Ireland.
- I.4 Since 1983/4, more intensive studies have been carried out in association with the Nature Conservancy Council at the main British wintering site, the Isle of Islay (Stroud, Easterbee and Bignal in prep).
- I.5 The group continues to take a major lead in actively promoting the conservation of the Greenland White-fronted Goose through the collation of information and the co-ordination of studies throughout the range of the goose. The group is independent and entirely self-supporting, relying on self-funding and financial support from various academic, research and conservation organisations for specific projects.

2. DISTRIBUTION AND ABUNDANCE

- 2.1 The Greenland race of the circumpolar White-fronted Goose (Anser albifrons flavirostris) breeds solely in west Greenland between 64°N and 73°N and winters exclusively in western and northern Scotland, Ireland and two sites in Wales.
- 2.2 Occasional vagrants are seen on the eastern seaboard of North America (Palmer 1976, and references in Fox and Stroud 1981) and in north-western England, although these do not constitute regular wintering flocks.
- 2.3 The geese traditionally associate with peatland areas which represent their natural feeding grounds. As a result, wintering sites are scattered and discrete and flocks in Britain rarely exceed 300 birds at any one site.
- 2.4 The highly dispersed breeding distribution and remote nesting areas makes summer population size assessment impossible. Estimates of the world population thus derive from winter counts alone. Past counts are few, and for much of the range non-existent, yet by the 1970s, Ruttledge (1973) had noted a major decline at many traditional Irish sites.
- 2.5 Ruttledge and Ogilvie (1979) estimated the world population in the 1950s at 17,500-23,000 birds, falling to 14,300-16,600 by the late 1970s. Numbers in Ireland were reported to have declined by 50% whilst numbers in Britain had increased slightly in the same period.

- 2.6 In the late 1970s it also became apparent that not only was the population small and declining, but that recovery from further decline would be inhibited by low productivity (Ogilvie 1978). Massive continuing loss of traditional peatland habitat, especially in Ireland, was having a severe detrimental effect on Greenland White-fronted Geese (Owen 1978, Ruttledge and Ogilvie 1979, Ryan and Cross 1984, Reynolds 1984, Stroud 1984).
- 2.7 Since autumn 1982, a series of co-ordinated counts at all known sites in Scotland and Wales has been undertaken, with two complete censuses each winter, timed to coincide with those in Ireland organised by the Forest and Wildlife Service. The autumn count is normally undertaken during the second or third week of November, the spring survey during the last week of March/first week in April. The results have been published in a series of reports (Stroud 1983, 1984, 1985a) and are summarised in Table 1.
- 2.8 Intensive surveys of groups of wintering sites over the three years have been carried out to locate previously unknown wintering areas and assess census accuracy by repeated counts of certain sites. Thorough surveys of this nature have been undertaken on Coll and Tiree and in Galloway, Kintyre and Caithness.
- 2.9 Since February 1983, monthly counts on Islay by four teams of two counters have checked over 700 known feeding areas in a single day. Counts are repeated on two successive days to check the accuracy of the method and to look in detail at day-to-day distribution changes (Stroud, Easterbee and Bignal in prep). Peak counts on Islay for the last four winters are given in detail in Table 2, and all counts summarised in Table 3.
- 2.10 Between-day count accuracy varied, but rarely exceeded 10% on the two counts each month. Greater error was usually attributable to severe weather or degree of disturbance on one of the two days. During 1983/4, numbers declined in mid-winter from an autumn 'peak', then increased slightly in spring. Such changes were highly correlated to change in mean flock size, implying the fragmenting flocks in mid-winter were becoming increasingly difficult to find and count accurately. It is thus considered the mid-winter fall in numbers is a 'coverage error' and does not reflect emigration from the island.
- 2.11 Past counts in November on Islay, at least in recent years, are thus likely to have detected most birds present when flock sizes are large and geese tend to feed on stubble (but see 3.3). Further discussion is restricted to autumn counts.
- 2.12 **British Totals**
- 2.12.1 The November 1982 British total was found to be c. 7,200 and the spring total that winter was not significantly different (Table 1). Since the previously reported British total of Ruttledge and Ogilvie (1979), several small, but apparently long-established wintering flocks have come to light, notably Barvas (Isle of Lewis), two flocks on Mull, Isle of Danna (Argyll) and Loch a' Chnuic Bhrìc (Jura).

- 2.12.2 In calculating the British wintering population in the 1970s, Ruttledge and Ogilvie (1979) took the lowest and highest annual counts for the period 1974/75 to 1978/79. Using this method for the new sites (2.12.1) an additional 130-290 geese would have been involved, making the adjusted mid-1970's population 6,630-7,590. The results of the two 1982/3 censuses fall within the mid-range of that estimate and indicate no significant increase or decrease within Britain since the 1970s.
- 2.12.3 By November 1983, the population had increased to c. 8,200: a 14% increase. The increase was entirely accounted for by a very high Islay count (4,592) and numbers elsewhere had generally fallen. The proportion of the British population on Islay during 1983/4 (56%) was significantly higher than in 1982/3 (45%). This inflated British total is hard to reconcile with the very low numbers of young in the flocks: 1983 had been a below average breeding season. It is felt that the apparent increase was compounded by the more thorough counting techniques on Islay that season (3.2), since there was an 8.6% decrease in numbers at sites away from Islay. This decline (from 3,939 to 3,596) is what would be expected from the smaller proportion of young produced in 1983.
- 2.12.4 By November 1984, the population in Britain had increased to c. 9,490, a 13.7% increase from the previous autumn. This increase is considered genuine, since most British wintering flocks increased by a similar proportion and is in line with observed productivity (13.5% young overall in British flocks).

3. CHANGES IN COUNT QUALITY AND COVERAGE

- 3.1 This observed increase in numbers is compounded by known changes in coverage and count methodology, particularly on Islay where the largest proportion of the British wintering population is found.
- 3.2 Prior to February 1983, Islay was counted by one observer over the course of two to three days. Observations of Darvic-ringed birds (Fox and Stroud in prep) shows little short-term movement between different areas of the island, but sample size is small and such counting is inevitably less accurate than a complete count on a single day. From February 1983 until 22 November 1983, counts were made by three teams of counters covering different areas of the island in one day. From 23 November 1983 to the present, counts have been made by four co-ordinated teams.
- 3.3 Despite the numbers of counters and their routes remaining constant 'new' feeding areas are constantly being found. With well over 700 separate sites to check in the course of a day, it is inevitable that coverage errors will still play an important role in the final total. Islay counts are currently thought comparable and detect a very high proportion of the

total number present. However, with a survey route totalling 264 km, it is clearly impractical to locate every last bird on the island.

- 3.4 Elsewhere, coverage error is less important, sites tending to be discrete and usually well-known. Flocks are generally small, minimising count error (Stroud, Easterbee and Bignal in prep). November flocks are easily found and counted, although spring flocks away from Islay tend to be less predictable. 'New' sites continue to be located (see 2.12.1), although less frequently to the present, and most hold very small groups suggesting that all major wintering areas in Britain are now well known and regularly counted.
- 3.5 Analysis of historical records is fraught with difficulties. Early estimates for Islay considerably underestimate numbers present due to incomplete counts and lack of intimate knowledge of feeding areas. We agree with Ogilvie (1983) that "..... there seems to have been no long term change in numbers, either up or down", excepting the last two years' counts which do seem to represent a real increase. Coffey's assertion (1983a, 1983b) of an 80% increase on Islay "... from 2,000-3,600" seems to be a misunderstanding of the published counts for Islay and we would refute evidence for any such long-term increase.
- 3.6 Given the strong site fidelity of this race (Fox and Stroud in prep), the recent Scottish increase is better explained in terms of lower winter mortality of this population segment rather than any implication of immigration from elsewhere.
- 3.7 Elsewhere in Britain, there is evidence of both site desertion and the establishment of new flocks. A major wintering site at Cors Caron, Dyfed, Wales, which held a peak of 600 birds in the early 1960s was deserted by the end of the decade (Fox and Stroud in press). Several minor Scottish sites have been deserted each decade from the 1950s to the present and many sites have shown significant declines over the same period. In many cases, these desertions can be explained in habitat change, yet others appear spontaneous. It does appear, however, that site loss in Scotland has been considerably less than in Ireland, yet away from Islay, numbers continue to decline.
- 3.8 Increases have been reported at a few, genuinely new sites, although these do not balance larger desertions. A now regular flock on Jura was first noted in 1980/81, whilst at Rhunahaorine, Kintyre a flock first recorded in 1934/35 has now increased to over 850 birds.
- 3.9 Overall, evidence shows British Greenland Whitefronts are tending to become increasingly concentrated at a small number of heavily-used sites, a trend which can only make these flocks more vulnerable to land-use changes and increase the potential risk of conflict with local agriculture. However, to date there has been no agricultural conflict regarding Greenland Whitefronts in Britain, not even on the island of Islay.
- 3.10 In conclusion, we strongly feel the historical record is too patchy and liable to varying types of bias to permit heavy reliance on it when compared with results of recent surveys and counts where bias is controlled to a minimum. In formulating

decisions affecting a major proportion of a scarce race, stress must be given to recent censuses which have at least established a base-line for the population. Past recollections and vague counts can be useful in identifying trends but are unreliable in formulating a conservation policy.

4. CURRENT PROTECTION

4.1 Legal Status in Britain

4.1.1 The Greenland White-fronted Goose was placed on Annex 1 of the 1979 EEC Directive on the Conservation of Wild Birds. The British Government is thus required to take the following measures:

- i) To take special conservation measures concerning their habitat (Article 4).
- ii) Classify the most suitable territories as Special Protection Areas (Article 4).
- iii) Take steps to avoid pollution, deterioration of habitat or any other disturbance affecting the birds within designated areas (Article 4).
- iv) Provide protection from shooting.

British legislation was introduced to comply with obligations under the Wild Birds Directive in 1981, although to date, no Special Protection Areas have been designated in Great Britain in compliance with this directive to protect the goose areas.

4.1.2 Under the terms of the Wildlife and Countryside Act (1981), White-fronted Geese (Anser albifrons) were protected in Scotland. This effectively gave protection to the vast majority of British wintering Greenland Whitefronts. Although enjoying no legal protection in Wales, a voluntary shooting ban has been in operation on the main Welsh site (Dyfi Estuary) since 1972; this ban has undoubtedly been the major factor in the survival of this small flock (Fox and Stroud in press).

4.1.3 Although enacted in 1981, the provisions affecting the Whitefront did not commence until September 1982, the winter of 1982/83 being the first when the race was fully protected in Scotland. Although there have been, and no doubt will continue to be, infringements of this protection, the change in legal status in Britain has been generally accepted and no great enforcement problems have arisen.

4.1.4 Of importance in context is the continued shooting, under licence, of Barnacle Geese on Islay. These geese can now be shot throughout the spring until their departure in late April. On many areas of Islay, flocks of Whitefronts, feeding in association with Barnacle Geese, have been severely disturbed throughout the crucial late spring feeding period (7.1). Refuge

management on Islay, while primarily aimed at Barnacle Geese, will benefit some Greenland Whitefronts also. However, the intended or established Barnacle Goose refuges lie outwith the main Greenland Whitefront feeding areas (Stroud, Easterbee and Bignal in prep). The same authors conclude that Greenland Whitefronts require a broader management policy than Barnacle Geese, including habitat protection over a wider area of Islay.

4.2 Legal Status in Ireland

4.2.1 Protection for a three year period (winters 1982/3-1984/5 inclusive) was given to Greenland Whitefronts by the Irish Government.

4.3 Legal Status in Northern Ireland

4.3.1 Protection has recently been given to Greenland White-fronted Geese in Northern Ireland under a Wildlife and Conservation (Northern Ireland) Order issued by the Department of the Environment for Northern Ireland in February 1985.

4.4 Legal Status in Iceland

4.4.1 Shooting commences in late August and geese can be shot in Iceland throughout the autumn migration. With only 600 waterfowl hunters in 1974 and little tradition of goose-shooting (Lampio 1974, Ruttledge and Ogilvie 1979), there appears little threat from this source of mortality. However, there have been 31 recoveries of ringed Greenland White-fronted Geese to the present, 8.6% of all recoveries, an alarming proportion of these in their first year of life. The Icelanders are now considering legislation to move in line with Great Britain, and since there are no agricultural conflicts nor a large and active shooting lobby given the abundance of other goose quarry, this seems likely to be implemented in the near future.

4.5 Legal Status in Greenland

4.5.1 In February 1985, the Greenland Landstinget (Home Rule Parliament) gave full protection to Greenland Whitefronts from spring 1985 for a provisional three year period. This decision is regarded as important, since it is the first change in bird protection legislation since declaration of Home Rule in May 1979.

4.5.2 An important factor in the decision was the increased shooting pressure on geese first arriving on the breeding grounds in May. Greenland Whitefronts are unusual amongst geese of the world in not staging en route to the breeding grounds on migration. Instead, they derive supplementary nutrition in Greenland during a period of pre-nesting feeding close to their ultimate nesting areas (Fox and Madsen 1981, Fox and Ridgill in press). Since it appears the earliest arriving geese are breeding adults, this increasing shooting

was disproportionately affecting the already small number of nesting pairs.

4.5.3 Although present in midden remains, whitefronts never seem to have been important prey for historical Inuit and Greenlandic cultures (Stroud in prep). With the notable exception of a very few specialised settlements, these geese have not been a part of the traditional Greenlandic diet. The hunting in spring has been undertaken for sport (rather than subsistence) and generally by Danes and visiting US Service personnel. It is thus considered this legislation change will not significantly affect the Greenlandic way of life.

5. BENEFITS OF PAST PROTECTION

5.1 Analysis of past census and productivity data from Islay suggests numbers have risen in winters following good breeding seasons. However, increases are never sustained, with numbers soon falling back to the long-term average of 3,500-4,000 geese. This implies mortality, from whatever source, has always been sufficient to damp any tendency for real and sustained increase in population size.

5.2 In considering this information, we feel that count and coverage error (3.5) would not affect productivity scores, nor would have been sufficiently great to mask real and sustained increase in numbers on Islay.

5.3 Since protection, Greenland Whitefronts on Islay have apparently risen for two years in succession. Whilst some of the increase following the poor 1983 season may have been due to better counting methods (2.9), the increase following the average breeding season in 1984 is no doubt real.

5.4 Although too early to determine if the Islay increase will be sustained, we feel there can be no doubt that protection over the last three winters has been beneficial to the population there.

5.5 In bearing this in mind, it should be remembered that Islay is by far the largest and most important of the British wintering sites and may not be typical of the rest of the range where numbers are smaller, more vulnerable and productivity poorer.

5.6 Few sites elsewhere have sufficient base-line counts to judge increases against, and whilst some sites have shown a recent increase, others have remained stable and yet others have continued to decline. Declines are most commonly manifest amongst the smaller and most isolated flocks. Although a longer period of monitoring is required, we feel that protection has undoubtedly helped in most areas, particularly at sites which were subject to heavy shooting disturbance and mortality.

6. TRENDS IN RECRUITMENT AND MORTALITY

6.1 Breeding success has been monitored on Islay by age ratio and brood size determination since 1962/63 (Ogilvie 1983, Stroud 1983, 1984, 1985a) and are summarised for Islay in Table 4.

- 6.2 The success varies greatly from year to year; this may be due to extrinsic factors such as the weather on arrival and throughout the summer in Greenland, but may also reflect aspects of the goose condition on the winter grounds during the previous spring.
- 6.3 Confidence in these sample estimates increases with sample size, and some of the earlier samples are based on small numbers of geese aged which may be misleading.
- 6.4 Mean productivity on Islay was 14.51%, alarmingly low for a goose population and particularly so for a quarry species. In contrast, the European race of Whitefront (Anser albifrons albifrons) has on average 34% young in autumn, and the two North American sub-species (Anser albifrons gambeli and Anser albifrons frontalis) produce 37 and 37.5% (Owen 1978).
- 6.5 Brood size, however, is high, the mean of 2.6 equals that of the European race, but is far higher than the 2.2 and 2.5 of the American races. This means that an exceptionally low proportion of mature Greenland Whitefronts breed successfully. This feature is confirmed by studies of Darvic-ringed birds caught in Greenland during 1979 (Fox et al 1983).
- 6.6 With such a minute proportion of the population contributing to new recruitment through successful breeding, it is vital that no additional factors contribute to the failure of this small number of breeding pairs.
- 6.7 There is no direct information about mortality rate, although analysis of ringing recoveries of geese ringed in Greenland during 1946-1978 gives a mean of 30.1% (+ 1.4% standard error, after the method of Haldane 1955; Fox and Stroud in prep). This is far higher than that of other western European grey geese (eg Boyd 1956, 1957).
- 6.8 Ogilvie (1983), balancing loss against productivity from incomplete Islay counts, suggested the mean rate of loss to be 10.5% annually there, although clearly to balance population gains in what has been assumed to be a stable population, the total rate of loss must have been considerably higher than this.
- 6.9 Whilst it is impossible to interpret the distribution and cause of death amongst recovered birds as reflecting the loss amongst ringed geese and is even less likely to represent the unmarked population, it is of interest to examine these records. Of 230 recoveries of ringed geese in the British Isles, 88.7% were shot, and of those recovered in Ireland, 93.3% were shot, the remainder being recovered by other means.

7. EFFECTS OF WINTER SHOOTING/DISTURBANCE ON BREEDING SUCCESS

- 7.1 Winter shooting, at least on Islay, is age specific. Bag analysis from 1979-1982 (prior to protection) shows that although the number of adults exceeds that of juveniles in all years (2.32 : 1.00 ratio), juveniles are represented in a higher proportion than in the population as a whole in all years (Wilson, Norriss, Stroud and Fox in prep).

- 7.2 This high juvenile mortality from shooting pressure is a feature of all quarry goose populations (Wright and Boyd 1983) and is considered to be related to the experience of an individual and its ability to avoid the hunter which is improved with age. Such off-take, particularly in years of poor young production, will severely affect recruitment into breeding age classes in future years.
- 7.3 All geese show an increase in feeding rate prior to migration, usually associated with an improvement in condition. Most geese in Europe and North America then migrate northwards to their arctic breeding grounds via several staging areas where nutrient reserves can be topped up during the energetically demanding flight north.
- 7.4 Greenland White-fronted Geese do stage briefly in Iceland, but are generally far more dependent on accumulated reserves in winter to get them to Greenland.
- 7.5 Disturbance of feeding in late spring prior to departure by shooting of Barnacle Geese (as on Islay under licence) or Greylags (as in Caithness under licence) is likely to have a severe detrimental effect on the efficacy of this feeding period.
- 7.6 In extreme cases, that of breeding females, insufficient accumulated food reserves may result in the inability to breed, or where incubating females need to leave the nest more frequently to avoid starvation, to failure of the breeding attempt.
- 7.7 Fox et al (1983) drew attention to the observed dispersion of marked geese from one area of the breeding grounds to many areas throughout the wintering range. This implies birds from any one wintering flock may derive from many areas in Greenland.
- 7.8 Hence, while the general theory of leapfrog migration appears to relate to Greenland Whitefronts (whereby northern breeding birds resort to the southern parts of the wintering range and southern breeders winter in the north of Britain), high levels of shooting or disturbance at a few wintering areas will affect the birds throughout the summer range (Fox and Stroud in prep). In this way, high levels of mortality at single wintering sites could potentially depress breeding success throughout the population (Abraham 1981).
- 7.9 Given this latter situation and whilst studies relating population structure and dispersal continue, it would appear premature to permit high levels of shooting mortality.
- 7.10 In conclusion, further investigation is required to evaluate rates of mortality in order to comprehend the population dynamics of this goose. It appears that until very recently, mortality balanced production in years of mild winters at least on Islay.
- 7.11 Declines at many other sites suggest that mortality here exceeds recruitment although emigration may be involved at some sites. Since shooting constitutes a major proportion of the winter mortality, this, in conjunction with small population size,

vulnerability to poor breeding years and high mortality in severe winters and its overall low production rate all make the Greenland White-fronted Goose an unsuitable quarry species.

8. CONSERVATION OF TRADITIONAL PEATLAND HABITATS

- 8.1 Ruttledge and Ogilvie (1979) considered loss of traditional habitat was a major cause of the population decline between the 1950s and the late 1970s. Reynolds (1984) and Ryan and Cross (1984) have discussed and described the current rate of destruction of Irish peatlands and both concluded that the current rate of site conservation is inadequate to conserve the range of variation present in Irish peatlands. The Forest and Wildlife Service has been documenting those peatlands important for Greenland Whitefronts and the protection of these should be a high priority for any management plan concerning these geese in Ireland.
- 8.2 Although the rate of site loss is not as high in Britain as in Ireland important Greenland Whitefront sites are under threat. In July 1984, the Secretary of State for Scotland gave permission for commercial peat-cutting over Eilean na Muich Dubh SSSI on Islay (Stroud 1985b). This is the most important British site for the race holding a roost of over 600 birds. Despite a request from the European Commission that the site be added to the United Kingdom list of Special Protection Areas under the Wild Birds Directive (4.1), the British Government has refused to withdraw planning permission and site work commenced in May 1985.
- 8.3 In the light of the loss of Eilean na Muich Dubh SSSI to development, a review of all roost sites in Britain is being undertaken in order to provide statutory protection to the most important. An expanding hill forestry industry currently threatens many sites on Islay and in north and west Scotland.

9. SUMMARY

- 9.1 Numbers of Greenland White-fronted Geese in Britain have increased under protection from c. 7,200 in autumn 1982 to c. 8,200 in autumn 1983, to c. 9,490 in autumn 1984.
- 9.2 The proportion of British Greenland Whitefronts wintering on Islay has increased from 45% in 1982/83 to 55% in 1984/85.
- 9.3 There is no evidence of a long-term decline or increase on Islay. During two winters since protection, there has been a real increase in numbers there, although this increase is confused by more thorough counting techniques.
- 9.4 Greenland Whitefronts typically produce large clutches without nutrient supplement at spring migration staging areas, placing a higher reliance on spring condition on departure from wintering grounds and on arrival in Greenland.
- 9.5 Although brood size is relatively high, productivity is less than half that of most races of the White-fronted Goose. Consequently, the race is highly dependent on small numbers of successfully breeding pairs for continued recruitment into the population.

- 9.6 Survivorship is low compared to most European grey geese, with a large proportion of the annual mortality resulting in the past from shooting. Recruitment may fall short of mortality in most years away from Islay, but further information is required on these features of the population.
- 9.7 Small overall population size, poor productivity and low survivorship all make the Greenland White-fronted Goose an unsuitable quarry species. As a result it is presently protected throughout most of its world range: in Scotland (since September 1982), in Northern Ireland (since March 1985), in Greenland (since March 1985) and on the Dyfi Estuary in mid-Wales by voluntary ban since 1972. In Iceland, they are not currently protected but legislation is being considered at present.
- 9.8 In addition to the other pressures on the population, habitat loss as feeding and roosting sites are drained, cut for peat or improved continues unabated in Ireland, whilst important areas in Scotland have either been lost or damaged in the recent past.

10. RECOMMENDATIONS

The Greenland White-fronted Goose Study urges the Wildlife Advisory Council to ensure that:

- 10.1 All remaining peatland roost and feeding areas are identified and given protection as a matter of urgent priority, as part of a wider peatland conservation programme.
- 10.2 Management strategy should aim to prevent large concentrations of geese developing at single localities by maintaining many other small flocks scattered throughout the country.
- 10.3 A shooting ban should continue in force throughout the wintering range until the world population of this rare sub-species of goose reaches a level regarded as sustainable in the long term. Even at population levels greater than this threshold, when regulated shooting may be introduced, disturbance of smaller flocks might prove unpermissible. If unregulated the population would have to be much greater to accommodate fluctuations in the widely varying levels of recruitment between years. The situation would also have to be revised in the event of any major redistribution within the range.
- 10.4 Shooting must only be permitted in situations of severe agricultural damage and after all other reasonable methods to avoid damage have been tried and failed. Sporting shooting would be in direct breach of the terms of the European Directive on the Conservation of Wild Birds (EC/409/79), and shooting would be implemented to disturb geese rather than as a cull.
- 10.5 The most important feeding and roosting areas should be notified as Special Protection Areas under the terms of the European Directive on the Conservation of Wild Birds (EC/409/79).
- 10.6 Adequate financial support is provided to enable the long-term monitoring of population size, productivity and the compilation of site inventories. Research should be carried

out to elucidate the population structure of the geese with particular reliance on the capture and marking of individual birds.

- 10.7 That by a programme of research, publicity and education, the conservation of the Greenland White-fronted Goose is assured within the framework of international obligations with the involvement and assistance of all shooting interests.

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Table 1. Summary of Greenland White-fronted Goose counts from Britain 1982/83 to 1984/85.

	Nov 1982	Mar/Apr 1983	Nov 1983	Mar/Apr 1984	Nov 1984	Mar/Apr 1985
NE Scotland	457	576	315	410	376	477
NW Scotland	185	80	177	136	176	79
N Argyll	873	1068	985	896	1304	1110
S Argyll - Islay	3250	3441	4592	4198	5256	4715
Other sites	1723	1413	1342	1484	1659	1635
Galloway	595	631	683	720	633	758
England	33	0	1	4	10	0
Wales	73	73	93	78	76	88
British Total	7189	7282	8188	7926	9490	8862

Table 2. Distribution by area (Stroud 1984) of peak counts of Greenland Whitefronts on the Island of Islay, Argyll.

	1981/82	1982/83	1983/84	1984/85
Oa	540	758	865	1232
Ardtalla	0	0	0	95
Gruinart	322	114	415	884
Gorm ...	232	197	454	390
Rhinns .	396	657	504	217
Laggan .	527	444	646	777
Glen ...	475	174	350	340
Kilmeny	1096	1535	1358	1321
Total ..	3588	3879	4592	5256

Table 3. Co-ordinated Greenland White-fronted Goose counts on Islay, 1982/83-1984/85.

1982/83		1983/84		1984/85	
16-19 November	3250	2 November	4030	25 October	2448
		15-18 November	4312	26 October	3362
		22 November	3925	21 November	3690
		23 November	4592	22 November	5256
		20 December	3936	19 December	4462
		21 December	3641	20 December	4012
2- 3 February	2826	19 January	3468	30 January	4473
		20 January	3331	1 February	3698
14 February	3879	16 February	3478	28 February	5358
15 February	3500	17 February	3730	1 March	4941
1- 2 April	3441	16 March	3435	28 March	4715
		27 March	4198	29 March	3789
21 April	2646	17 April	3164		
22 April	1829	18 April	2560		

Table 4. Long-term productivity data for Greenland Whitefronts wintering on Islay, Argyll. (Ogilvie 1983 and in litt, and Stroud unpubl).

Breeding Season	% Young	Mean Brood Size	Sample Size (where known)
1962	14.1	-	
1963	17.0	-	
1964	15.1	-	
1965	15.4	-	
1966	26.1	2.7	582*
1967	16.0	1.7	
1968	16.2	1.5	
1969	9.3	2.0	
1970	12.5	2.8	
1971	7.4	2.0	
1972	4.6	2.2	1347
1973	15.1	2.8	1600
1974	18.4	2.9	
1975	21.4	3.2	
1976	20.8	3.4	
1977	10.2	3.1	
1978	9.7	2.8	
1979	11.9	2.8	1440
1980	23.3	3.1	1787
1981	14.3	3.1	
1982	12.9	2.7	1309
1983	9.9	2.7	2121
1984	12.1	2.8	1920
\bar{x}	27.3	3.6	
Mean Values	14.51	2.60	

* Some doubt must be thrown on this apparent high productivity given the very small sample of geese aged.