

Greenland Barnacle Geese in the British Isles

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Introduction

There are two populations of Barnacle Geese *Branta leucopsis* wintering in the British Isles. The smaller one, breeding in Svalbard (Spitsbergen) and wintering exclusively in the Solway Firth, has been monitored closely for many years (Roberts, 1966; Ogilvie, 1970; Owen & Campbell, 1974). This paper concerns itself with the other, larger population, which breeds in East Greenland and in winter is found almost exclusively on islands off the west and north coasts of Ireland and Scotland. The virtually complete separation of the two populations from each other and from a third which breeds in arctic USSR and winters in the Netherlands has been shown by extensive ringing (Boyd, 1964; Larsen & Norderhaug, 1964; Salomonsen, 1967).

The Wildfowl Trust has been monitoring the Greenland Barnacle Geese in winter since 1957, by means of occasional aerial surveys, the majority over the whole range, and by regular counts on the island of Islay in the Inner Hebrides that have also included assessments of annual breeding success. Islay holds a considerable majority of the total population. Virtually the only other work on the population has been by Cabot on the Inishkeas, the most important Irish haunts, which he has visited almost annually since 1960 (Cabot & West, 1973). He has been concerned with the population dynamics of the 2,000–2,500 birds wintering on the islands and with looking for factors which may affect their use of the islands and breeding success, and is continuing a study of feeding ecology.

Censusing a population of birds which winters on nearly 200 remote islands (mostly now uninhabited by man) scattered from County Kerry to Sutherland must present certain problems. The only satisfactory method is counting from the air. Aerial surveys for goose counting were first undertaken in Britain on a regular basis in 1957. Although the technique is well known, there are a number of difficulties inherent in flying off the west coast of the British Isles. Airfields with fuel are few and survey routes have to be planned accordingly. The weather, which arrives there less well-heralded than further east in the country, often causes tiresome delays. To these logistical items must be added the problems of locating and counting

the birds. Boyd (1968) gave a full account of the techniques involved and some of the difficulties and pitfalls encountered. It is sufficient here to state that a light aircraft is used, flying at about 140 km/hr and at 150–200 metres above the sea. One or two observers are carried in addition to a pilot-observer. Photographs of flocks are obtained where practicable but are not relied on, as visual counting by experienced observers has been found to be as accurate as and more reliable than photographs, which must often be taken in very poor light.

Largely because of expense, aerial surveys of Barnacle Geese have been neither regular nor frequent. Partial or complete surveys were carried out in 1957, 1959 (two), 1961, 1962, 1965, 1966 and 1973. Those in 1957 and 1965 were restricted to the Scottish part of the range and in March 1959 only Ireland was covered and then not completely. Boyd (1968) gave the results for the Scottish range of the first six surveys but did not report on the Irish figures in any detail. Cabot & West (1973) reviewed the Irish results (though excluding March 1959), in the context of the study of the birds on the Inishkeas. This paper gives the full results of the 1973 survey and compares them with the results of all the previous surveys.

Barnacle Geese know nothing of boundaries between countries and draw no distinction between Ireland and Scotland. However in this paper the two countries will be separated if only because their current shooting and conservation arrangements are different, and future steps may be taken on a national not international basis.

Aerial survey results

In the course of the eight aerial surveys Barnacle Geese have been found on a total of 169 islands and (in a few cases) headlands. Cabot & West (1973) list a further 23 Irish sites where Barnacle Geese have been recorded at some time though none were present during any of the surveys. In some of the archipelagos in both Ireland and Scotland the geese almost certainly use all the suitable islands at some time although actual sightings have not been recorded. This will be true, for example, in the Sound of Harris, between Harris and North Uist, where Barnacle Geese

have been recorded from 20 islands during the aerial surveys but could be expected on virtually all the 50–60 islands (the exact number depends on definition) in the Sound.

A complete tabulation of the survey results has been deposited at the Wildfowl Trust. In any discussion of the figures, however, and especially in making comparisons between the years, it is more meaningful to group the islands according to an, inevitably somewhat subjective, assessment of how much, or how little, the geese move around during the course of a winter. For example, whereas there can be no justification for splitting the

Blasket Islands, Co. Kerry, into the five constituent islands, none more than four kilometres from the next and only two of which have held geese at the times of the surveys, it does seem right to treat them separately from the next nearest haunt, the Magherree Islands, 43 kilometres to the north-east.

The map (Figure 1) shows the groupings, while the survey results are given in Table 1. The majority of the individual sites group themselves conveniently but in some areas there may be a whole chain of islands stretching over 60 or 70 kilometres. In these cases an arbitrary 10 km has been chosen as



Figure 1. Map showing groupings of Barnacle Goose haunts. Numbering as in Table 1.

Table 1. The numbers of Barnacle Geese *Branta leucopsis* counted during aerial surveys, 1957–1973
 Figures in brackets represent interpolated means of other counts for that site or group. No interpolations have been attempted for the February 1957 and March 1959 censuses or for the individual sites or groups in Ireland in March 1965 (see text).

Region (see Table 4)	No. on map (Figure 1)	Site or grouped sites	No. of sites with geese in group	Feb 1957	Mar 1959	Dec 1959	Mar 1961	Apr 1962	Mar 1965	Mar 1966	Mar 1973
East Coast	1	Lambay Is.	1								45
	2	Wexford Slobs	1		0						2
Kerry-Clare	3	Blaskets	2			12	85	0		20	0
	4	Magherree Is.	2			0	34	0		0	0
	5	Illaunearon	1			0	0	90		60	0
	6	Mutton Is.	1			6	280	265		320	480
Galway-S. Mayo	7	MacDara's Is.	1		0	0	0	0		0	43
	8	High Is.	8		106	190	140	213		411	53
	9	Inishbroon	1		40	40	0	0		0	20
	10	Inishdalla	6		40	160	51	86		90	4
	11	Clew Bay	3		160	53	150	85		0	0
	12	Inishgallon	1		0	50	0	0		40	0
W. and N. Mayo	13	Duvillaun	4		90	30	157	23		156	145
	14	Inishkeas	2		1600	1200	2300 ¹	2500 ¹	2800 ¹	2600 ¹	1980 ¹
	15	Inishkeeragh	4		190	10	153	188		40	240
	16	Kid Is.	6			240	152	76		42	164
Sligo Donegal	17	Lissadell	5			363	230	304		370	210
	18	Inishduff	2			0	0	35		18	45
	19	Rathlin	1			10	0	(20)		0	70
	20	Toraylaydon	5			90	130	182		262	395
	21	Inishdooney	8		30	210	247	309		195	282
	22	Clonmass	1		0	0	50	45		80	0
	23	Glashedy Is.	4		71	107	5	3		14	220
		TOTAL IRELAND	69		2327	2771	4164	4424	(4095)	4718	4398
Islay	24	Islay	1	3000		2800	5500	4800	(8300) ²	8500	15000
Inner Hebrides	25	Trodday	1	0		0	18	0	(3)	0	0
	26	Brosdale Is.	2	38		140	107	124	(76)	45	0
	27	En. Mor (Kintyre)	1	35		0	14	44	(67)	196	110
	28	En. Mor (Jura)	1	0		10	4	0	(6)	16	(6)
	29	Oronsay	1	16		0	0	230	(51)	18	40
	30	Soa	1	5		0	0	0	(17)	61	35
	31	Treshnish	5	317		299	470	390	510	795	419
	32	Tiree	3	420		25	380	484	(301)	354	143
Inner Hebrides	33	Muck	1	19		0	0	2	(5)	(5)	(5)
Outer Hebrides	34	Barra	11	223		49	142	171	289	443	80
	35	Sound of Barra	6	238		86	452	415	392	360	336
	36	South Uist	1	200		110	250	0	23	0	0
	37	Monachs	3	330		480	519	860	750	1035	640
	38	Sound of Harris	20	490		174	599	498	493	575	980
	39	Taransay	2	201		15	120	7	0	120	125
	40	Gaskeir	1	41		110	10	70	140	122	0
	41	Shiantis	3	303		290	214	317	450	483	450
	42	L. Roag	2	37		0	0	0	52	19	0
	43	L. Erisort	2	0		0	0	32	0	6	0
Skye	44	Isay	4	151		130	140	395	420	380	297
	45	Ascribs	3	193		0	122	204	308	272	132
	46	Trodday	4	182		60	108	47	264	236	143
N. and W. coasts	47	Longa	1	38		56	15	20	5	0	(22)
	48	Foura	1	21		0	0	0	11	0	(5)
	49	Summer Is.	6	95		73	0	57	(74)	146	(74)
	50	A. Chleit	2	52		37	33	0	(26)	33	0
	51	Chrona	4	121		172	100	9	(92)	55	96
	52	Roin Mor	2	0		21	64	0	(58)	74	190
	53	Hoan Is.	2			(214)	180	244	(214)	425	6
	54	Rabbit Is.	3			(199)	179	135	(199)	130	350
		TOTAL SCOTLAND (excluding Islay)		3766		2750	4240	4766	5285	6579	4684
		TOTAL SCOTLAND	100	6766		5550	9740	9566	12396	15079	19684
		GRAND TOTAL	169			8321	13904	13990	17680	19802	24082

Notes. 1. We have followed Cabot & West (1973) in using ground counts of geese on the Inishkeas for the last four Irish surveys. They were generally made within a month of the aerial census, and their increased accuracy over aerial counts is thought to outweigh the danger of movements having taken place in the interval.
 2. This interpolated figure for Islay is the mean of two ground counts made on the island that winter.

the dividing distance. This brings the number of grouped haunts to 23 in Ireland and 31 in Scotland, a total of 54. The table also shows how many individual sites go to make up each group. The names used in the table are of the largest or most important site in each group, if there is no convenient accepted geographical name for the latter.

Some attempt has been made in Table 1 to compensate for gaps in the surveys. Some Scottish haunts were omitted from the surveys in 1959 (December), 1965 and 1973, due to lack of time, or to bad weather. By averaging the existing counts for these haunts and interpolating the average figure into each survey a more realistic total is arrived at. Only in 1965 is the added figure more than a few hundreds and then only because an estimated total for Ireland (not covered that year) has been given. Estimates have not been attempted for the first survey carried out in each country (February 1957 in Scotland and March 1959 in Ireland) which were to some extent exploratory, and for which interpolation is impracticable due to the lack of antecedent counts from most sites.

Because the number of geese present on Islay completely dominates the totals, a separate total, excluding Islay, has also been given for each survey. These show that there was a virtual doubling of the numbers of geese between December 1959 and March 1966 at a rate only slightly exceeded by what was happening on Islay. Between March 1966 and March 1973, however, numbers away from Islay dropped slightly, back to the level of March 1965, while the numbers on Islay nearly doubled again. Indeed, other counts on Islay, both before and since the March 1973 count, have produced even high numbers, up to 19,400. There is not a great deal of pattern in the changes that have occurred at other haunts in the 1966–1973 period though in the 13 haunts averaging over 250 geese, numbers have declined at ten and increased at only four. The big questions that need answering are: to what extent have birds deserted other haunts in favour of Islay; and how much is due to special factors operating at Islay alone? It is doubtful whether exact (or indeed any) answers can be given but some of the evidence can at least be examined.

Our knowledge of changes in farming and other human uses, or of natural causes such as plant succession, or loss of turf in storms, that might affect the numbers of geese on the remote islands frequented by them, is fragmentary. Only in one case is there an obvious reason why Barnacle Geese have completely deserted a locality. A rocket range was

constructed in 1961 on the machair beside Loch Bee, South Uist, and the flock of up to 250 Barnacle Geese that used to winter there promptly, and not surprisingly, went elsewhere. The next nearest haunt to Loch Bee is the Monach Islands off the west coast, where there was an increase of the right order by the time of the next survey. Numbers continued to increase on the Monachs up to April 1966. In December 1966 the islands were declared a National Nature Reserve, primarily for the geese. The latter appear to have repaid this gesture by a large drop in numbers by 1973. The islands are not wardened and rarely visited in the winter months and there do not appear to be any reliable counts between 1966 and 1973. Other increases or decreases can readily be found in Table 1 but in no case are there easy answers to the question of why the numbers have changed. An alteration in the number of shooting parties, disturbance by fishermen, changes in the numbers of sheep being grazed, are all possible factors that come to mind, and for none of them does any remotely useful or precise information exist.

Table 2a sets out the percentage of individual sites counted in each survey which actually held geese. These show an increase to a peak in 1962, then a decline of 6% by 1966 and a further decline of 10% in 1973. The picture for the two countries is much the same. The usage of grouped sites (Table 2b) has shown more fluctuation than change; although 1973 was 9% below 1966 it was only back to the level of earlier years. The drop from 1966 to 1973 was much more pronounced in Scotland than in Ireland. Both tables show a decrease between 1966 and 1973 that parallels the overall decline in numbers of geese elsewhere than on Islay, reinforcing the suggestion that the great increase on Islay since 1966 has been at the expense of other individual sites. Further surveys are needed to see whether these losses will become permanent.

Another possibility that would lead to a reduction in the number of sites being used is if the birds are changing their flocking habits. Any tendency to concentrate in fewer larger flocks would have the same effect on site use. Away from Islay, the geese occur in a great many very small flocks. Table 3 shows the counts from the five complete surveys broken down by flock size and expressed as percentages of the total number of flocks. Nearly one-third of all flocks were under 50 birds, while only about a quarter were over 250. These figures exclude Islay. They have been calculated for the grouped sites as shown in

Table 2. The percentage use by Barnacle Geese *Branta leucopsis* of individual and grouped sites, 1957–1973

		$\frac{\text{Number of sites used at each census}}{\text{Total number of sites used, 1957–1973}} \times 100$							
Country	Total No. of sites used, 1957–1973	Sep	Mar	Dec	Mar	Apr	Mar	Mar	Mar
		1957	1959	1959	1961	1962	1965	1966	1973
Ireland	69		32	42	37	53		48	43
Scotland	102	52		37	57	56	55	49	37
Total	171	52	32	40	49	55	55	49	39
Total of sites counted in each census		97	44	164	169	164	69	167	160

		$\frac{\text{Number of grouped sites used at each census}}{\text{Total number of grouped sites used, 1957–1973}} \times 100$							
Country	Total No. of grouped sites used, 1957–1973	Sep	Mar	Dec	Mar	Apr	Mar	Mar	Mar
		1957	1959	1959	1961	1962	1965	1966	1973
Ireland	23		85	76	71	71		76	74
Scotland	31	86		69	77	74	81	87	73
Total	54	86	85	72	75	73	81	82	73
Total of grouped sites counted in each census		29	13	50	52	52	16	51	49

Table 1. If the actual counts recorded for each individual site are used in place of class frequencies, we find that just over 50% of flocks are under 50. Though the proportion of flocks over 250 has risen from 14% in 1959 and 19% in 1961 to 37% in 1966 and 32% in 1973, no statistically significant changes in relative frequency of flock sizes have occurred.

Mean flock size is also shown in Table 3. There was virtually no change between 1966 and 1973 but both are considerably higher than the three earlier years.

Regional changes

If overall changes in use of sites and flock size are not easy to find, changes in regional distribution are a little more obvious. The data from Table 1 have been lumped into five Irish

and five Scottish regional groupings. The dividing lines are shown in Figure 1. Islay is considered on its own. Otherwise the groupings are by fairly natural boundaries with distances in excess of 30 km between the nearest haunts in adjacent regions. The resulting regional totals are shown in Table 4, while Figure 2 uses the same data expressed as percentages of the earliest survey total for each region.

Apart from the dominating position of Islay, the other regions show some interesting changes. Excluding the hardly represented east coast of Ireland, numbers in the other eight regions fluctuated somewhat between the early surveys but all showed a rise between 1962 and 1966 so that by the latter survey all were above their starting level, in some cases considerably so. This trend was noticeably reversed between 1966 and 1973, six regions dropping in numbers and two

Table 3. Percentage distribution of flock sizes per grouped sites of Barnacle Geese *Branta leucopsis*, 1957–1973. The figures exclude Islay.

Flock size	Dec 1959	Mar 1961	Apr 1962	Mar 1966	Mar 1973	All
1–50	37	23	31	29	26	30
51–100	17	11	16	15	11	14
101–250	32	47	24	19	31	30
251–500	11	11	24	27	23	19
over 500	3	8	5	10	9	7
No. of flocks	35	38	38	41	35	187
Mean flock size	146	222	187	250	252	235

falling below their datum.

It is noteworthy and rather encouraging that the furthest part of the range, Kerry-Clare, has shown an increase, albeit a small one. If the southernmost two Irish regions are added together there has been a slight overall

increase, though with a rather large drop from the peak of 1966. Sligo-Donegal gained from 1966 to 1973 and the central part of the Irish range declined. However, it does appear that despite a withdrawal from the Wexford Slobbs during the 1950s, the population is not con-

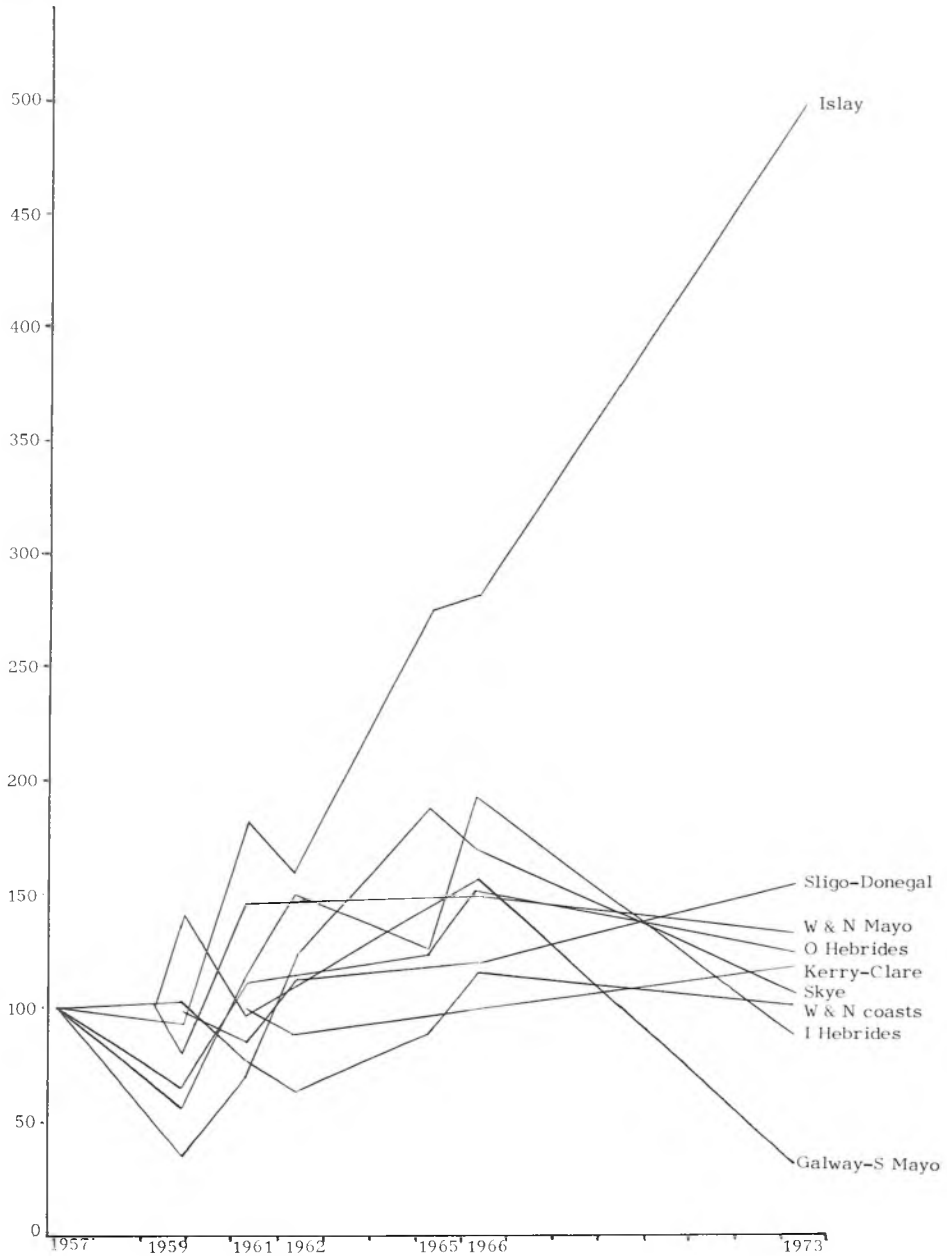


Figure 2. Regional totals of Barnacle Geese expressed as percentages of earliest survey total for each region.

Table 4. Regional distribution of Barnacle Geese *Branta leucopsis*, 1957–1973

Region	Feb 1957	Mar 1959	Dec 1959	Mar 1961	Apr 1962	Mar 1965	Mar 1966	Mar 1973	mean
E. coast								47	47
Kerry–Clare			18	399	355	4095	400	480	330
Galway–S. Mayo		346	493	341	384		541	120	371
W. and N. Mayo		1880 ¹	1480	2762	2787		2838	2529	2479
Sligo–Donegal		101 ¹	780	662	898		939	1222	900
Islay	3000		2800	5500	4800	8300	8500	15000	6843
Inner Hebrides	850		474	993	1274	1036	1670	758	1008
Outer Hebrides	2063		1314	2306	2370	2589	3163	2611	2343
Skye	526		190	370	646	992	888	572	598
W. and N. coasts	327 ¹		772	571	476	668	863	743	682
Total	6766 ¹	2771 ¹	8321	13904	13990	17680	19802	24082	16297

¹ Incomplete, and excluded from calculation of means.

tracting its range in response to the opportunity of exploiting of apparently better wintering conditions further north on Islay.

Numbers in Ireland as a whole have not changed very much over the period 1961 to 1973 after an initial increase from the first complete survey in November 1959. The total for Scotland, excluding Islay, was very similar to that for Ireland for the November 1959, 1961 and 1963 surveys, leaped ahead in 1966 but dropped back to only just above the Irish figure in 1973. The recent decline was fairly evenly spread between all four regions, with the largest drop both proportionately and absolutely in the Inner Hebrides, the area nearest to Islay. The area further away from Islay, the west and north coasts of the mainland, showed the least decline.

Table 5 shows the percentage distribution of the geese between the regions for each complete survey. Although Islay has always been

the largest single component of the whole, it is only since 1966 that it has become completely dominating, holding at the time of the 1973 census no less than 62% of the entire population. The other regions have declined accordingly, with Ireland and the rest of Scotland, formerly holding roughly one-third apiece, now down to about one-fifth.

Discussion

There is no doubt that the censuses since 1957 of Greenland Barnacle Geese wintering in the British Isles have revealed a substantial increase in total numbers. Higher counts on Islay since the last complete census (the latest being 19,400 in November 1974) suggest that the overall increase is being maintained. What is less satisfactory is the continuing concentration of the geese on to Islay. Despite the

Table 5. Percentage distribution of Barnacle Geese *Branta leucopsis* by regions, 1959–1973.

Region	Dec 1959	Mar 1961	Apr 1962	Mar 1966	Mar 1973	mean
E. coast	0	0	0	0	<1	<1
Kerry–Clare	<1	3	3	2	2	2
Galway–S. Mayo	6	2	3	3	1	2
W. and N. Mayo	18	20	20	14	10	17
Sligo–Donegal	9	5	6	5	5	6
Islay	34	40	34	43	62	43
Inner Hebrides	6	7	9	8	4	6
Outer Hebrides	16	16	17	16	11	15
Skye	2	3	5	5	2	4
W. and N. coasts	9	4	3	4	3	5
Ireland	33	30	32	24	18	27
Scotland, excl. Islay	33	30	34	33	20	30

mitigating discovery that the range is not also contracting, it must be a matter for concern that so large a proportion of a relatively small population of birds is to be found in just one haunt. Apart from the danger of some natural or man-induced calamity destroying the birds or their habitat, there is an increasing amount of conflict with agriculture on the island. The major landowners are on the whole favourably disposed towards the geese but some of their tenant farmers are understandably getting more and more worried. Some small-scale experiments to assess the effects of the grazing by the geese are under way and there has been an increase in the amount of deliberate scaring on a few farms. Control measures, though of an unspecified nature, have been advocated, presenting the conservation bodies, both statutory and non-statutory, with the major problem of reconciling the interests of farming with the wellbeing of such an important flock of geese. A detailed account of the numbers of Barnacle Geese on Islay in the last twenty years is in preparation, together with an analysis of the annual breeding data.

As has earlier been stated, we have lamentably little information that can help us answer the question of why the Barnacle Geese are concentrating on Islay. Apart from possible changes in farming practice already mentioned, there are the potential effects of shooting. The species was given full protection in Ireland in 1962, but few of the birds in that country were ever accessible to heavy shooting pressure and it seems unlikely that the change in the law has had a significant effect. After being given full protection in Scotland in the 1954 Protection of Birds Act, a relaxation was made the following year allowing a two-month shooting season from 1st December to 31st January on islands to the west of longitude 5°W. This effectively covers all haunts of the Greenland Barnacle Goose in Scotland except for a handful on the north coast of Sutherland. Again it seems doubtful whether there has been any major change in the amount of shooting, or at any rate sufficient to produce the concentration of birds on Islay. Shooting on that island is not heavy, being controlled by the few large estates.

If we cannot explain what has happened in the past, perhaps it is still pertinent to look into the future. It seems clear that although there is probably still room for further increase on Islay, scaring and shooting there will also increase, leading to a levelling off of the numbers if not an actual decline. What is therefore needed would seem to be some way of improving the situation for the geese

elsewhere than on Islay, to encourage the birds to maintain their numbers on the many other haunts, or better still to increase them. It is easier to say this than to decide what measures could be taken but they might include statutory protection on the more important Scottish haunts, though the effect of declaring the Monachs a National Nature Reserve is disappointing, coupled with the encouragement of continued grazing of the islands by sheep to help maintain suitable feeding swards for the geese. Additionally, future oil exploration off western Scotland and any associated industrialization must be carefully watched to minimize adverse effects on the geese.

Unfortunately the kinds of research that would be needed to discover some of the basic facts about why the geese are moving to Islay and how to persuade them to move away again would be very expensive. Even the minimum monitoring of a complete census has only been afforded at ever longer intervals. Regular counts on Islay are relatively cheap and are continuing, but the census results show clearly that the relationship between the Islay situation and what is happening over the rest of the range is a steadily changing one and predictions of the latter based on the former must be regarded with due care. It is to be hoped that if further major changes take place in the numbers of geese on Islay, in whichever direction, the consequent need to look again at the overall picture will be recognized.

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We cannot overemphasize the part played by the pilots in these aerial censuses. Dr S. K. Eltringham and Mr A. Wingnall flew the aircraft in 1958 and 1959, but it is to Mr J. D. H. Radford that the principal thanks are due particularly for his simultaneous application of the skills of piloting the aircraft, counting the geese and photographing them, all done in flying conditions that were often less than perfect. Dr D. B. Cabot acted as an observer for one of the Hebridean and several of the Irish surveys and Mr O. J. Merne for one of the latter.

Summary

Aerial censuses of the Greenland population of the Barnacle Goose *Branta leucopsis* wintering mostly on islands of the west and north coasts of Ireland and Scotland revealed an increase from 8,321 in December 1959 to 24,100 in March 1973.

Simultaneously the proportion of the total wintering on the main haunt of Islay has risen from 34% to 62%. Changes in the use of sites and in the size of flocks are discussed in relation to the increasing importance of Islay. The conservation implications of this latter factor are reviewed.

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Plumed or Eyton's Whistling Ducks *Dendrocygna eytoni* at Slimbridge (Joe Blossom).

