GREENLAND
WHITE-FRONTED
GOOSE STUDY

Greenland White-fronted Geese

Land use and conservation at small wintering sites in Scotland

Ian Francis[1], Carl Mitchell[2], Larry Griffin[3] and Tony Fox[1]

Final report
November 2011

[1] **Greenland White-fronted Goose Study**
c/o Department of Wildlife Ecology and Biodiversity
National Environmental Research Institute
University of Aarhus
Kalø
Grenåvej 14
DK-8410 Rønde
Denmark

Contact: Ian Francis
ian@farmland.plus.com

[2] **Wildfowl & Wetlands Trust**
Slimbridge
Gloucestershire GL2 7BT
UK

[3] **Wildfowl & Wetlands Trust**
Caerlaverock Wetland Centre
Eastpark Farm
Caerlaverock
Dumfriesshire
DG1 4RS
UK

Contents

Summary

The conservation status of Greenland White-fronted Geese at their smaller wintering resorts in Scotland is of concern, since an earlier analysis showed that the numerically smallest flocks were showing the most serious declines. Addressing the loss of wintering sites and contraction of winter range was considered to be a priority for action by the Greenland White-fronted Goose International Workshop in February 2009.

With the support of Scottish Natural Heritage (SNH), the Greenland White-fronted Goose Study (GWGS) and Wildfowl & Wetlands Trust (WWT) (assisted in two areas by RSPB Scotland staff) undertook a study of these smaller sites, with the aims of identifying any factors that could be addressed to improve their status at each and prevent flock extinctions if possible. During the winters of 2009-2010 and 2010-2011, 19 sites across the Scottish winter range were visited. We assessed land use and a range of other factors in the field against a set of standard criteria, and collated historical information and comments from local counters and some farmers. Information about participation of many areas in agri-environment schemes was also provided by SNH, following entry of the site data into their Geographic Information System.

We recognised at the outset that it would be difficult to identify those specific local environmental factors that were affecting the local rates of decline in small flock numbers during a period of overall population decline. The factors affecting the demographics of small flocks are occurring against a background of complex ecological conditions that may come into play throughout the annual cycle, and in any case we have only poor existing knowledge of many wintering sites and their land use history. One 'snapshot' visit, together with other background information can only partially contribute towards an understanding and diagnosis of any site-related problems. Nevertheless, this is the first time that an exercise of this kind has been undertaken and much useful site-related information was gathered.

In most cases, we could find no obvious reason why goose numbers at any of the small sites should be low or declining, and there were no clear habitat-related limits to suitable areas that the geese could feed or roost in. Often, very small numbers of Greenland White-fronts were found within an extensive landscape of suitable or even apparently optimal habitat.

However, some characteristics of areas used by Greenland White-fronts were identified by a rudimentary analysis. We found that they appeared to select improved land, especially older improved pastures which were 'green-yellow' in appearance rather than bright green, with shorter swards and medium to high grazing intensities (possibly grazed more preferentially by sheep). Preferred fields had little or lower cover of *Juncus* rushes compared to those available to the geese generally, and there was a slight preference for fields with seasonally flooded areas rather than permanent standing water. Thirteen of the 19 sites had active agri-environment measures operating over some part of the land used by the geese, though none of these was aimed at goose management. By frequency, the most widespread measures were open grazed grassland and Corncrake management options. Although factors not linked to the characteristics of wintering sites may be the most important in driving local population trends, the geese apparently preferred certain features, and possible management actions could maximise their extent and potentially benefit the birds.

Population size and trends at individual sites were analysed, along with flock size and an attempt to identify sites that may be of higher priority for possible conservation action. The top priority sites were considered to be Loch Ken, Stranraer, Colonsay and Oronsay, South Uist, The Loons (Orkney) and Moine Mhor. In this study we found a significant trend for the number of geese at larger sites to decline more rapidly. We looked at threats and conservation designations across all sites but could find no clear relationships between these and the population trajectories.

There could be certain inherent biological properties of 'small flocks' which may affect the number of geese at these small sites, and it may well be that factors operating outwith the wintering range are most important. However, habitat change has also affected these areas, and we make recommendations for management actions which we hope would benefit Greenland White-fronts, both generally and for the individual sites.

Management recommendations

The most important issue is to keep 'small site' management options as wide as possible.

- There is a need for smaller scale, more flexible goose management arrangements in areas where Greenland White-fronted Geese occur in isolation, perhaps where other geese are absent or only present in small numbers. All such areas should have a management plan aimed at the specific requirements of a particular flock, drawn up using local knowledge.
- This could take the form of either a further dedicated goose scheme, or appropriate options under SRDP. Ideally these would be non-competitive when dealing with Annex 1 species. They should be offered as both LMOs and Rural Priorities, depending on option complexities, and the issue, in appropriate RPAC areas, should be listed as a regional priority.
- Ideally, specific SNH management agreements should still also be possible. This option has generally been removed due to 'integration' of such arrangements within SRDP. If possible, it should be reinstated. There is more flexibility and probably greater effectiveness and value for money in such targeted arrangements than there is in say 'unmonitored' LMO payments.

Actions at individual small sites are likely to depend on site-specific requirements, hence the idea of developing Greenland White-front management plans for each. Issues that may need to at least be considered include:

1. Integration of Greenland White-fronted Goose management on sites which are designated and managed for other natural heritage reasons. It is important to ensure that management aimed at the geese does not conflict with the conservation objectives for other species and habitats.
2. Consideration of agricultural land management, including issues such as reseeding and drainage and disturbance, as well as potential changes in stocking densities over the long term (e.g. reduction in numbers of grazing animals in the Western Isles to a point where insufficient grazing of favoured fields takes place).
3. Interactions with other goose species, either directly or indirectly through hunting disturbance of other species, as well as possible behavioural factors. Improving fields for Greenland White-fronts may have the additional effect of attracting increasing numbers of local or Icelandic Greylag Geese (and for example, at Moine Mhor, increasing numbers of Canada Geese). Thus, a farmer may be reluctant to continue goose grazing improvements for White-fronts if they also attract unwanted goose species.
4. Obtaining a better idea of field use at all the small sites. As shown above, our knowledge of this is often unsatisfactory, and local studies would help understand the situation much better, and lead to more accurate management recommendations.

6.2. Possible management actions at small sites

The list below includes a variety of potential issues that may be worth reviewing within site management plans at some or all sites holding small numbers of Greenland White-fronts. Some of these may already be covered by Rural Priorities options under SRDP, others possibly through direct agreements with SNH. In some cases, other mechanisms might be found.

General

1. Management plan preparation – management plans for each individual winter resort, including integrated species and habitat planning which takes into account other features such as Corncrakes in overlapping SPAs. These would include all factors below if necessary and would be sensitive to each site's requirements. In some cases, management planning would be at the scale of individual fields.
2. Production of a Greenland White-front management advice sheet, to be given to farmers with the birds on their land, explaining their status and requirements, and suggesting management good practice. This may help with more directly sympathetic land management, as well as raise the profile of the species amidst increasing numbers of other more problematic geese.
3. Monitoring of management and its effects at any site where this takes place should be undertaken.

Land management

4. *Juncus* rush topping and removal, especially when extensive or dense (perhaps >40% cover). This may need to be sustained over several years. May overlap into breeding wader prescriptions.
5. Reseeding and fertilising of selected plots, which may include seaweed spreading. This would need to be carefully applied and monitored, and the impacts on other aspects of the natural heritage assessed beforehand.
6. Control of slurry application management at certain sites. This can render fields unsuitable for a period if done at large scale.
7. Drain blocking/wetland expansion, pool creation, mixed with suitable feeding habitats.
8. Fence removal or re-spacing in areas where field divisions may make edges less attractive.
9. Hay cropping, silage cutting and aftermath grazing regime – individual site actions, if needed.
10. Changes to livestock grazing (stock type and intensity) – individual site actions, if needed.
11. Arable/grassland balance, including root crops as well as cereals. Ploughing up of grasslands and conversion to cereals/stubble may have adverse effects in places, so this needs to be planned in relation to goose use. Conversion to maize is also likely to be adverse and needs to be considered.
12. Rabbit control, if necessary.
13. Farm woodlands and scrub. Avoid planting so as to affect feeding areas or cause deterrence from preferred areas (this is relevant to the currently uncontrolled LMO woodland options). Manage scrub encroachment into feeding fields where relevant.

Disturbance reduction

14. Disturbance management – general disturbance including recreation, wildfowling and fishermen – disturbance reduction strategy, where relevant on site by site basis.
15. Undisturbed refuges and carefully channelled routes for footpaths.
16. Recreation signage and local leaflets.
17. Consideration of management of impacts of other geese on Greenland White-fronted Goose usage. This may be through competition or through association (i.e. White-fronts being considered as part of a wider goose 'issue' affecting farmers actually caused mainly by Canada Geese or Greylags). In most cases clear actions will not be apparent or feasible, but the issue needs to be considered at some sites, including in a public affairs sense.

1. Introduction

The winter range of the Greenland White-fronted Goose *Anser albifrons flavirostris* in Ireland and Britain consists of a few large aggregations and numerous sites with smaller numbers (Figure 1). Some of these "small sites" hold only a few tens of birds and all are extremely vulnerable; of 17 sites holding fewer than 200 geese (11 with less than 50), eight are currently declining and abandonment or extinctions have already occurred at a further nine sites over the last 26 years. Although large wintering groups of Greenland White-fronts may be protected through site designations and management schemes, small flocks are usually outwith such measures, since by definition, European Union Special Protection Areas and Ramsar sites tend to be designated on the numerical significance of flocks and their contribution to conservation of the population as a whole. Maintaining range and ensuring the safeguard of these small flocks was considered an urgent priority by an international Greenland White-fronted Goose flyway management conference held in Islay, Scotland in February 2009 (*http://gwfg-conservation.wikispaces.com/Islay+international+workshop*), and action to address this began with the current project.

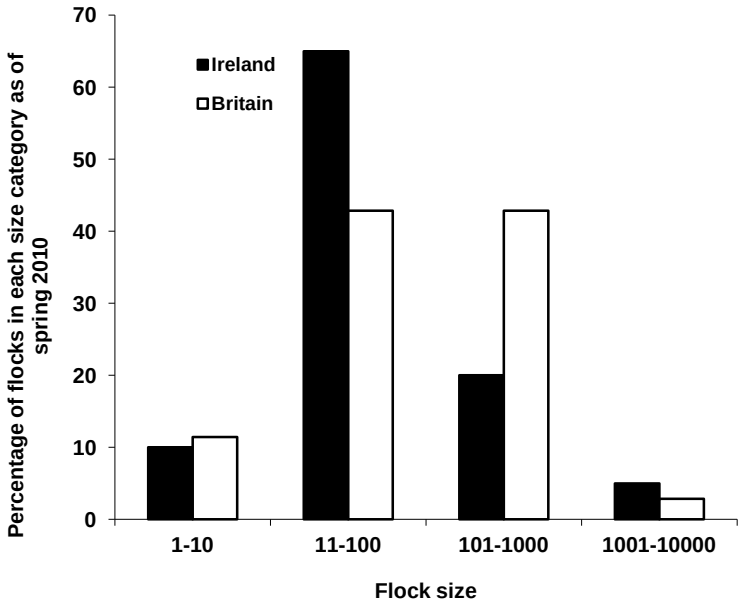


Figure 1. Structure of Greenland White-front wintering flock sizes in Ireland and Britain

It was envisaged from the start that work on this project would span two winters (2009-10 and 2010-11). Detailed analysis of the results was not available in time to feed fully in to the National Goose Management Review, though some preliminary comments were submitted. Decisions on the future of goose management in Scotland have not yet been taken, so we hope that this report can play a part in future developments relevant to Greenland White-fronts, as well as contribute to the implementation of some actions within the draft International Action Plan (http://gwfg-conservation.wikispaces.com/Draft+international+action+plan).

Aims of the project

1. To assemble all available information about numbers, habitats, land use and conservation issues at wintering sites holding small numbers of birds and enter into a Geographic Information System (GIS).

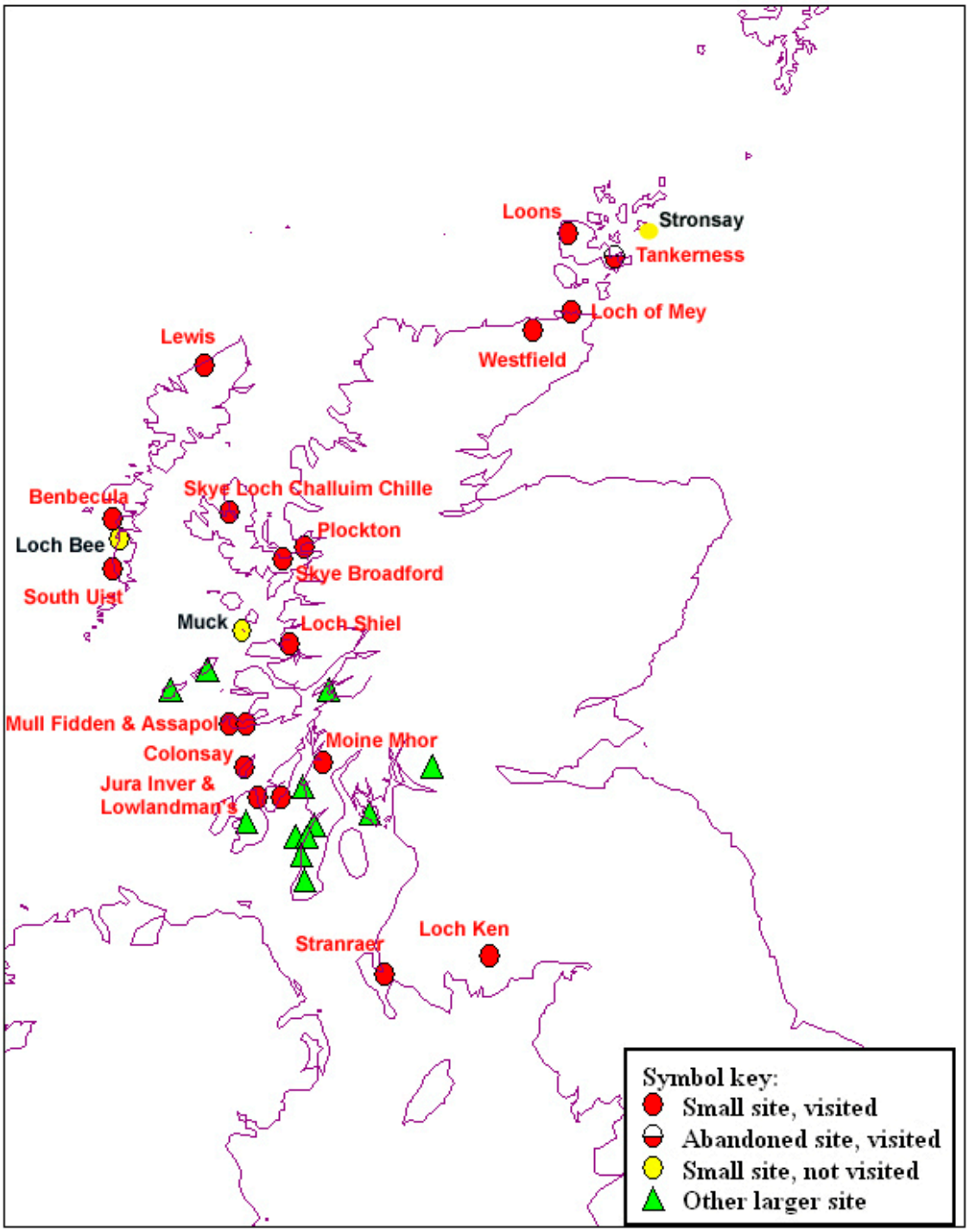
2. To gather updated field information for top priority sites in winter 2009/2010.

3. To produce a prioritised list of small sites for conservation action, with actions tabulated for each with timescale and estimated cost.

4. To analyse cross-cutting (general) issues relevant to the conservation of the geese at the suite of small sites and make recommendations to SNH, GWGS and the Scottish Goose Management Review Group.

Aims 1 and 2 are covered in Section 3 of this report. Aims 3 and 4 are considered below, in Sections 4, 5, and 6.

Greenland White-fronted Goose 'small sites' and other wintering areas



2. Sites visited in alphabetical order and main page references

Section 3 below sets out the rationale used to select these sites for further investigation.

3. Methods

The primary reference for each site considered is the inventory on the Greenland White-fronted Goose Study website - http://greenlandwhitefront.org/gb-site-inventory/. This contains a compilation of much of the historical and biological information for each site known to GWGS. The site accounts below include extracts from this inventory with additional information gained from the field visits in 2009/2010 and 2010/2011.

Between 17 and 19 wintering sites have held fewer than 200 birds in the three winters to 2009/2010, with others close to this numerical threshold or apparently recently abandoned. We chose 19 sites to visit, divided into the categories below (please note, these differ slightly from the groupings in the interim report, due to re-analysis).

Small sites in Scotland

A. **TOP PRIORITY SITES: (those with declining numbers over the last 26 years)**:

South Uist (Kilpheder & Askernish)
Skye (Loch Chaluim Chille, Skeabost – Loch Snizort)
Mull (Fidden)
Colonsay and Oronsay
Moine Mhor
Loch Ken
Stranraer
Jura (Lowlandman's Bay)

B. **Sites with stable, fluctuating or very recently declining numbers over the last 26 years:**

Caithness (Westfield, Broubster)
Caithness (Loch of Mey)
Lewis (Loch Urrahag)
Benbecula (Nunton)
Skye (Broadford)
Loch Shiel
Orkney (Loons)
Jura (Inver)

C. **Other sites recently or possibly abandoned:**

Mull (Loch Assapol)
Plockton
Tankerness (Orkney)

Other contender sites NOT visited:

The main resorts (Islay, Kintyre and linked sites, Tiree and several others) are not listed here: they were not considered contenders for the small sites project. The following sites were considered for survey but excluded for various reasons.

Bute – numbers just above threshold and increasing.
Keills & Danna, Argyll – numbers just above threshold.

Loch Bee (South Uist) - though numbers <200, flock has increased; not surveyed.
Loch Lomond – numbers just above threshold and increasing.
Lorn/Benderloch, Argyll - (above threshold, increasing and probably interlinked with Lismore)
Loch of Strathbeg - very small numbers, mostly associated with other geese.
Loch Scarmclate, Caithness – abandoned.
Loch Winless/Wester, Caithness - abandoned.
North Uist - used very sporadically.
Muck - logistically too difficult.
Stronsay - logistically too difficult.
Bladnoch Valley, Galloway - extinct.
Loch Eye, Easter Ross - extinct.
Sullom Voe - extinct.

Protocol for field visits

Logistical note: The field visits to these 19 sites, plus associated preparation, analysis and write-up took at least 55 person days. In addition, we acknowledge the help given by RSPB Scotland staff based on two islands, which reduced the travel required, and the comments and time given by other locally-based counters.

We prepared maps and recording forms for each site, using previous information about the exact areas normally used by the geese. At the sites we recorded or attempted to assess the following for the general area:

- General observations and comments
- General agricultural management and changes over time
- Agri-environment measures
- Habitat changes such as spread of rushes, tree planting, drainage etc.
- Shooting issues and changes over time
- Agricultural disturbance and changes over time
- Recreational disturbance and changes over time
- Numbers and trends of other geese present
- Presence of predators especially Foxes
- Weather impacts

Many of these factors are very hard to assess on single visits, and often difficult to gauge even when talking to land managers and others. We tried to speak to some land managers, and gleaned some useful information, but memories are often hazy, and in many Greenland White-front areas, especially crofting townships, it is almost impossible to find owners, who are often dispersed, along with their land ownership parcels. Information gathered for the above factors was therefore patchy and not in any way comprehensive. Tackling this would require enormous resources.

For each identified and numbered field or other land area, we recorded the following:

- Grid reference *(for Field Identifier Number, field area, presence of agri-environment options)*
- Field boundary type
- Distance to roost (if known)
- Distance to nearest roads and buildings
- Field habitat type (using categories developed in a previous study on Islay (Ridgill *et al*. 1994)

Field type
Arable cereal (AC)
Arable root crop (ARC)
Bog/moor (BM)
Loch (L)
Old/semi improved pasture (OIP)
Permanent rough grassland (PG)
Recently improved pasture (RIP)

- Dominant grass colour (proxy for degree of improvement)
- Sward length
- *Juncus* rush cover
- Flooding/waterlogging
- Type of grazing animal if present or known
- Goose presence/use

Grass colour	Sward length	*Juncus* cover	Flooding/waterlogging
Yellow	Short (<5cm)	Little present	
Yellowy-green	Medium short	Some present	No evidence (0% cover)
Greeny-yellow	Medium (5-15cm)	Widespread	Seasonal evidence (%)
Green	Medium long	(% cover estimate)	Permanent pool (% cover)
Very Green	Long (>15cm)		

In practice, these categorisations apply best to agricultural areas. We did not attempt to classify the wide range of semi-natural wetlands that the geese use, but we did note whether there were any obvious factors affecting these areas that could influence possible goose use. We also considered, on visits (and through consultation with local counters and others) what habitat or other management measures might be undertaken to improve conditions for the geese. Please note that all field areas and data about participation of sites in Rural Priorities agri-environment measures were provided by SNH, using the SIACS database.

It is important to note that Greenland White-fronted Geese at these small sites usually inhabit very complex habitat mosaics, which are difficult or at times impossible to describe or classify in any meaningful or simplified way. For example, the area used by the geese around Kilpheder on South Uist consists of some 220 marked land parcels on the 1:25,000 scale OS map, in a complex array of linear fields. On the ground, many of these have merged, boundaries have disappeared, new boundaries have appeared, and superimposed across the whole landscape of field units, there is a highly intricate mosaic of small-scale habitats, from reed beds to wet heaths, sedge beds, pools, improved fields, reseeded patches and so on. Attempting to describe this rigorously would lead to the delineation of well over 1,000 roughly homogeneous habitat units which would be almost impossible to map. Hence, gross generalisation is necessary, and this same principle applies in part to most other sites (though not all, as sometimes quite simple habitat arrays are used).

Each individual wintering site is described below in Section 4, and any conclusions about local factors and management summarised. The overall information from field visits was analysed to investigate whether there were any general patterns, especially relating the features of fields most preferred by the geese to the characteristics of a wider sample. The results of simple analyses for some of these variables are presented in the second part of Section 4. Further multivariate analysis would be needed to disentangle the cross-correlations amongst some of the data gathered.

4. Results

4.1 Site accounts

This section draws heavily on the Greenland White-fronted Goose Study web-based site inventory but all the information there is not repeated here; instead, key points are extracted and presented in a truncated format. Further analysis based on the 2010-2011 visits is presented in sections in each account, along within this summary information. Sites are presented in the following order:

Please note that not every 'small site' was visited in this study, and not all parts of each were considered. During the review, further actions were identified but which have not been completed. This study has furthered substantially our knowledge and understanding, but we will continue collecting information and refining our detailed knowledge of site use by the geese, together with habitat and management issues, drawing on the Greenland White-fronted Goose Study's network of counters and supporters. Further updates will be placed on http://greenlandwhitefront.org .

Mapping conventions: in the annotated maps for each site: Pink = fields surveyed during project; Bright green/dull green numbered fields = fields most favoured (bright green = >10% of records)/ dull green = used by geese but not as frequently as above).
Green fields with X = other fields noted by local observers as being also used by the geese, but not necessarily surveyed by us. There is no attempt here to assess frequency of use so lower category (dull green) is assumed.

Site vulnerability graphs: these are presented in some site accounts. A log regression was performed so there is a curve fitted to the data but the y axis is untransformed, and is therefore more meaningful to the reader, as it is easier to visualise counts and the changes in these over time.

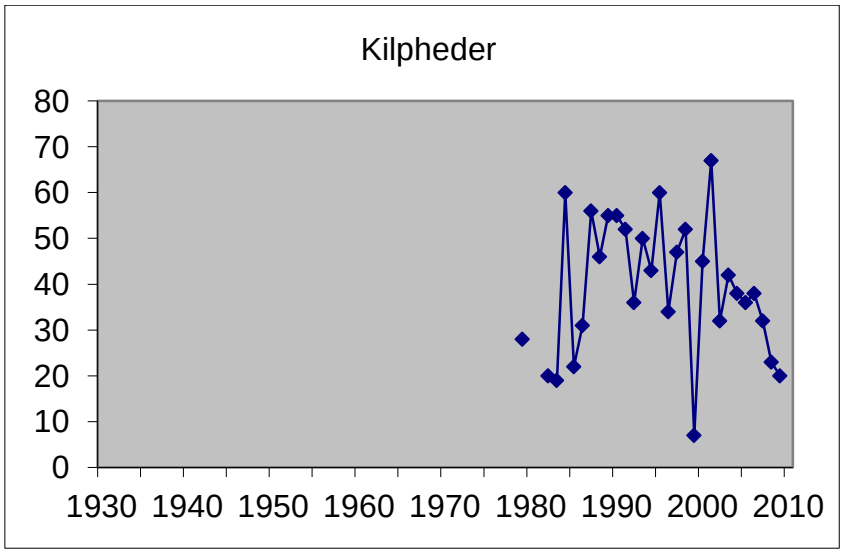
Note on references used frequently in site accounts: Atkinson-Willes (1963) is referred to as A-W (1963) and Ruttledge & Ogilvie (1979) is referred to as R&O (1979)

A. TOP PRIORITY SITES: (those with declining numbers over the last 26 years):

South Uist (Kilpheder & Askernish)

General status, population summary, graph of trends and age ratios
Most recent international census count: ***33*** *(Dec 2010)*
General trend: downward since late 1980s.

Since the mid-1980s numbers have fluctuated between 7 and 67, the large differences between years may suggest unknown feeding areas and hence incomplete counts, so it is difficult to be certain whether there has been a decline in numbers over the period or the magnitude of that decline. If there were regularly 100-200 birds at Loch Hallan in the mid to late 1970s (see below), there has been a marked reduction, but possibly these older counts amalgamate all South Uist birds.



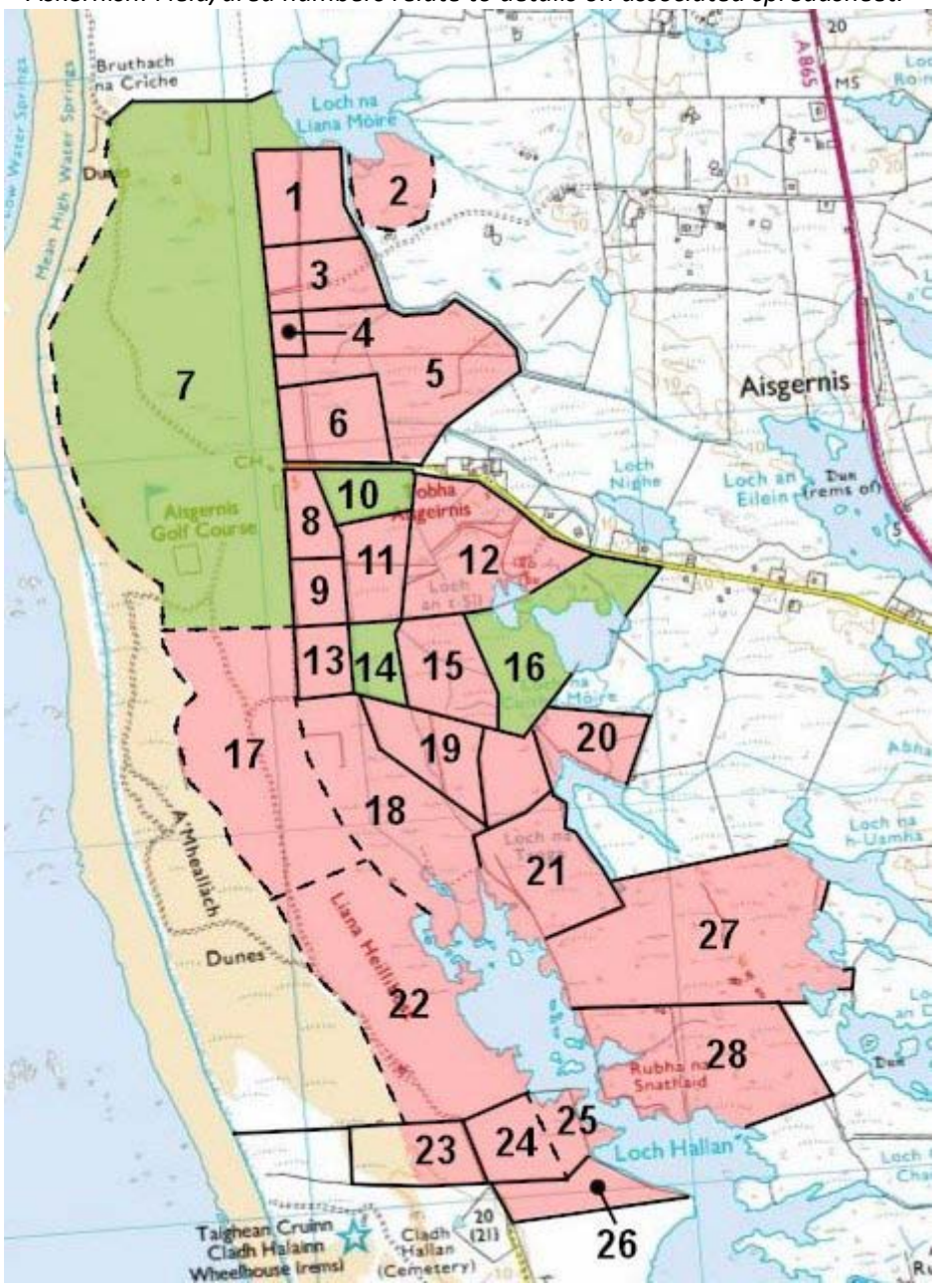
Breeding success: No consistent production data from this site.

Any other relevant population information – inter-site movements, collars
Four collared birds have been seen at this site, three were migrants, two in spring, and one in autumn. 1PT was ringed at Wexford in 1987/8; it was seen briefly in November 1988 on South Uist before turning up at Wexford in December 1988. 5CT was a spring migrant from Wexford where it was caught in 1991/2, wintered in 1992/3 but showed up on South Uist in April 1993. A7Y was a Greenland ringed bird from Isunngua which wintered at Askernish in 1992/3, but moved to Caithness in the following year. H8H was ringed in west Iceland in spring 1999. It moved several times between years, being seen at Benderloch in 1999/2000, Wexford in 2000/1, 2001/2, Benderloch 2002/3, Wexford 2004/5 (to February) but also stopped at Kilpheder on 8th April 2005.

Long-term history
History: Little historical data. Most authors considered the Outer Hebrides as a unit, but since now-abandoned North Uist held the greatest numbers in the past, it is difficult to make comparisons. A-W (1963) reported up to 250 birds on machair on the west coast and R&O (1979) implied that 300-400 occurred in the past. They suggested 100-200 birds at Loch Hallan, the main resort for these birds, but stressed the scarcity of data, despite suggesting reductions in number in recent years.

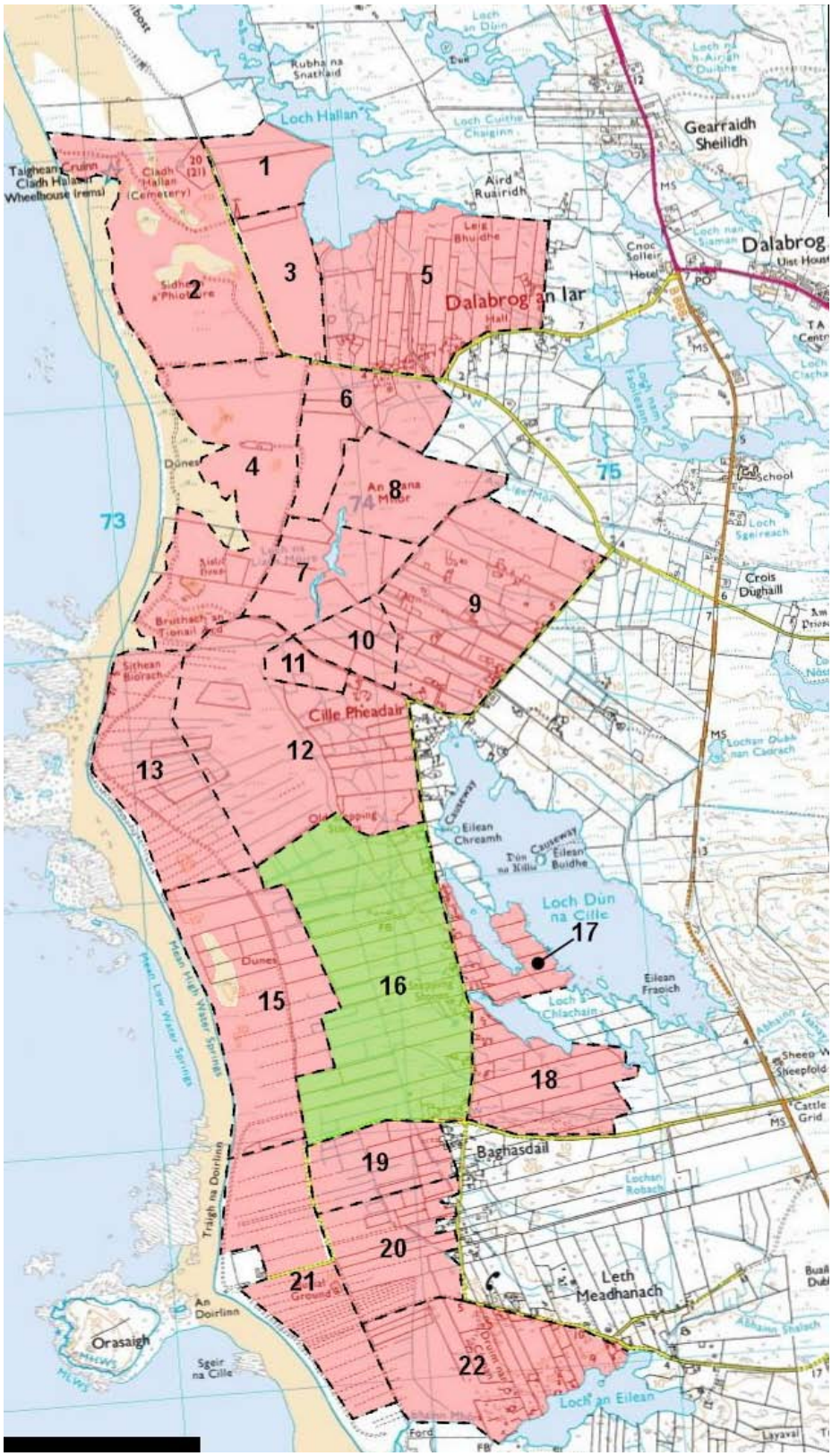
Map of Kilpheder & Askernish area (north map followed by south map)

Askernish: Field/area numbers relate to details on associated spreadsheet.



Areas most frequently used by Greenland White-fronts (green) and fields surveyed (pink)

Kilpheder: Field/area numbers relate to details on associated spreadsheet.



Areas most frequently used by Greenland White-fronts (green) and fields surveyed (pink)

Site photographs – Kilpheder & Askernish

Askernish area, February 2010

Askernish area, February 2010

Kilpheder area, February 2010. 8 Greenland White-fronted Geese in this photo

Kilpheder area, February 2010

Kilpheder area, February 2010

Kilpheder area, February 2010

Habitat and field mosaic around Kilpheder, Google Earth, 2005 imagery

Feeding and roosting locations used by geese

Feeding sites and habitat: Machair, low intensity farmland and bog, with freshwater areas.
Roosting sites: Not known; there are abundant lochs in the immediate vicinity.

Characteristics of fields and other habitats and visit notes

A subset of habitat variables is presented below, derived from data collected in the field. All fields with available area values in hectares (using SIACS information) are included. The variables selected are those thought most likely to show differences between sites, and which had data available consistently for most fields. The summaries below therefore characterise certain aspects of the site. They are only approximations, though, due to data complexities.

Total area of fields analysed (ha)	1859
Average field area across site (ha)	41

Habitats	ha	%
Mixed Arable	298	16.0
Bog/Moorland	367.37	19.8
Old Improved Pasture	664.38	35.7
Old Imp P/Bog/M	129.97	7.0
Permanent Grassland	399.44	21.5

Feature	Area of fields showing feature (ha)	%
Short sward (<5cm)	1232	66.3
Medium sward	130	7.0
Long sward (>15cm)	496	26.7
Little *Juncus* (score 1)	1222.3	65.8
Some *Juncus* (score 2)	142	7.6
Widespread *Juncus* (score 3)	495	26.6
No standing water (score 1)	1232.3	66.3
Some seasonal inundation (score 2)	477.2	25.7
Permanent wetland (score 3)	149.8	8.1

The data analysed show that the Askernish/Kilpheder 'small site' is very varied, with arable, grassland and bog and moorland habitat, and the general area has more *Juncus* and is more seasonally or permanently inundated than many of the other small sites. Shorter, grazed grass fields are intermingled with this semi-natural habitat here, amidst many lochs and pools.

Habitat change and land use history

The land is all in crofting tenure as crofts and common grazings. The southern section (Kilpheder/Boisdale) has probably had some reduction in cropping and grazing overall, whilst the area has become more fenced since the 1980s with many of the crofts apportioning their common machair (effectively extending their crofts westwards and taking areas out of communal cropping/grazing – fenced areas west of the tracking running up through the southern area are apportionments). Reseeded/improved fields will largely stem from the 1980s. Grazing is still a mix of cattle and sheep. Some areas of marsh are cropped/cut only very intermittently due to them usually being too wet (particularly along large drains). At the Askernish end Storas Uibhist have spent a lot of time and money upgrading the golf course (on the Askernish machair – field 7) which will affect human use of the area but it is unlikely to result in significant winter disturbance, despite a clubhouse on the edge of the machair.

Agri-environment measures in place

Based on frequency, the following measures are in place over fields at this site:

Agri-environment measure	% frequency
Conservation Management for Small Units - Individual	26.1
Grazing Management of Cattle - Retention	17.4
Mown Grassland for Corncrakes - 1 Aug/15 Aug	13.0
Management of Cover for Corncrakes	8.7
Cropped Machair - with FYM/seaweed	8.7
Grazing Management of Cattle - Introduction	8.7
Open Grazed or Wet Grassland for Wildlife	4.3
Management of Wetland	4.3
Mown Grassland for Corn Buntings	4.3
Grazed Grassland for Corncrakes	4.3
	100.0%

Due to the multiple occurrence of measures in single fields, differing field boundaries, and some discrepancies in grid references, it is not possible to analyse the area coverage of measures.

Disturbance issues

Hunting disturbance: Formerly a problem with poachers in the 1980s and later, but probably less disturbance now, despite modern day Greylag Goose *Anser anser* shooting.

Agricultural disturbance: Not known, there is much background agricultural disturbance, but it seems unlikely that this constitutes a problem at current levels.

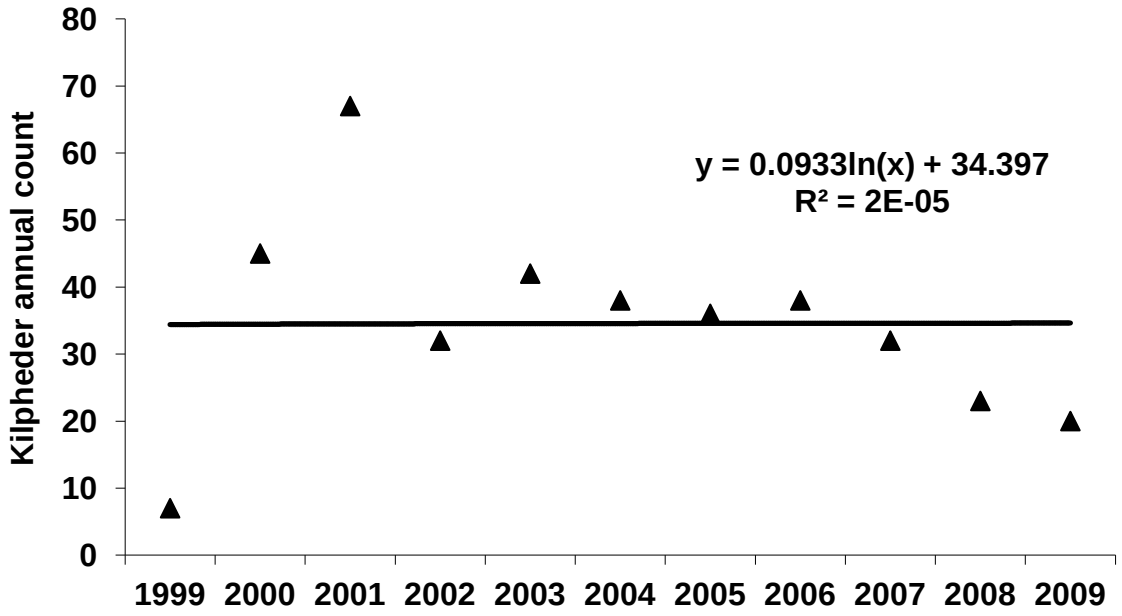
Conservation designations and site protection

Site safeguard: Loch Hallan is NCR SSSI and is part of the South Uist Machair and Lochs SPA and Ramsar site, which includes adjacent machair fringing the loch which is used by the geese. The southern section lies within the Kilpheder to Smerclate SPA, principally designated for Corncrake.

Assessment of possible adverse influences on goose numbers

Threats: The area is subject to shooting disturbance, though at current (lower) levels this appears not to be a serious issue. However, there appears to be a return to higher shooting pressure as Greylag numbers increase. Shooting on some machair areas is managed by RSPB under the LIFE project and accurate figures should be available. A new gun club has recently formed in South Uist.

Site vulnerability



Population trend since 1999

Despite relatively stable numbers, there has been a recent downturn and this site is considered to be at high risk of extinction due to low numbers and should be considered a high priority for appropriate conservation action.

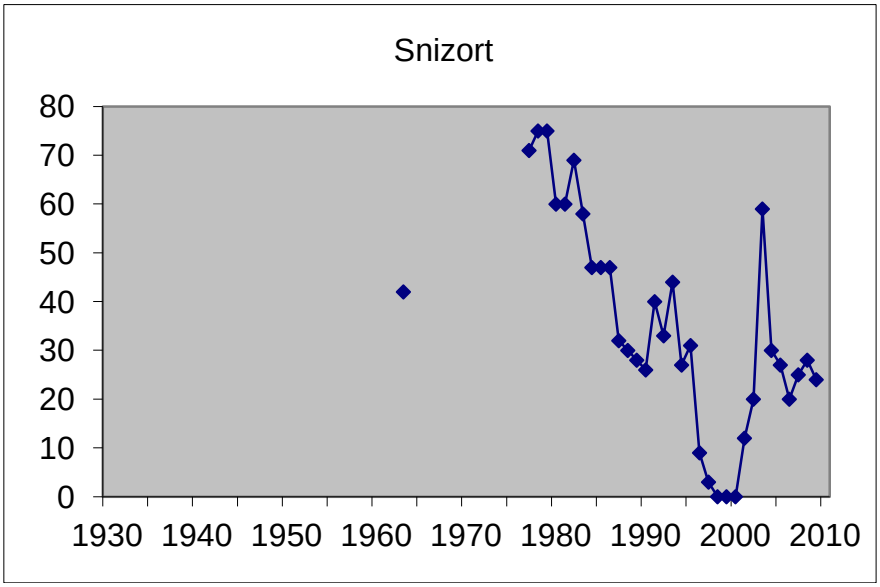
Recommendations for management

There are few obvious management actions that would benefit the geese here; small numbers live in a large and varied landscape of apparently abundant resources. Given the relatively high cover of *Juncus effusus*, some topping of patches may be helpful, to open up more feeding opportunities (e.g. perhaps the fields immediately north-east of Loch Dun na Chille), along with small-scale reseeding of drier areas within habitat mosaics (though these would have to be planned and managed very sensitively). There is more than adequate wetland here, together with loch and pool refuges. The management actions above would also probably benefit Greylag Geese too, since the two species often feed together; it is difficult to suggest measures here that would only benefit Greenland White-fronts. It is important also to take full account of existing management measures aimed at other designated features of SPAs.

Skye (Loch Chaluim Chille, Skeabost – Loch Snizort)

General status, population summary, graph of trends and age ratios
Most recent international census count: ***26*** *(March 2011)*
General trend: downward since early 1980s.

In the late 1970s, there were regular reports of 70-80 individuals, but despite the overall increase in the global population, numbers consistently declined through the 1980s and 1990s. However, the birds have always been (and continue to be) notoriously elusive, frequently hidden in dense vegetation, and this makes accurate assessment of their status difficult. No birds were located at all for a run of seasons in the late 1990s when the flock deserted the hitherto most frequently used areas near Skeabost Bridge. Subsequent searches and effort eventually found them further to the north around Kilmuir, often at Loch Chaluim Chille, where the birds have resorted in subsequent winters. There have been occasional records from Dunvegan and on nearby Waternish as well, but there is no evidence of regular use. If all these records represent the same flock they have a very large area of potential feeding areas throughout the northern part of the island and it may be that the trend in numbers displayed below does not reflect their true abundance. It is certainly possible that the Kilmuir birds were present at the same time as those at Skeabost, and were overlooked (B. McMillan, pers. comm.).



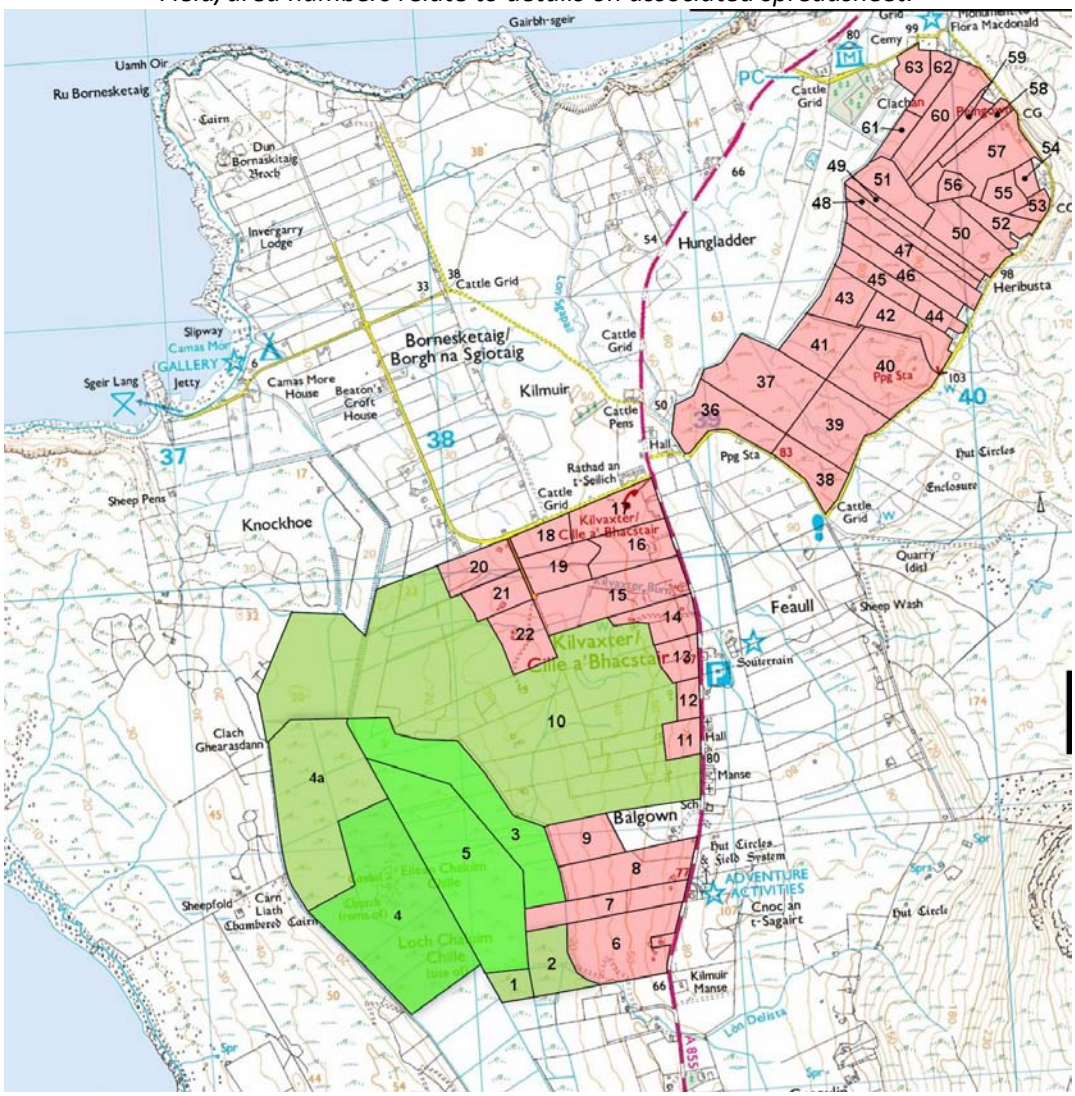
Breeding success: No consistent production data from this site.

Any other relevant population information – inter-site movements, collars
Linkages with other sites: None

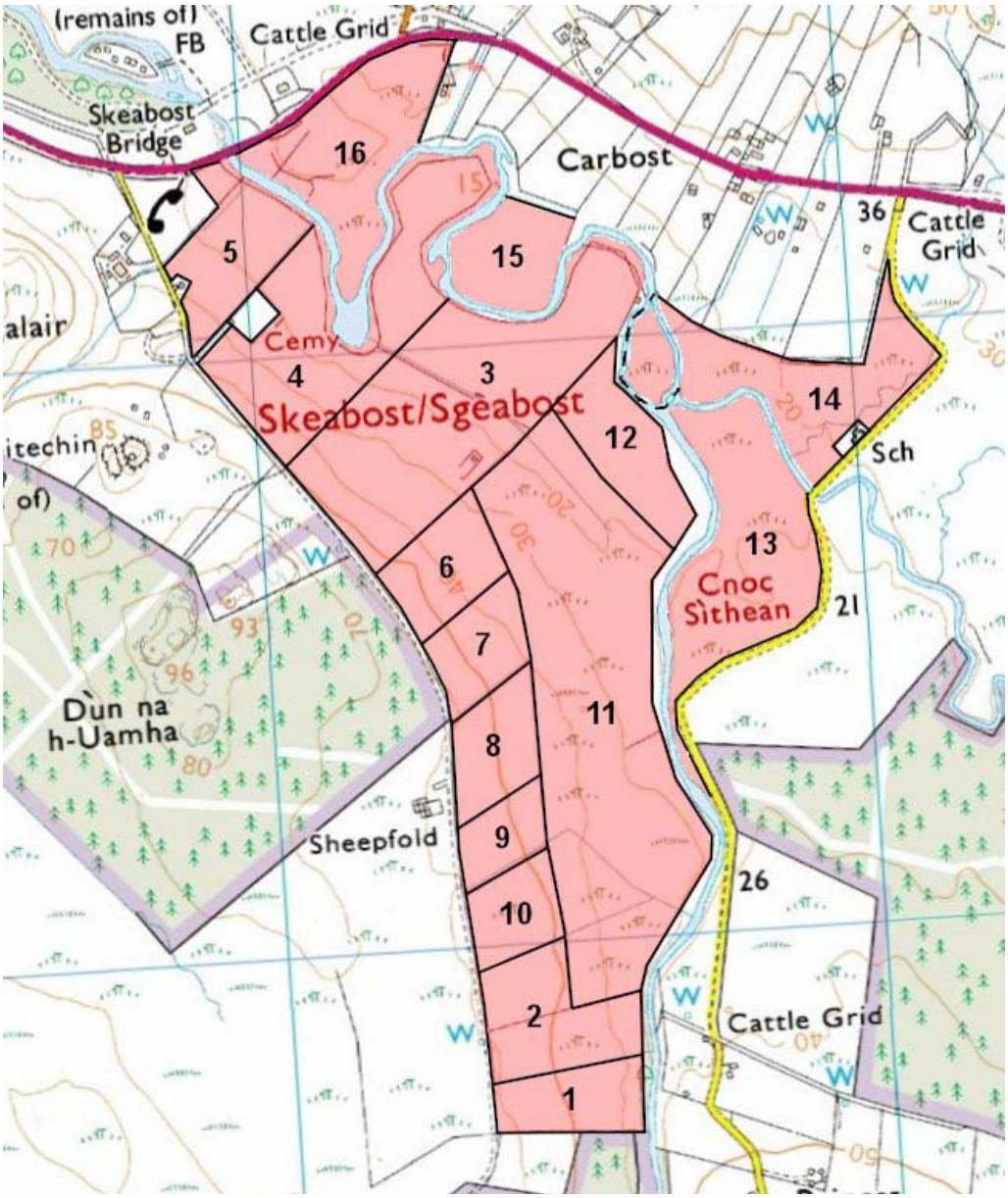
Long-term history
History: A-W (1963) reported some 20 birds wintering at the head of Loch Snizort Beag which were sometimes reported from the Dunvegan area of the island. Murray (1954) considered them more numerous than Greylag Geese in the area. The history of this flock is largely unknown; R&O (1979) considered the site deserted and even today, their daily whereabouts and ability to shift feeding areas make it difficult to keep tabs on this little flock.

Map of area surveyed – Loch Chaluim Chille

Field/area numbers relate to details on associated spreadsheet.



Areas most frequently used by Greenland White-fronts (green) and fields surveyed (pink)



Map of Skeabost area surveyed: field/area numbers relate to details on associated spreadsheet.
No recent records of Greenland White-fronts in this area

Site photographs

Skeabost area, February 1998

Skeabost area, Google Earth 2004

Loch Chaluim Chille area, Google Earth 2004

Loch Chaluim Chille, Mar 2003

Loch Chaluim Chille, Feb 2010

Loch Chaluim Chille, Feb 2010 – 19 Greenland White-fronted Geese were present in centre of photo

Loch Chaluim Chille, Mar 2003

Feeding and roosting locations used by geese

Feeding sites and habitat: For most of the period covered by the counts presented here, the flock fed around the southern end of Loch Snizort Beag on rough and improved pastures, mostly without rushes and on freshwater marshes and wetlands. Frequently used areas in particular were around Borve (NG4448), Drumuie (NG4546), Tote (NG4149), Peinmore (NG4248), Carbost (NG4248), Peiness (NG4246) and Coulnacraggan (NG4345), but the favoured areas were in the immediate vicinity of Skeabost and Skeabost bridge (NG4248) and for many winters in the 1980s and 1990s they fed on the Skeabost football pitch with some frequency and regularity, the only known use of soccer turf in the range. Since 2004, they have been seen with great regularity at Chaluim Chille, Kilmuir and this now seems to form their regular foraging area. They have also been reported by locals from the area north-west of this towards Heribuster.

Roosting sites: The roost sites have never been firmly established for this flock, but they may have roosted either on Loch Niarsco, at Chaluim Chille or perhaps on the offshore Ascrib Islands, though there is no recent evidence of this; it is possible they remain at Chaluim Chille overnight (B. McMillan, pers. comm.).

Characteristics of fields and other habitats and visit notes

A subset of habitat variables is presented below, derived from data collected in the field. All fields with available area values in hectares (derived from SIACS information) are included. The variables selected are those thought most likely to show differences between sites, and which had data available consistently for most fields. The summaries below therefore characterise certain aspects of the site. They are only approximations, though, due to data complexities.

Total area of fields analysed (ha)	1513
Average field area across site (ha)	23

Habitats	ha	%
Bog/Moorland	253.6	16.8
Bog/Moorland/Old Imp Past	126.3	8.3
Recently Improved Pasture	527.6	34.9
Old Improved Pasture	186.7	12.3
Permanent Grassland	200.9	13.3
Old Imp Past/Perm Grass	107.9	7.1
Recent Imp Past/Perm Grass	11.6	0.8
Other	98.8	6.5

Feature	Area of fields showing feature (ha)	%
Sward not rec or n/a (e.g. ploughed)	225	14.9
Short sward (<5cm)	699.9	46.3
Short medium	3.4	0.22
Medium	333.4	22
Short, medium and long	26	1.72
Medium long	62.7	4.14
Long sward (>15cm)	162.8	10.8
No *Juncus* (score 0)	256.0	16.9
Little *Juncus* (score 1)	587.4	38.8
Some *Juncus* (score 2)	306.8	20.3
Widespread *Juncus* (score 3)	363.0	24.0
No standing water (score 1)	1252	82.7
Some seasonal inundation (score 2)	261	17.3

The areas considered within the different parts of this site showed considerable variability and small average field sizes. Some 60% of the areas classified were grass fields of various kinds, mostly with short or medium swards and fairly dry. However, the main area used by the geese at Loch Chaluim Chille is wet, rush covered and generally rank. The other areas nearby were surveyed but we do not know whether the White-fronts use them much.

Habitat change and land use history

Not known.

Agri-environment measures in place

Based on frequency, the following measures are in place over fields at this site:

Agri-environment measure	% frequency
Grazed Grassland for Corncrakes	20
Management of Cover for Corncrakes	20
Mown Grassland for Corncrakes - 1 Sept	20
Open Grazed or Wet Grassland for Wildlife	20
Management of wetland	20
	100.0%

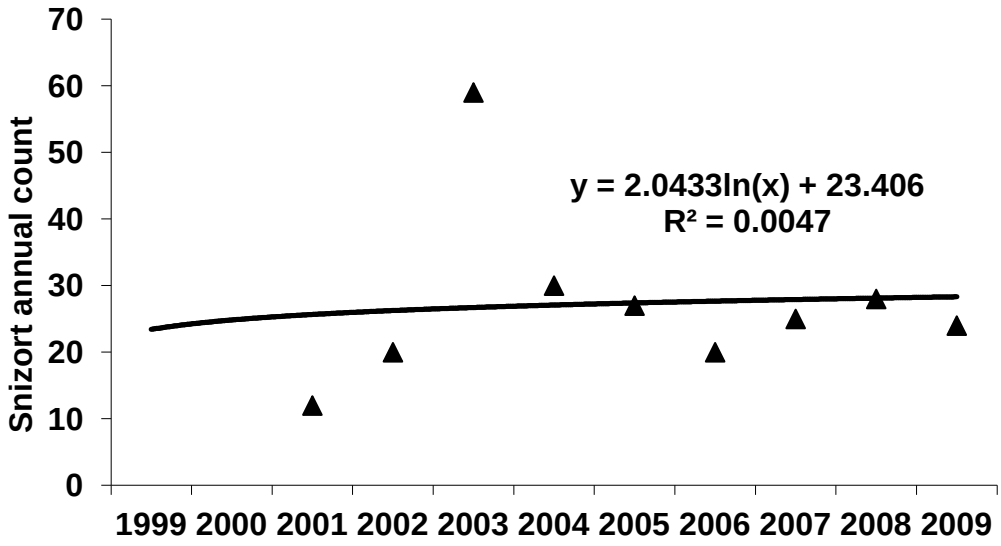
These figures relate to Loch Chaluim Chille only; there appear to be no agri-environment measures operative at Skeabost. Due to the multiple occurrence of measures in single fields, differing field boundaries, and some discrepancies in grid references, it is not possible to analyse the information according to the area covered.

Disturbance issues
Aircraft disturbance: None known.
Hunting disturbance: Some shooting occurs in the area, and the geese are generally highly unapproachable in the area, but it is not known to what extent hunting may affect this flock.
Agricultural disturbance: Not more than comparable farmland areas; Chaluim Chille probably less so.

Conservation designations and site protection
Eilean Chaluim Chille is a Highland Council Local Nature Conservation site.

Assessment of possible adverse influences on goose numbers
Threats: A house built on the Ascrib Islands in recent years may have affected any roost here, though there is little evidence of this. At Skeabost, geese may have been disturbed by shepherds and dogs or even football matches. Disturbance at Loch Chaluim Chille (the current resort) seems very low.

Site vulnerability



Population trend since 1999

This site is considered to be at low risk of extinction soon but should be considered a medium priority for appropriate conservation action due to low population size.

Recommendations for management

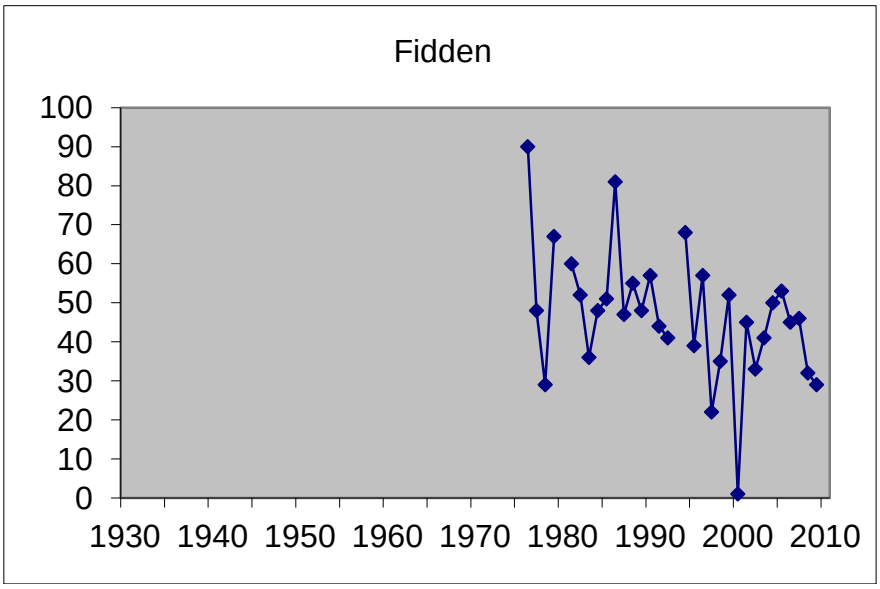
Loch Chaluim Chille
The main marsh area is used most regularly and is a drained former loch. The whole site has significant conservation value and any management here would have to take account of this, including other birds roosting in the tall rushes. Potential hydrological management or cutting of rushes to expose more feeding opportunities would be difficult in terms of machine access. A plan is needed covering actions suitable for both the geese and other species. We can make no useful recommendations for areas further north around Kilvaxter as we have few records of site use here.

Skeabost
This site may now have been abandoned, with birds wintering at Loch Chaluim Chille, so management intervention is not a priority. Stocking densities are quite high here, but pasture improvement seems unlikely given the susceptibility of the area to waterlogging. Avoidance of drainage would seem to be a wise precaution.

Mull (Fidden)

General status, population summary, graph of trends and age ratios
Most recent international census count: ***32*** *(December 2010)*
General trend: downwards since the early 1980s.

This flock was always considered separate to those at Loch Assapol, but ever since the first counts from this resort, numbers have fluctuated widely suggesting that there may well have been interchange between the two groups and/or that other feeding sites used by this flock remain to be discovered, not least on Iona where this flock has been noted to resort. Although there have been marked birds seen on Mull, they have not been helpful in enlightening exchange between the feeding areas. Numbers at this resort have shown a tendency to gradually decline from an initial count of 90 in 1976 to around 30 in recent seasons.



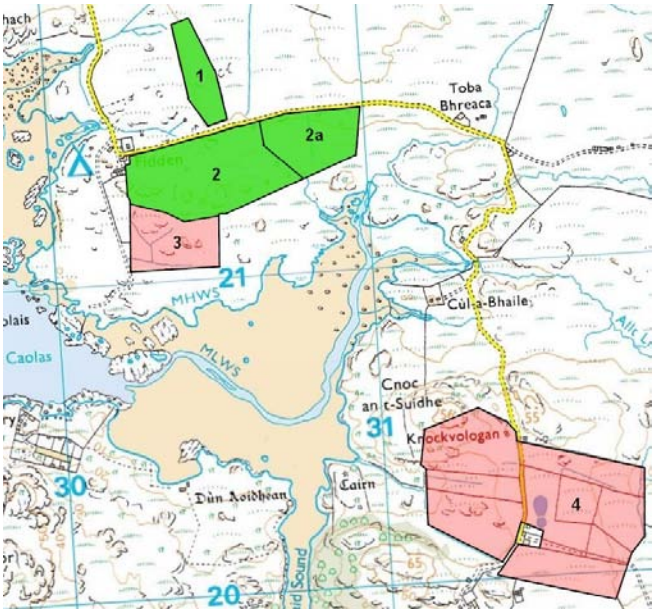
Breeding success: No figure provided because of the small flock size and few data.

Any other relevant population information – inter-site movements, collars
Nine collared birds have been seen here. One, 9UE was a Wexford-wintering regular from 1987/8 until 1991/2, but it stopped briefly at Fidden in October 1988 before turning up at Wexford in November 1988. C0L was caught in west Greenland in summer 1992, and was seen just once in March 1993. C2C was caught at Wexford in 1992/3 where it wintered in 1993/4, but moved to Bute in 1994/5 and 1995/6 before shifting to Mull for the winter of 1996/7. It was not seen again until the winter of 2000/1, when it turned up on Islay and where it remained until 2002/3. F8S was ringed at Wexford in 1995/6, but was on Mull from November 1996 until April 1997. Subsequently, it was back at Wexford on 20th October 1997, but in an unprecedented move, shifted back to Islay where it was to winter the rest of that year and every winter until 2003/4, yet wintered again at Wexford in 2004/5. Finally, a family group N0T (female) and N2T (male) with their offspring N2P, N4P and N4T were caught at Wexford in winter 2003/4, and all showed up at Fidden in 2004/5.

Long-term history
History: Neither Berry (1939), A-W (1963) nor R&O (1979) reported White-fronted Geese on Mull at all, so there is no extended history of this flock beyond the time of Richard Coomber, who recorded geese from the Ross of Mull since 1975.

Map of Fidden area: Areas most frequently used by Greenland White-fronts (green) and fields surveyed (pink)

Field/area numbers relate to details on associated spreadsheet.



Site photographs (Fidden)


Fidden, 2006


Fidden, Aridghlas, Mar 2006: GWF Geese using field

Fidden and Loch Poit na h-I, Bing Maps, imagery date 2010?

Feeding and roosting locations used by geese

Feeding sites and habitat: Geese feed mostly at Fidden (NM304217) on reseed, rough pasture and adjacent blanket mire, although they have been occasionally seen to the north and south of Fidden farmhouse. There have been sightings of geese from the offshore island of Iona. Interchange between the island, Fidden and potentially with the Loch Assapol flock are not well understood.

Roosting sites: The geese have been seen flighting to Loch Poit na h-I (NM313223) where they roost on the west shore of the loch. Displaced birds have also been seen on the edges of the loch. Local information has suggested that they also use Erraid (NM3019) as a roost and may feed there in daytime, but confusion with Greylag Geese is a possibility here.

Characteristics of fields and other habitats and visit notes

A subset of habitat variables is presented below, derived from data collected in the field. All fields with available area values in hectares (derived from SIACS information) are included. The variables selected are those thought most likely to show differences between sites, and which had data available consistently for most fields. The summaries below therefore characterise certain aspects of the site. They are only approximations, though, due to data complexities.

Total area of fields analysed (ha)	308
Average field area across site (ha)	64

Habitats	ha	%
Part Machair	308	100

Feature	Area of fields showing feature (ha)	%
Short sward (<5cm)	308	100
Little *Juncus* (score 1)	105	34
Some *Juncus* (score 2)	203	66
No standing water (score 1)	308	100

The five fields analysed are short, grazed, well-drained coastal grassland resembling machair. These fields are often used. Other fields used occasionally by the geese nearer Loch Poit na h-I were not included.

Habitat change and land use history
None known to affect the geese.

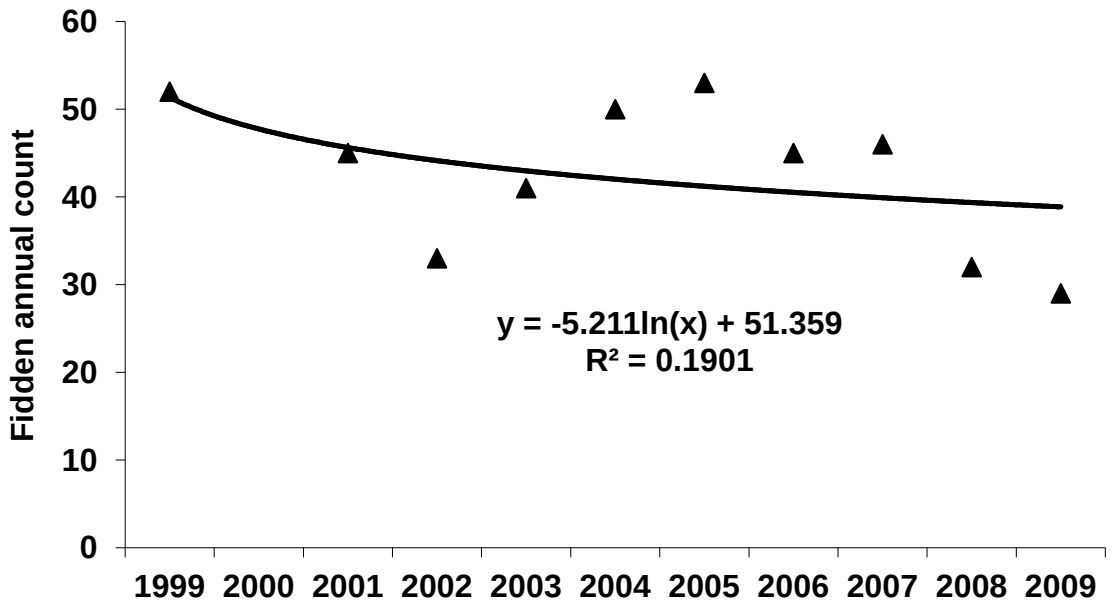
Agri-environment measures in place
There appear to be no agri-environment measures operational in fields used by the geese at this site.

Disturbance issues
Aircraft disturbance: The site is near a low-flying route, but the effects of this are unknown.
Hunting disturbance: Not known, but not thought a problem.
Agricultural disturbance: Not known, but not thought significant. Passing vehicles have little effect when the geese are grazing in fields by roads.

Conservation designations and site protection
None.

Assessment of possible adverse influences on goose numbers
None known.

Site vulnerability



Population trend since 1999

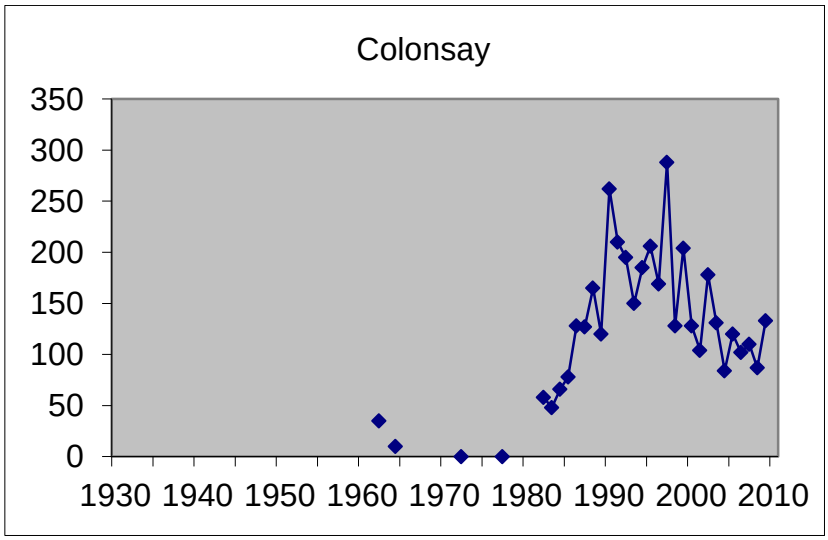
This site is considered to be at lower risk of extinction soon due to lower decline rate, but should be considered of medium priority for conservation action due to low population size.

Recommendations for management
There are no obvious management actions. The extent of the fields and their habitats appear more than adequate to sustain current or increased numbers, and resemble conditions found at many other sites.

Colonsay and Oronsay

General status, population summary, graph of trends and age ratios
Most recent international census count: ***94*** *(March 2011)*
General trend: Decline since late 1980s.

This flock increased from 50-80 in the earliest surveys of the 1980s, to peak at 150-300 individuals in the 1990s. There was considerable year to year variation, and it could be the case that there are movements to and from unknown feeding areas. Since the peak count of 288 in 1997, numbers have declined to the present, as is the case at many resorts.



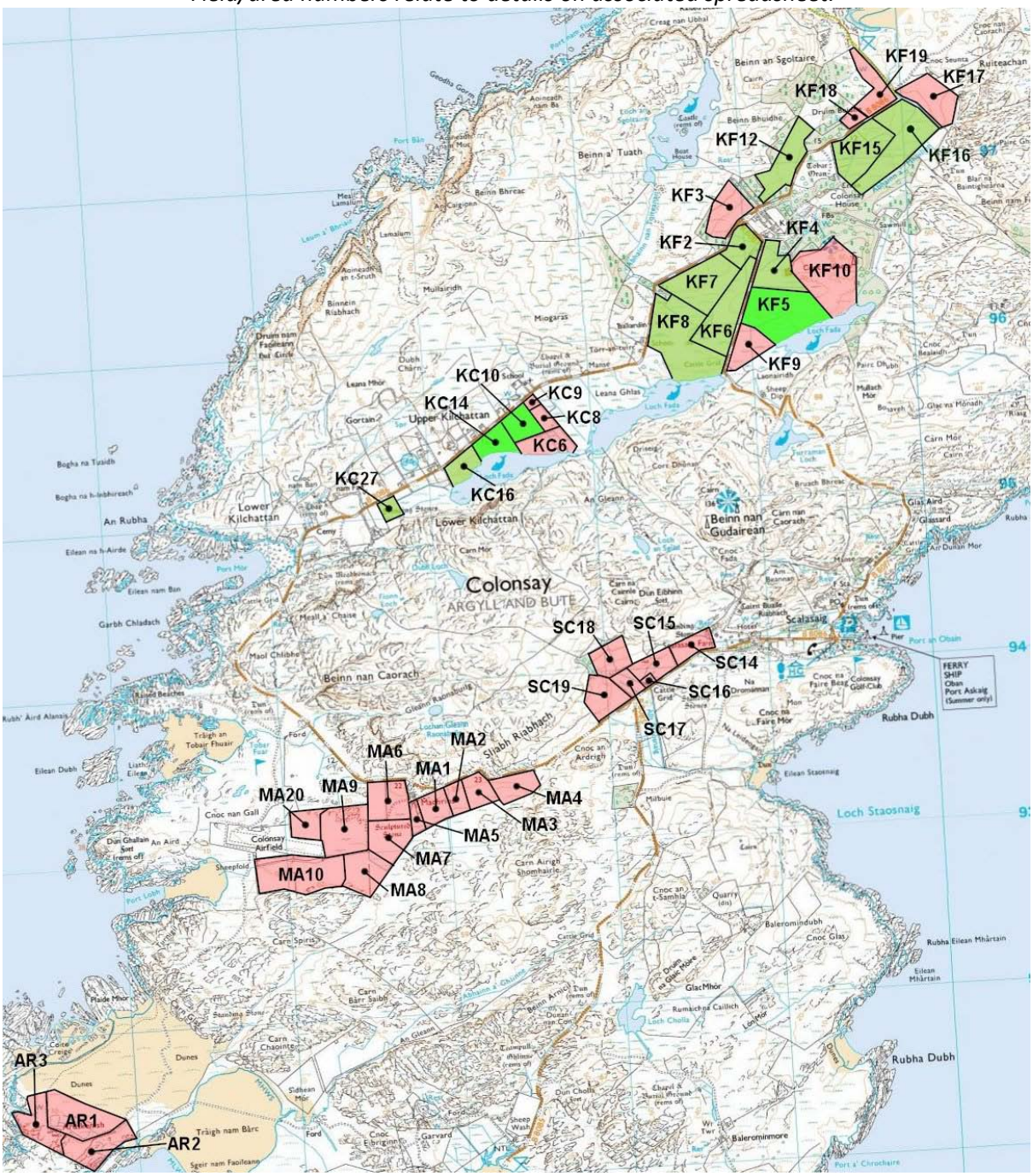
Breeding success: There is not enough information to provide a long run of data from the island.

Any other relevant population information – inter-site movements, collars
Colonsay and Oronsay lie on the main migration route to Islay and other wintering areas to the south. Large skeins pass over every autumn on obvious "goose days" but fewer geese are seen migrating in spring. Despite this, only one marked individual has been seen here, a short stopping migrant: A8S was ringed in Isunngua, west Greenland in summer 1992 and staged briefly on Colonsay in October 1992, before wintering at Machrihanish on Kintyre from late October that year.

Long-term history
History: Colonsay and Oronsay were apparently only colonised during the 1930s, with only two records prior to 1934 (Jardine *et al*. 1986). Two pinioned pairs of Canada Geese *Branta canadensis* were introduced by the estate in 1934 to try and attract wintering wildfowl on the island (Clark 1977). This seemed to work, as by 1968, possibly around c.200 Greenland White-fronted Geese were wintering, though there was also a major expansion on all the winter quarters at that time. Neither Berry (1939) nor A-W (1963) mentioned White-fronted Geese on Colonsay, but there was a symbol for 10-100 birds on the island in A-W's (1963) map. R&O (1979) reported 20 regularly from the 1950s, but reported few after that time. Despite this, Clarke & Clarke (1990) reported that numbers at that time appeared less than the 200 or so which were regular by 1968. R&O (1979) noted that none could be found on the island in either April 1973 or April 1978 and speculated over whether the flock had gone or simply that the geese were only present in the first part of the winter. Clarke & Clarke (1990) suggest there were still c.70 in the late 1970s, but their detailed counts started in 1981/2 when there was a maximum of c.60 present in April 1982. Thus we know little of the distribution, abundance and history of this flock prior to regular monitoring that started in the early 1980s.

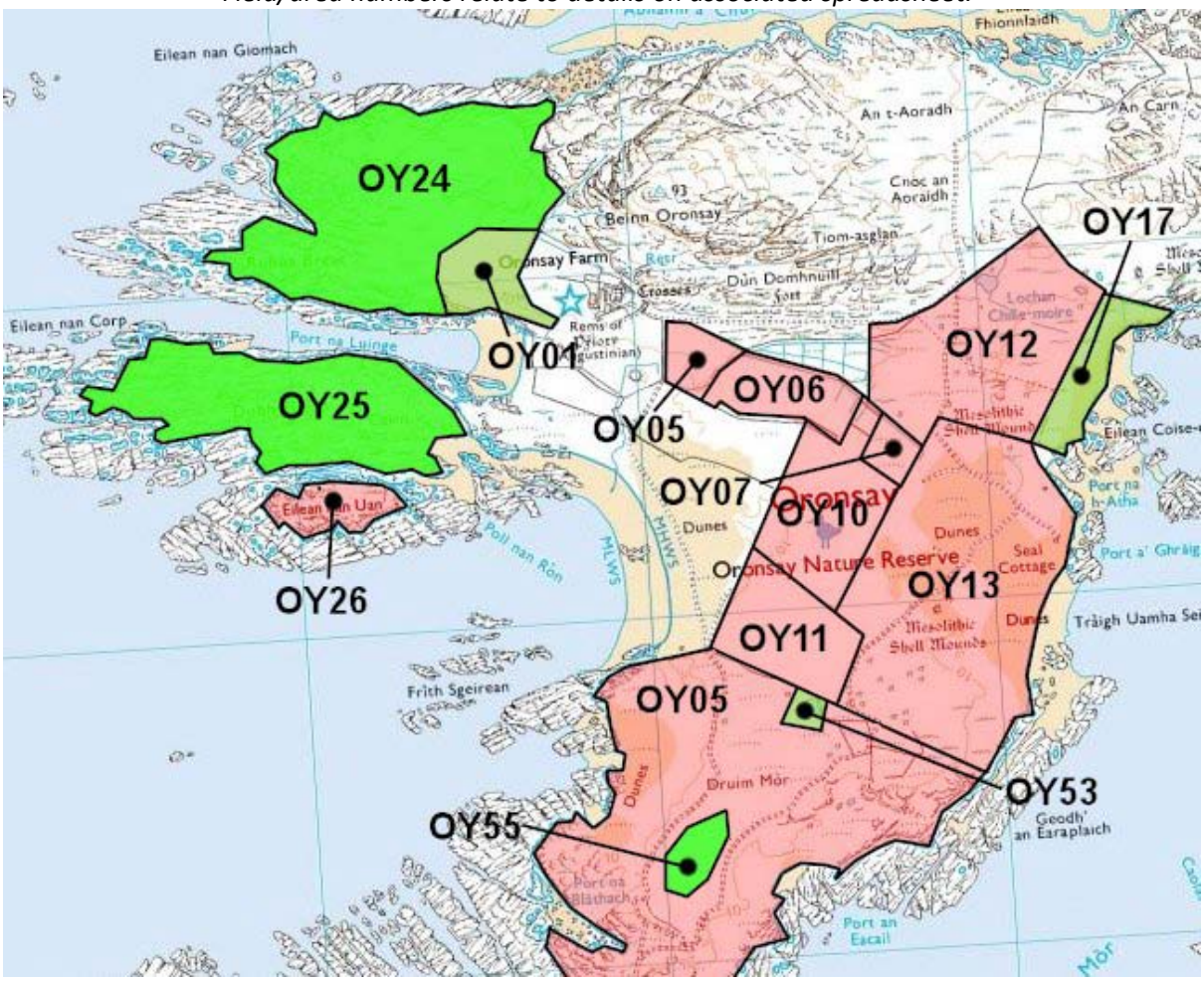
Maps of different parts of the islands (Colonsay then Oronsay)

Field/area numbers relate to details on associated spreadsheet.



Areas most frequently used by Greenland White-fronts (green) and fields surveyed (pink)

Field/area numbers relate to details on associated spreadsheet.



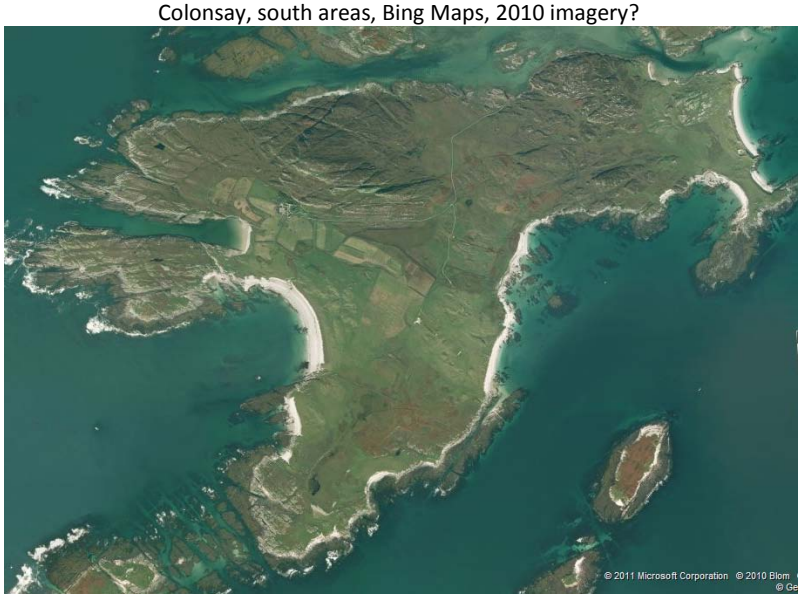
Areas most frequently used by Greenland White-fronts (green) and fields surveyed (pink)

Site photographs Colonsay

Colonsay fields KF05, KF10 and Loch Fada (Mike Peacock, 2011)

Colonsay, north and central areas, Bing Maps, 2010 imagery?

Colonsay, south areas, Bing Maps, 2010 imagery?



Oronsay, Bing Maps, 2010 imagery?

Feeding and roosting locations used by geese

Feeding sites and habitat: Clarke & Clarke (1990) noted use of the fields of Kiloran, Machrins, Oronsay, Scalasaig and Kilchatten farms in that order of importance. The birds conspicuously do not use every field on each farm, but seem to favour good grazing away from potential danger. Geese use in-bye fields, rough pasture and improved and managed grasslands, mostly in the vicinity of Kiloran. Clarke & Clarke (1990) speculated on the effects on the geese of changes in grass ley management on the island. In the 1960s, 3-year rotation was the norm and up to 200 geese were reported, but this changed to 7-year leys in the 1970s and the flock numbered 70-80, later in the 1980s 5 year leys became more popular and numbers increased again, albeit during a period of overall population increase. Nevertheless, these changes in grassland management did mean that the average area of grassland reseeded annually changed from 25 ha to 15 ha to 20 ha respectively during these three decades, making a substantial difference to the area of new grass available to this goose flock.

Roosting sites: In early winter, geese seem to roost in or close to their feeding site (Clarke & Clarke 1990). Later in mid-winter and spring, they use lochs or wet marshy areas away from the feeding areas, such as Loch an Sguid, Ardskenish Point, Loch Fada or the southern part of Oronsay.

Colonsay Fields KF06 and KF07 (Mike Peacock 2011)

Colonsay field KF17 (Mike Peacock 2011)

Oronsay Field OY55 (Mike Peacock 2011)

Characteristics of fields and other habitats and visit notes

A subset of habitat variables is presented below, derived from data collected in the field. All fields with available area values in hectares (derived from SIACS information) are included. The variables selected are those thought most likely to show differences between sites, and which had data

available consistently for most fields. The summaries below therefore characterise certain aspects of the site. They are only approximations, though, due to data complexities.

Total area of fields analysed (ha)	4199
Average field area across site (ha)	71

Habitats	ha	%
Mixed Arable/sown with grass	16.088	0.4
Bog or Moor or Marsh or moorland or fen	951.69	22.7
RIP (recently improved pasture)	335.2	8.0
OIP (old improved pasture)	778	18.5
PP or PG (permanent grass/pasture)	1383.35	32.9
OIP/PP	52.934	1.3
unknown (L?) or n/a	681.75	16.2

Feature	Area of fields showing feature (ha)	%
Not recorded or n/a (e.g. ploughed field)	1023.0	24.4
Short	1921.6	45.8
Short Medium	10.6	0.3
Medium	1161.7	27.7
short, medium and long	7.9	0.2
Long	74.2	1.8
Little *Juncus* (score 1)	761.8	18.1
Some *Juncus* (score 2)	174.4	4.2
Juncus widespread (score 3)	380.4	9.1
Not recorded	2881.3	68.6
No standing water (score 1)	1397.2	33.3
Some seasonal inundation (score 2)	476.16	11.3
Permanent pool (score 3)	2171.9	51.7
Not recorded or n/a	153.7	3.7

The Colonsay and Oronsay areas seem characterised as predominantly grassland, particularly permanent grass, but with areas of recent improvement. Swards are short to medium, and many fields have permanent water. Other favoured areas are dominated by bog and moor.

Habitat change and land use history
None known to affect the geese.

Agri-environment measures in place
Based on frequency, the following measures are in place over fields at this site:

Agri-environment measure	% frequency
Mown Grassland for Corncrakes - 1 Sept	28.6
Open Grazed or Wet Grassland for Wildlife	26.5
Management of Cover for Corncrakes	18.4
Management of Wetland	10.2
Grazed Grassland for Corncrakes	6.1
Bracken Management Programme for Habitat Enhancement	4.1
Creation and Management of Cover for Corncrakes	2.0
Management of Species Rich Grassland	2.0
Muirburn and Heather Swiping	2.0
	100.0%

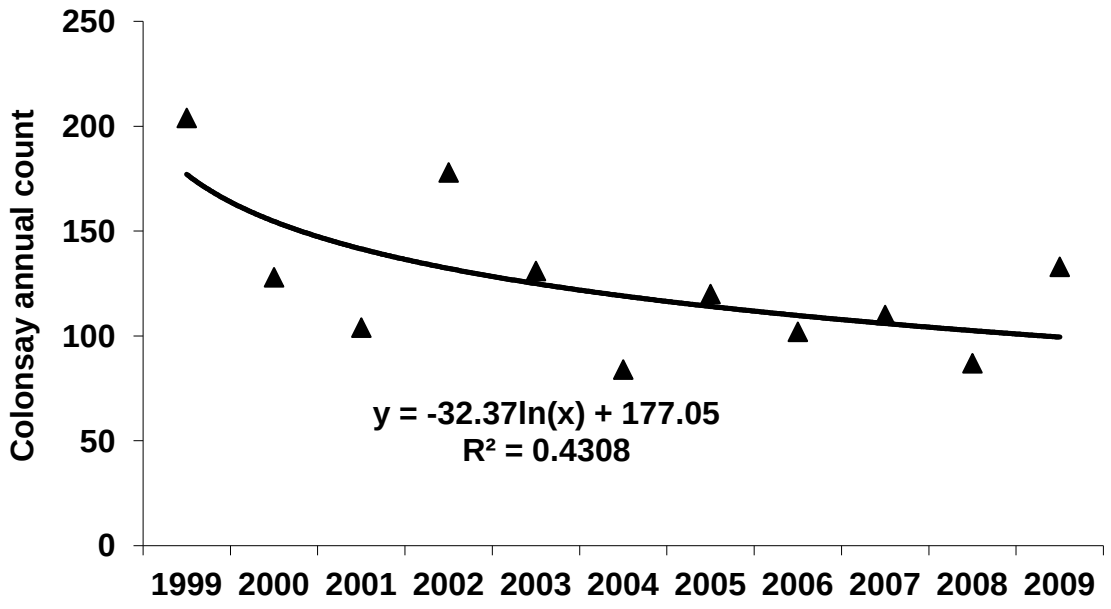
Due to the multiple occurrence of measures in single fields, differing field boundaries, and some discrepancies in grid references, it is not possible to analyse the information according to the area covered.

Disturbance issues
Aircraft disturbance: Not known.
Hunting disturbance: Not known, but not thought to be a problem.
Agricultural disturbance: Not known, but not thought to be significant.

Conservation designations and site protection
The feeding areas on Oronsay and Loch Fada on Colonsay are protected as SSSI and Oronsay is an RSPB reserve managed sympathetically for the geese.

Assessment of possible adverse influences on goose numbers
Damage from Greenland White-fronted Geese in recent winters has been cited as the reason for early reseeding of some fields, although Greylags and Barnacle Geese *Branta leucopsis* are also present. However, farmers on Colonsay and Oronsay have been comparatively tolerant of geese, although any increase in damage could cause problems in the future.

Site vulnerability



Population trend since 1999

This site is considered to be at high risk of extinction due to high rate of decline and should be considered a high priority for appropriate conservation action.

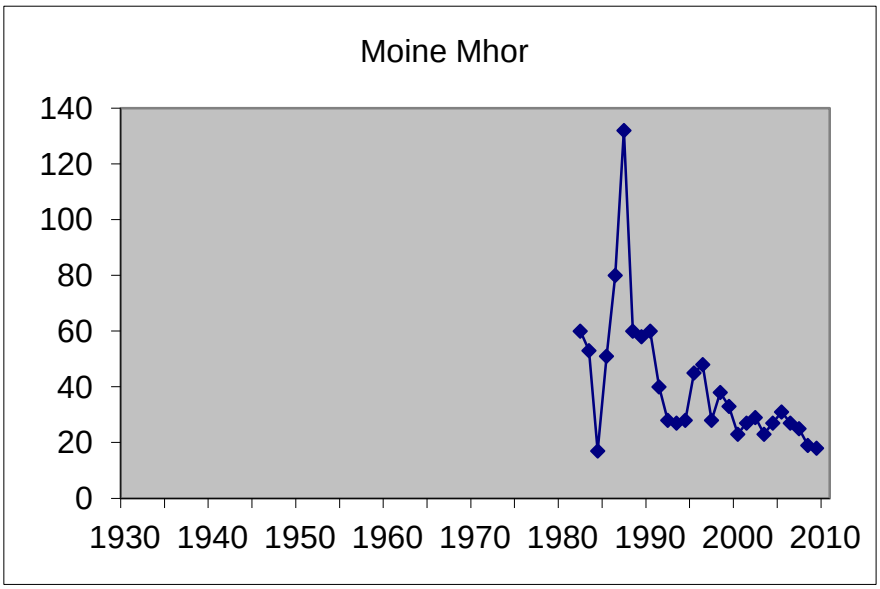
Recommendations for management
Continuation of a rotational reseeding programme for all relevant grassland areas would seem to be the best option for retaining numbers. Cutting of *Juncus* may be appropriate in places, and Colonsay estate has recently embarked upon rush control in some fields. Wetland management in some areas may be beneficial – for example, some of the *Juncus*-rich fields on Colonsay could be made wetter, in the recent past a lot of the drains have been cleared out, especially from Loch Fada; therefore some of the fields may have become drier. A plan for such work should be considered.

Moine Mhor

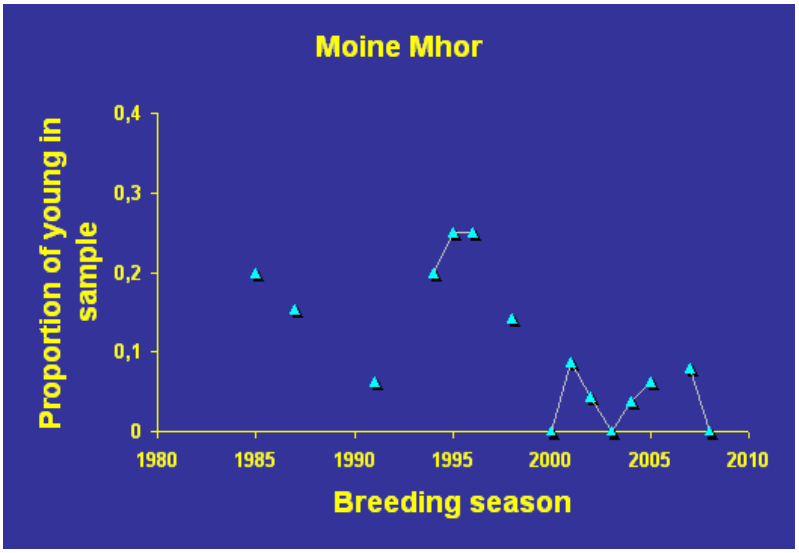
General status, population summary, graph of trends and age ratios

Most recent international census count: ***17*** *(March 2011)*
General trend: slow decrease since 1980s

Numbers have shown some variation since regular counts began in 1982 with an abnormal count of 132 suggesting the presence of substantial numbers from another resort. Otherwise, the annual peak counts have been between 30 and 60, with a gradual decline overall from around 50 to fewer than 20.



Breeding success: Although assessment of breeding success has not been annual at Moine Mhor, there are enough data to suggest a long term downward trend and in particular very low productivity in very recent years. Because the flock is numerically small, the difference between one family and two makes a very large difference to the ratio of young in the flock, so variance is high, but the trend is clear. However, a family of 6 young was noted in 2010 as part of a welcome increase in numbers here this season.



Any other relevant population information – inter-site movements, collars

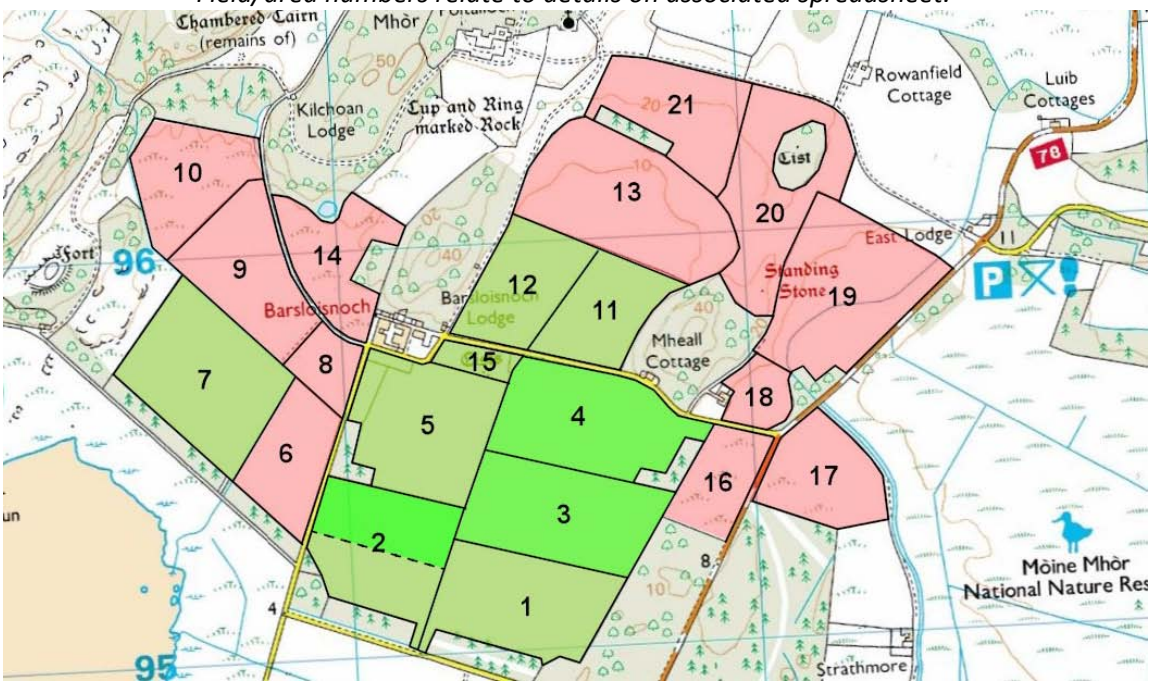
Four marked individuals have been seen at this site. 1RU wintered in Wexford in 1985/6 and 1986/7, at Loch Ken in 1987/8, Wexford in 1988/9, Moine Mhor in 1989/90, was back at Wexford for the winters of 1990/1, 1991/2 and 1992/3, was on Islay in 1993/4 and finally back at Wexford for 1994/5! 6HH ringed on Islay, was there in 1995/6, was seen at Moine Mhor in 2004/5, but was not seen in the intervening period. H7X was caught in Hvanneyri west Iceland and staged at Moine Mhor in early November 2001 en route to Wexford, to winter from mid November onwards.

Long-term history

History: There is no mention of this flock in Berry (1939) nor in A-W (1963), so there is little historical data on this flock. It was clearly traditionally associated with the raised mire systems of Crinan Moss and the associated wet pasture and rough grazing of the periphery and is likely have been long established, if overlooked. R&O (1979) mention that up to 100 had been reported from the resort at the time of their account, but gave no details and wrote that none had been reported from here in the previous five years.

Map of Moine Mhor surveyed area

Field/area numbers relate to details on associated spreadsheet.



Areas most frequently used by Greenland White-fronts (green) and fields surveyed (pink)

Site photographs, Moine Mhor

Moine Mhor, Feb 2005

Moine Mhor, Feb 2005

Moine Mhor, Feb 2005

Moine Mhor, Feb 2005

[No useful Google or Bing aerial imagery]

Feeding and roosting locations used by geese

Moine Mhor (Crinan Moss) is a coastal raised mire with transition from saltmarsh through to raised bog vegetation. Geese use the surrounding low-intensity pasture along the River Add for feeding, resorting to the bog dome as a disturbance-free refuge, although this is also used for undisturbed daytime feeding. They are now rarely seen away from the Barsloisnoch fields, where fields 2, 3 and 4 are most frequently used.

Roosting sites: Not clear. Moine Mhor raised mire may be used; the estuary seems more frequently utilised. They have also been seen on forest hill lochs south of Dunadry (P. Batty, pers. comm.).

Characteristics of fields and other habitats and visit notes

A subset of habitat variables is presented below, derived from data collected in the field. All fields with available area values in hectares (derived from SIACS information) are included. The variables selected are those thought most likely to show differences between sites, and which had data available consistently for most fields. The summaries below therefore characterise certain aspects of the site. They are only approximations, though, due to data complexities.

Total area of fields analysed (ha)	241.5
Average field area across site (ha)	11.5

Habitats	ha	%
Bog/Moorland/Marsh	109.5	45.3
Recently Improved Pasture	8	3.3
Old Improved Pasture	96.7	40.0
OIP and BM	27.3	11.3

Feature	Area of fields showing feature (ha)	%
Short sward (<5cm)	80.283	33.2
Short medium	17.68	7.3
Short medium and long	34.04	14.1
Long sward (>15cm)	109.469	45.3
Little *Juncus* (score 1)	116.48	48.3
Some *Juncus* (score 2)	2.468	1.0
Widespread *Juncus* (score 3)	122.527	50.8
No standing water (score 1)	241.5	100

This site is dominated by old improved pasture and marsh. Swards and *Juncus* coverage were polarised between areas with short grass and little *Juncus* and areas much ranker with much *Juncus*. Most fields had little standing water at the time of survey.

Habitat change and land use history
Some rush cutting has taken place, which may affect goose use. Growth of *Juncus* in field 13 may have deterred the geese; they rarely use it now (P. Batty, pers. comm.), and this may also be true of the southern part of field 2.

Agri-environment measures in place
There appear to be no agri-environment measures operational in fields used by the geese at this site, though rush cutting has taken place, possibly not linked to any agri-environment programme.

Disturbance issues
Aircraft disturbance: Not known.
Hunting disturbance: Not known, but not thought to be a problem. Some rough shooting takes place, aimed at Canada and Greylag Geese.

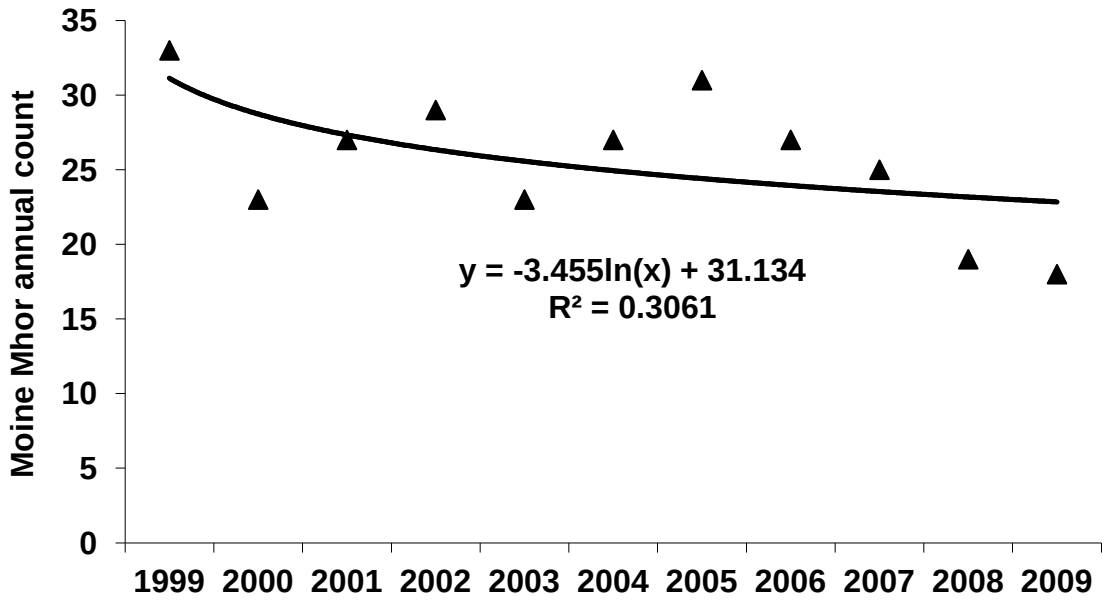
Agricultural disturbance: Not known, but not thought to be significant. A track was built in the fields at Dunamuck in the 1990s which was thought to have increased disturbance here.

Recreational disturbance: Dog walking may affect the birds here at times (noted in 2011), but this is not thought to be a general problem.

Conservation designations and site protection
The geese use parts of the Moine Mhor NCR SSSI which is National Nature Reserve and a proposed Ramsar Site. Fields used along the River Add lie outwith the SSSI.

Assessment of possible adverse influences on goose numbers
No unequivocal issues identified, but spread of rushes in some fields may have affected the details of site use. The large growth in numbers of Canada Geese (191 counted in 2011, and present most of the year) may have increased competition with the White-fronts but there is little clear evidence. Greylag Geese are also present, but numbers have not increased much (P. Batty, pers. comm.).

Site vulnerability



Population trend since 1999

This site is considered to be at moderate risk of extinction but should be considered a high priority for appropriate conservation action due to low population size.

Recommendations for management

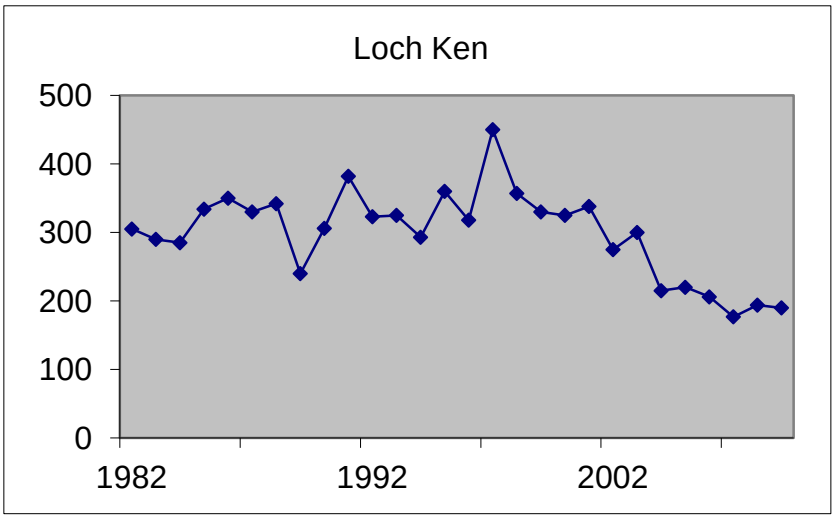
Rush cutting has taken place here and this should continue; this should be compatible for any management for breeding waders. In particular, field 13 would benefit from rush cutting and reintroduction of more intensive grazing by cattle and sheep. There is a small car park at Barsloisnoch, and a notice compliant with the Outdoor Access Code requesting walkers not to let their dogs into the key field may be helpful.

Loch Ken

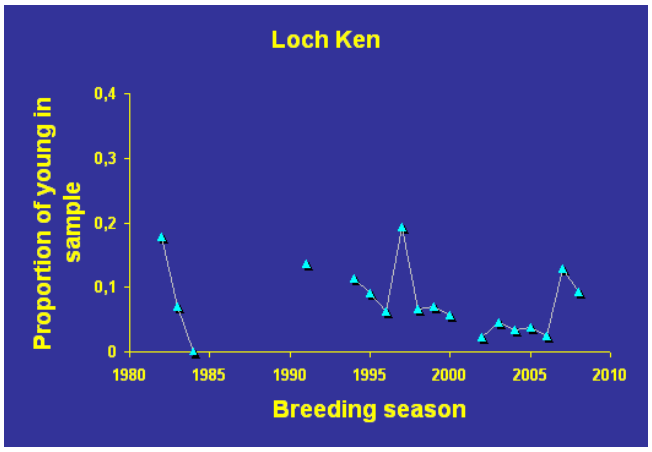
General status, population summary, graph of trends and age ratios

Most recent international census count: ***194*** *(March 2011)*
General trend: overall decline since the 1970s.

There was a gradual increase from 1978 to the late 1990s but there has been a marked general decline since 1998 to around 200 in the last three years.



Although variable, with data not available every year, evidence suggests a gradual decline in productivity, with proportions of young below 5% since 2001, excepting 2010 and 2011. The production of young has been lower than on Islay, but the sample size is smaller.



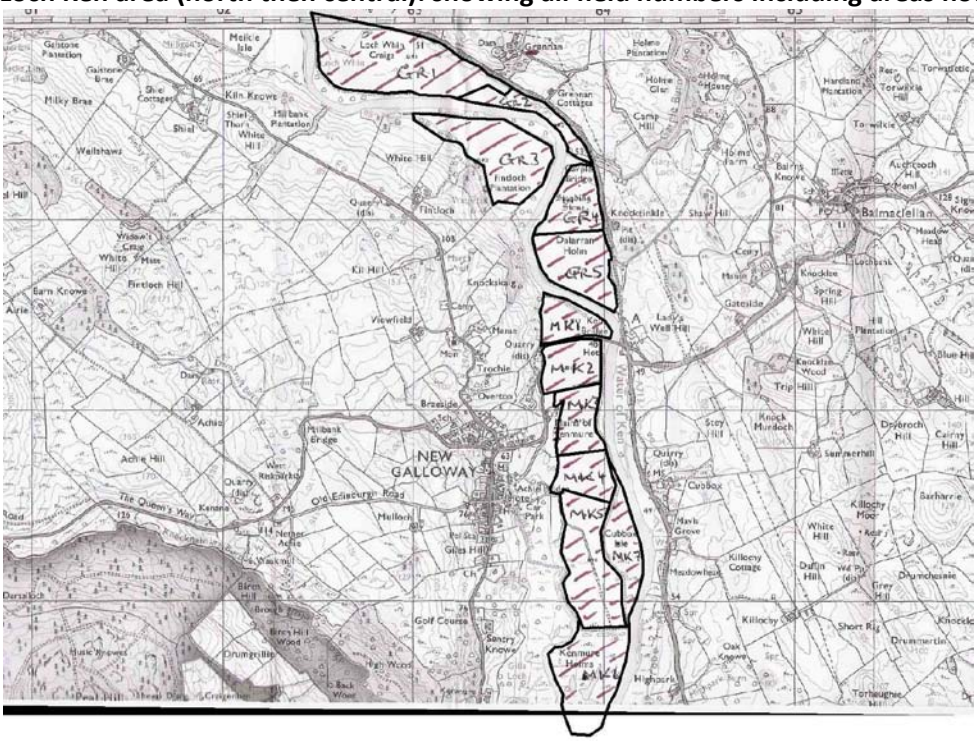
Any other relevant population information – inter-site movements, collars

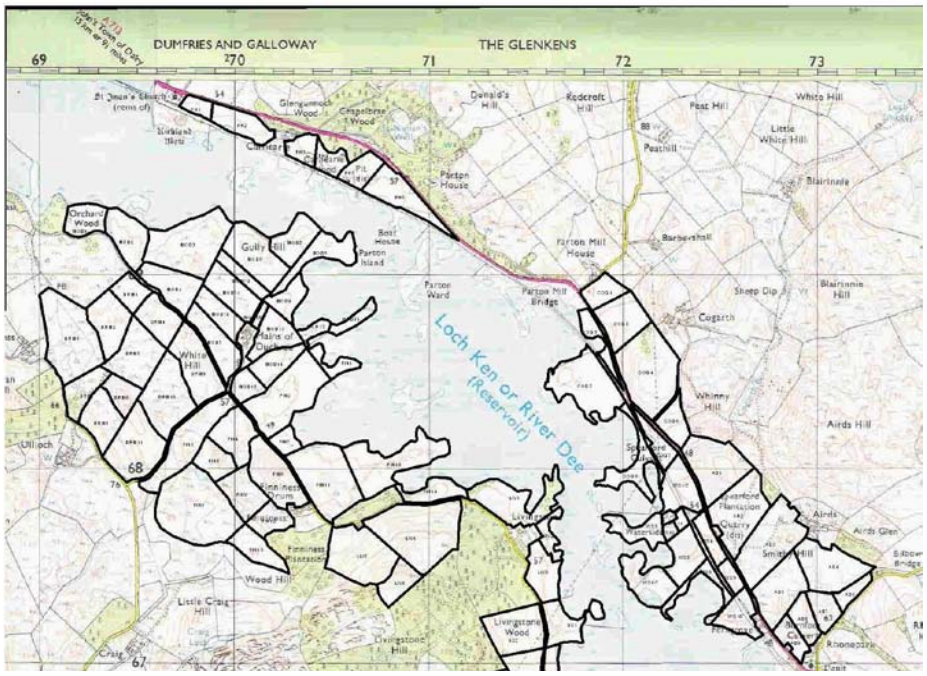
18 marked birds have been seen here, including 6 geese ringed in Eqalungmiut Nunaat in west Greenland, suggesting the origin of many Loch Ken birds. 2CC was caught in Isunngua Greenland in 1989 and wintered every year until 1999/2000, also visiting Islay in this time. A5X and C3D, caught in Isunngua Greenland in 1992 also wintered here. Other reports involve Wexford birds shifting to Loch Ken for one year (4 birds), three of which returned to Wexford subsequently, and one bird that changed wintering sites almost every year. Ever since winter 2008, WWT have captured and marked individuals with collars and telemetry devices which will be invaluable in providing data on individual survival and reproductive success, as well as illuminating details of individual ecology and site interchange.

Long-term history

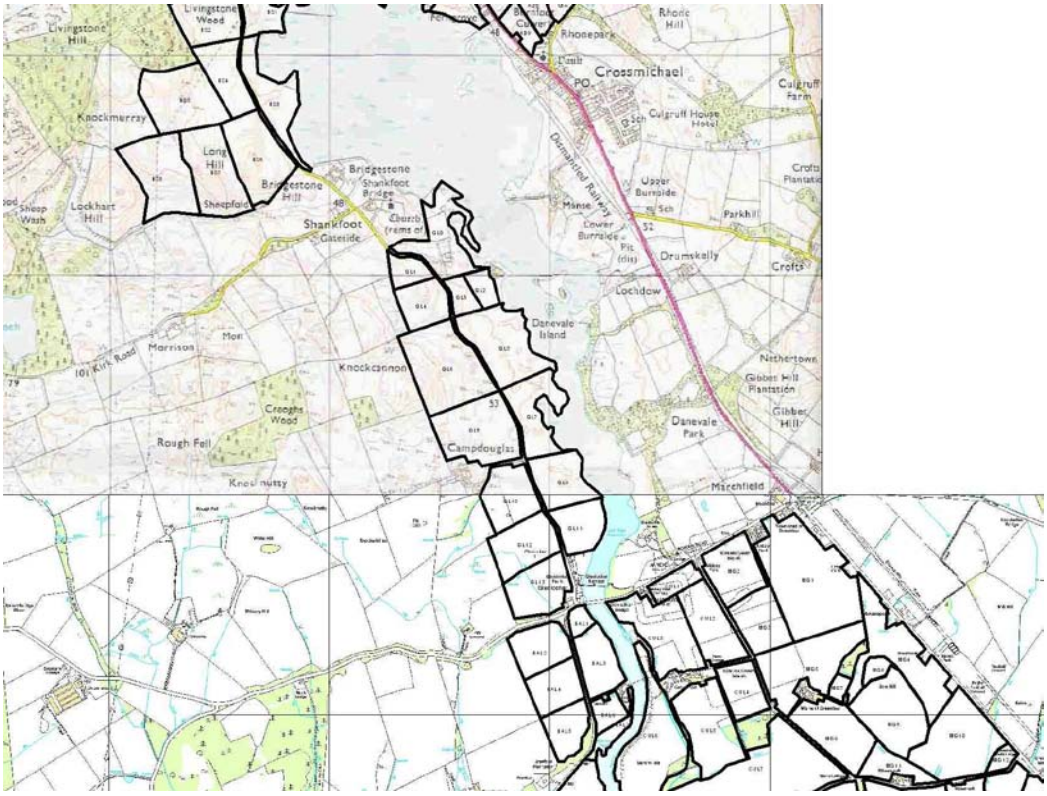
A-W (1963) mapped the site and reported regular numbers of 400-500 geese. Later, R&O (1979) presented annual peak counts of between 250 and 530 birds between 1965/6 and 1978/9, Although annual peak counts varied a great deal, there was a hint of a decline with less than 300 geese counted in the last of those three winters. R&O (1979) speculated that the decrease in numbers since 1962/3 coincided with increases in the numbers of Greylags using the area, which also attracted more attention from wildfowlers. It is clear that especially towards the end of the period when White-fronted Geese were legal quarry (to 1981), they were killed and hunting pressure was severe – protection was effective from winter 1982/83.

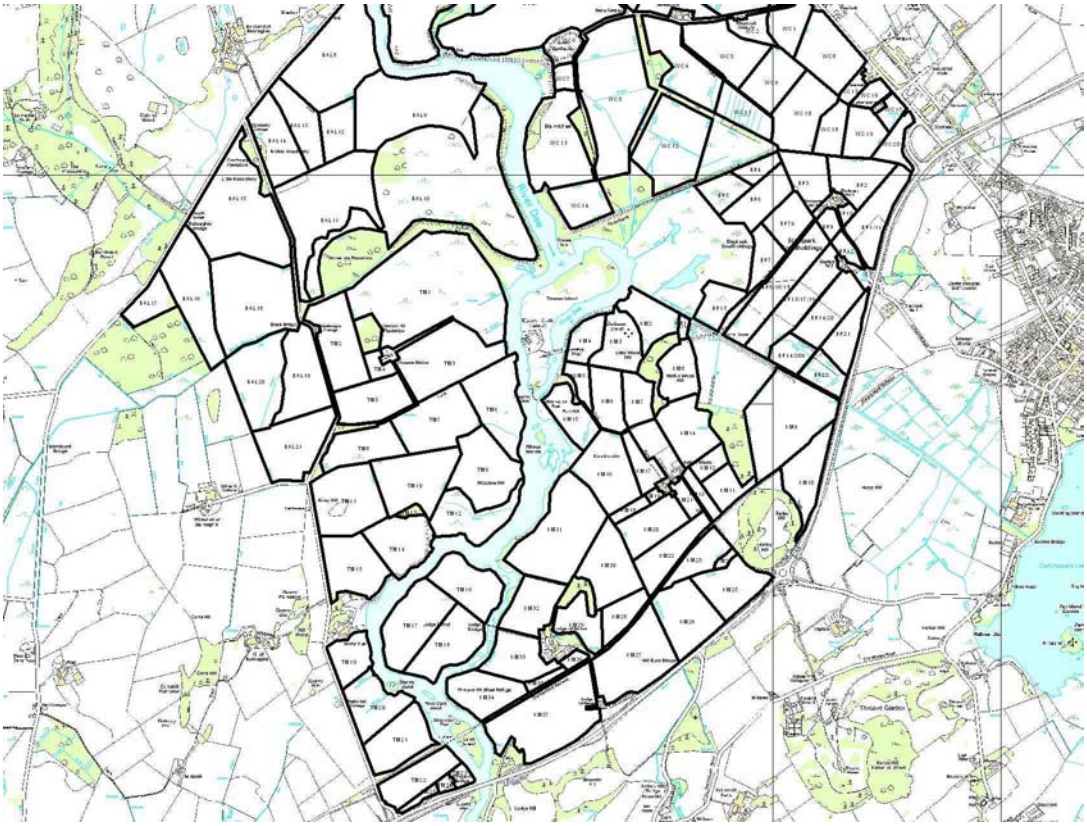
Loch Ken area (north then central): showing all field numbers including areas not surveyed



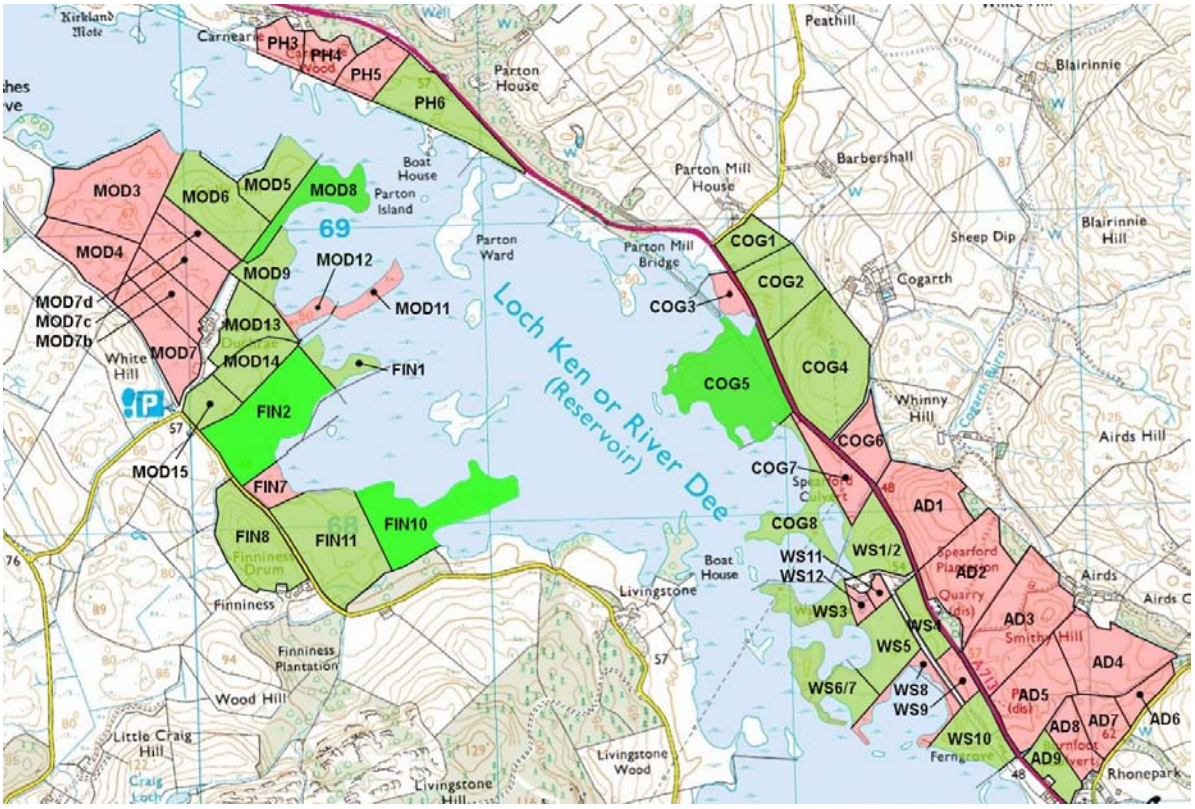


Field/area numbers relate to details on associated spreadsheet.

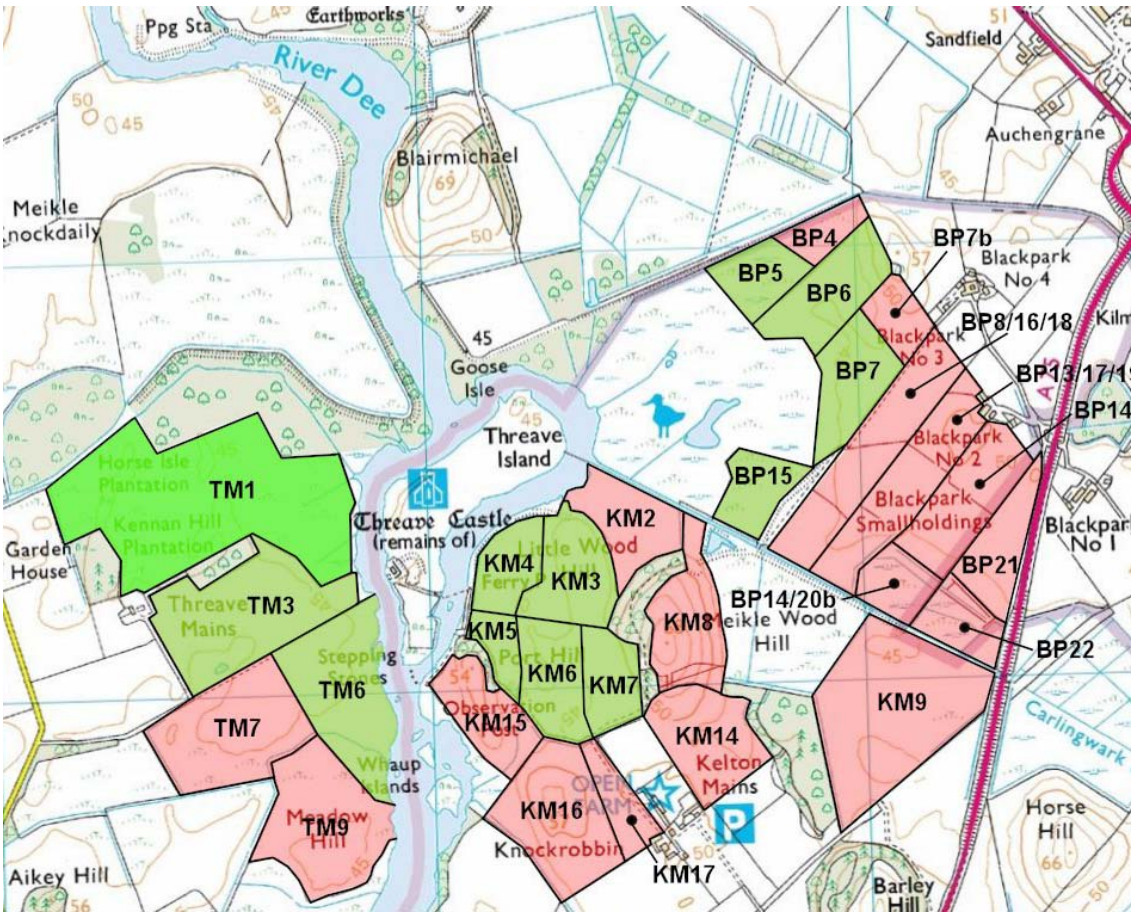




Loch Ken area (south): field/area numbers relate to details on associated spreadsheet.



Areas most frequently used by Greenland White-fronts (green) and fields surveyed (pink)



Site photographs, Loch Ken

[No useful Google Earth or Bing Maps imagery]

Loch Ken, Mains of Duchrae area, February 2005

Loch Ken, February 2005

Finniness view, March 2011 (Larry Griffin)

Finniness view, March 2011 (Larry Griffin)

Finniness view, March 2011 (Larry Griffin)

To Mains of Duchrae, March 2011 (Larry Griffin)

Feeding and roosting locations used by geese

The traditional areas used during A-W's (1963) day have changed, with geese increasingly deserting the area at the head of Loch Ken, where Greylags are now very plentiful, contributing to discussions about possible interactions between the two species, though Greylags have recently declined slightly here. Stubble feeding used to occur in autumn, but does not normally occur now; later an array of grassland types are used throughout the winter, especially improved grassland and reseeds. Wetlands and inundation marsh adjacent to a long-established hydro-electricity generation loch are also exploited. They show some preference for certain regularly used areas which may suffer less disturbance. Favoured areas were centred on Mains of Duchrae, but the geese frequently use the Parton, Finniness, Cogarth, Waterside and Crossmichael areas, as well as sites further south around Threave and Blackpark.

Roosting sites: Loch Stroan was formerly used as a roost, but this no longer seems to be the case. Observations and satellite tracking have shown that the birds roost more often in the marshes at Threave/Blackpark where the River Dee broadens out, when the birds are feeding in that area. When birds are feeding further north around Loch Ken they can use a variety of sites including the bays either at Cogarth or Waterside or most commonly in the sheltered bays below Finniness. The Threave roost is often used when the loch is frozen or when it is flooded. At times, the birds vacate all known areas and utilise unknown areas for roosting and feeding for anything up to a month at a time.

Characteristics of fields and other habitats and visit notes

A subset of habitat variables is presented below, derived from data collected in the field. All fields with available area values in hectares (derived from SIACS information) are included, not just those used by the geese. The variables selected are those thought most likely to show differences between sites, and which had data available consistently for most fields. The summaries below therefore characterise certain aspects of the site. They are only approximations, though, due to data complexities.

Total area of fields analysed (ha)	495
Average field area across site (ha)	6.2

Habitats	ha	%
Arable/cereal	13.3	2.7
Recently Improved Pasture	24.6	5.0
Old Improved Pasture	422.2	85.3
Permanent Grassland	9.7	2.0
Unknown or n/a	25.2	5.1

Feature	Area of fields showing feature (ha)	%
Not recorded or n/a	23	4.6
Short sward (<5cm)	135.1	27.3
Medium	273.48	55.2
Long sward (>15cm)	63.4	12.8
No *Juncus*	232.5	47.0
Little *Juncus* (score 1)	125	25.3
Some *Juncus* (score 2)	107.6	21.7
Juncus widespread	29.8	6.0
No standing water (score 1)	306.6	61.9
Some seasonal inundation (score 2)	84.1	17.0
Permanent water	34.7	7.0
Seasonal and permanent	69.5	14.0

The Loch Ken site has largely dry grass fields, with little *Juncus* and short to medium swards. There is very little bog, moor or marsh within the areas surveyed, though such habitats are present nearby and often immediately adjacent.

Habitat change and land use history

There has been a tendency over the last few years to plough some of the old pastures at Mains of Duchrae for cereal growing. These fields were well used by the geese when under pasture. These stubbles tend to be very bare in winter and are fertilised with an odd mix of forestry brash which often contains a high percentage of rubbish such as plastic bags. Some key fields at Finniness can also be heavily stocked with sheep which seems to make them less attractive and pastures at Duchrae seem to be far more yellow in appearance mid-winter than in the past. Sometimes the key field at Threave Mains can be heavily grazed and poached by cattle late into the season which probably makes it less attractive to the geese. Increased slurry spraying and some scrub encroachment have also been noted, though not quantified.

Agri-environment measures in place

Based on frequency, the following measures are in place over fields at this site:

Agri-environment measure	% frequency
Hedgerows - 3 years for biodiversity benefits	21.4
Management of Wetland	21.4
Open Grazed or Wet Grassland for Wildlife	14.3
Wild Bird Seed Mix/Unharvested Crop	14.3
Biodiversity Cropping on In-Bye - basic management	7.1
Enjoyment of rural landscapes - restore built boundaries	7.1
Management of Species Rich Grassland	7.1
Scrub and Tall Herb Communities	7.1
	100.0%

Due to the multiple occurrence of measures in single fields, differing field boundaries, and some discrepancies in grid references, it is not possible to analyse the information by to the area covered.

Disturbance issues

Aircraft disturbance: Low flying jets are common and the geese are not disturbed by them, though helicopters even at a distance can often cause the geese to take flight.

Hunting disturbance: Throughout the recent past, regular and intense commercial shooting of Greylags has occurred in the vicinity of areas used regularly by the White-fronts and there have been problems with hunting in and around this site in the past. It may be that the considerable hunting pressure on the Greylag Geese with which the White-fronted Geese associate has had an effect both on the distribution of the geese and their abundance. During the last ten years at least, though, hunting disturbance does not appear to have been an issue.

Fishing: some limited disturbance from fishing occurs, particularly around Mains of Duchrae, but whether this is important in unclear.

Agricultural disturbance: Not likely to be more of a problem than anywhere else in Scotland. It is not clear to what extent such activity could have contributed to declines.

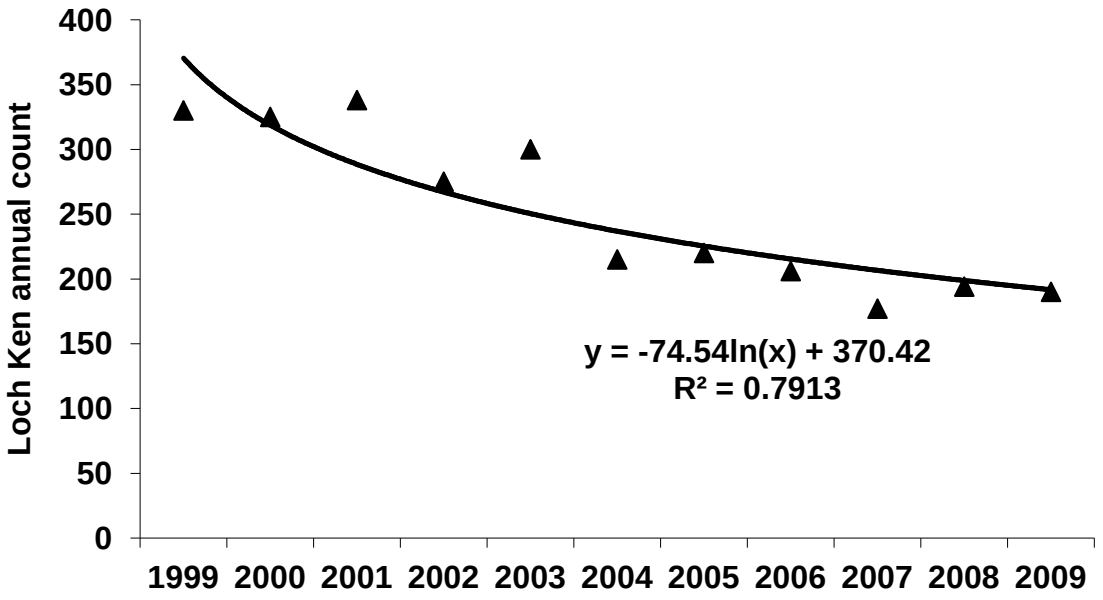
Conservation designations and site protection

Areas used include part of Loch Ken RSPB Reserve, the River Dee (Parton-Crossmichael), Kenmure Holms SSSI, parts of Threave and Carlingwark Loch NCR SSSI. Some of these areas were designated as the Loch Ken and River Dee Marshes SPA and Ramsar site in 1992.

Assessment of possible adverse influences on goose numbers

At the key site at Threave Mains, a field not visible from the road, a ruined barn has been converted for residential use and will likely be inhabited from summer 2011. If any associated dogs are exercised in the field this could be detrimental. As it stands even the increased disturbance associated with this site that would undoubtedly result coupled with the visitation to the Threave Castle in the river could be enough to discourage the White-fronts. It is quite possible the birds will simply shift their emphasis to the Blackpark fields next to the roost but it is a potential concern. However, it is not clear to what extent these disturbance issues are significant. At the three main farms around Loch Ken used by birds, broader feeding sites can be lost for up to a week or more when slurry is spread on all fields of a holding at the same time. A management plan might advocate only a proportion of fields covered with slurry in any one week.

Site vulnerability



Population trend since 1999

This site is considered to be at high risk of extinction due to the high rate of decline and should be considered a high priority for appropriate conservation action.

Recommendations for management

Clear broom and hawthorn scrub from peninsula field MOD11 as in the distant past the geese may have used this field and it would make sense that they did when this was more of a pasture. Also willow clearance along the south-east edge of FIN2 would likely make this field more attractive as it is/was a key field although it is difficult to judge how much of the possible decline in use is due to over-stocking: both sites appear to have been cyclically cleared of scrub when old aerial photos of the loch are examined. Scrub clearance would also give the geese easier access to loch edge for bathing, provide more food and reduce cover for foxes. Scrub clearance is planned in parts of the RSPB reserve in 2011. A couple of fields on Mains of Duchrae have been ploughed up and put to fairly bare stubble and also covered with a mix of woodland brash and containing plastic bags which has reduced the amount of good goose pasture. An undersow would help, perhaps covered by a management plan under future goose support. Funding an autumn fertiliser treatment to key fields on Mains of Duchrae would also probably help as in winters 2009/10 and 2010/11 they have looked less green compared to better used fields.

Access by fishermen and their caravans and generators to fields by the loch at Mains of Duchrae also affects the use of these key fields by the geese on certain days but particularly at weekends or during the Easter holidays, and this could be addressed using appropriate measures.

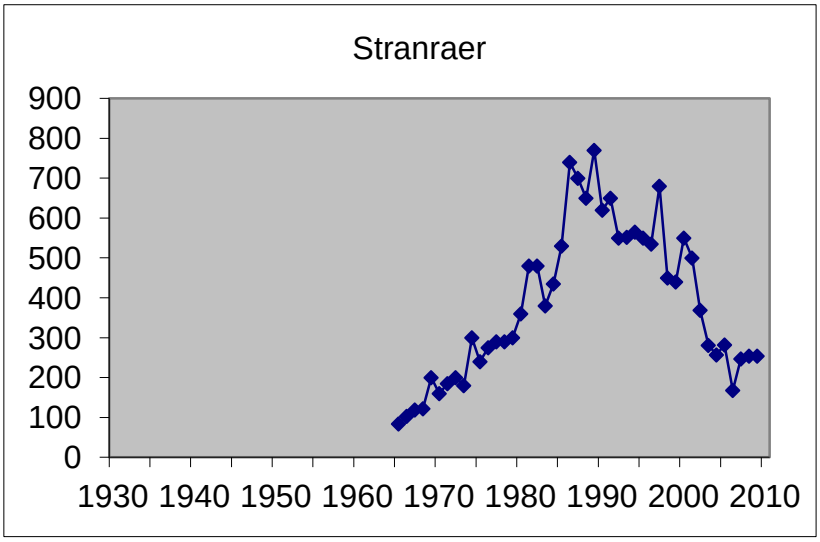
At Threave Mains recent development of the ruin is likely to lead to more disturbance here. If geese respond by spending more time at Blackpark or Wheatcroft, then the Wheatcroft area could be made more suitable by payment for bare stubbles to be undersown. This wetland area is well within their typical range and is rarely used but would probably be suitable for the geese if it had more reliable grass cover.

The White-fronts appear to feed relatively harmoniously alongside the increasing numbers of Canada Geese with which they often associate and the Greylag Geese that frequent the area. Over time, Canada Geese have increased their use of Mains of Duchrae and Cogarth while the White-fronts have increased their use of Threave. The Canada Geese appear to have a calming influence on the White-fronts making them less flighty and more tolerant of approach and may also direct the White-fronts to new foraging sites during periods of snow for example when non-traditional fields can be exploited. To be balanced against this though, the farmers in all the key areas do not distinguish between the goose species and blame them all for example for loss of forage or cereal crops and will scare any flocks with quads or tractors as opportunity affords and may be content to see fishermen cause this too.

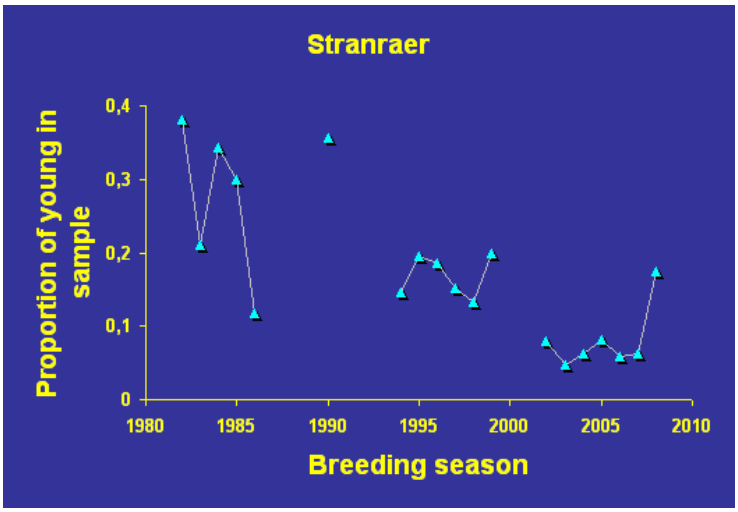
Stranraer

General status, population summary, graph of trends and age ratios
Most recent international census count: 318 (March 2011)
General trend: steep decline since late-1980s.

Regular counts at this site suggest an exponential increase since 1965/6 up until 1989 when numbers peaked at 770 birds, at the time one of the more important wintering sites away from Wexford and Islay, holding 3% of the global population and 5% of the UK total. A full review is given in Dickson (1996). The subsequent decline was earlier than those witnessed elsewhere in the range, and there has been a rapid decline to 200-250 in recent years. Emigration and/or low survival must have contributed to the annual falls in number, which cannot be explained alone by poor reproduction in this group of birds. These marked differences in the overall trajectory of the maximum numbers may suggest factors affecting birds using this resort are different to elsewhere.



Breeding success: Although not statistically significantly so, the production of young amongst the birds wintering at Stranraer has been higher than on Islay overall, with higher proportions of young in this flock especially in the early and mid 1980s. However, as witnessed elsewhere in the range, the production of young birds has fallen particularly over the period since 2000, with fewer than 10% first winter birds amongst the samples from the group (though the proportion has recently risen, in 2010 and 2011, subsequent to the graph below).



Any other relevant population information – inter-site movements, collars

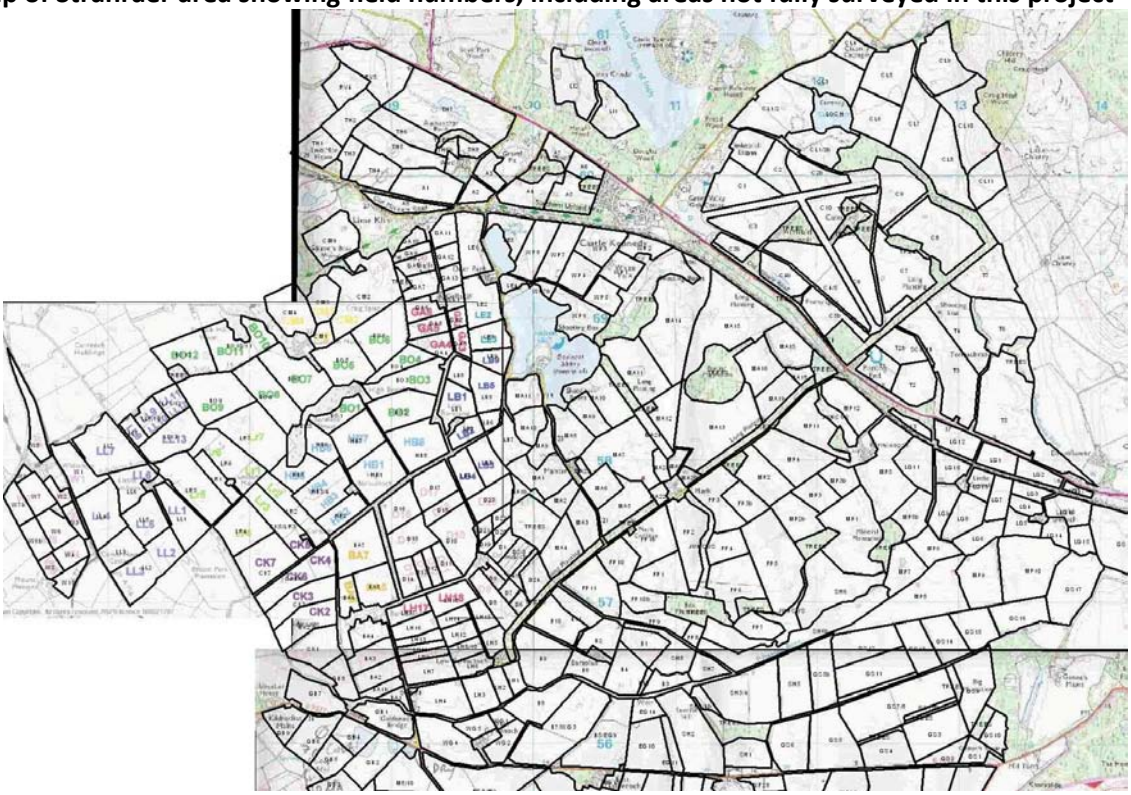
Seventeen collared individuals have been seen amongst the Stranraer flock. Six of these were ringed in Isunngua west Greenland in summer 1992, suggesting this flock was the winter quarters of several birds from this breeding area. Two moved between Kintyre and Stranraer in different winters. 4HC was marked on Islay in winter 1990, where it remained until it shifted to winter at Stranraer in 1995/6, 1997/8 and 1998/9. All other geese were marked in Wexford, and generally either changed wintering site to move to Stranraer or stayed for a single year and showed other changes in wintering site in subsequent years. Intriguingly, one Wexford bird, 6CP caught in 1991, wintered there every year until it moved to Loch Ken in 1992/3 remaining there in 1993/4 and 1994/5. In mid February 1996 it was amongst the Stranraer flock but was reported back at Loch Ken from 6th March that year where it remained until at least 16th April 1996. It continued to winter at Loch Ken until 1997/8. This is the only evidence for within winter exchange between these two resorts.

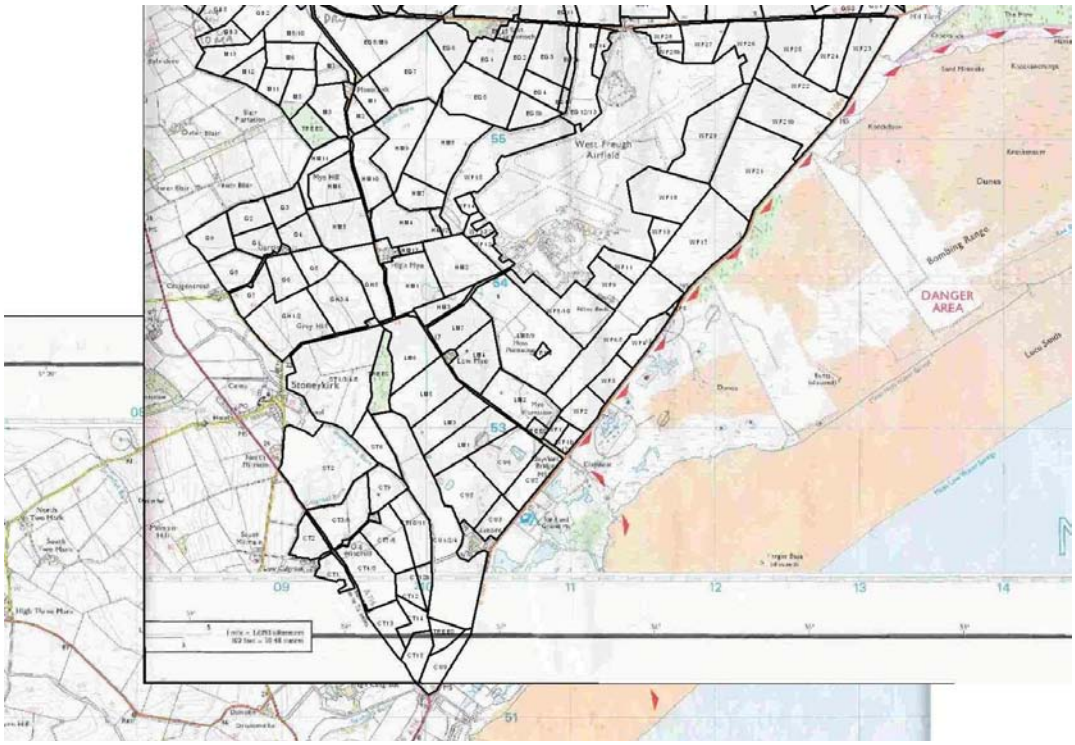
Long-term history

Berry (1939), writing of the Solway region, "comparatively small numbers annually visit a large freshmarsh in the east of the region, and a locality near the centre also is a regular haunt of this species. Elsewhere it is rare and uncommon. No change in status has been reported." There is no mention of this flock in A-W (1963), nor is the site mapped, but R&O (1979) gave annual peak counts of 84 to 300 birds from 1965/6 to 1978/9. On this basis, it is extremely difficult to judge the history and fortunes of this important flock. R&O (1979) speculated that the increase in the numbers since 1965/6 coincided with declines at the nearby Loch Ken resort, although they stressed that there was no proof of a direct connection. At that time, they thought hunting pressure on the White-fronts was light because wildfowlers concentrated on the more abundant Greylags in the area.

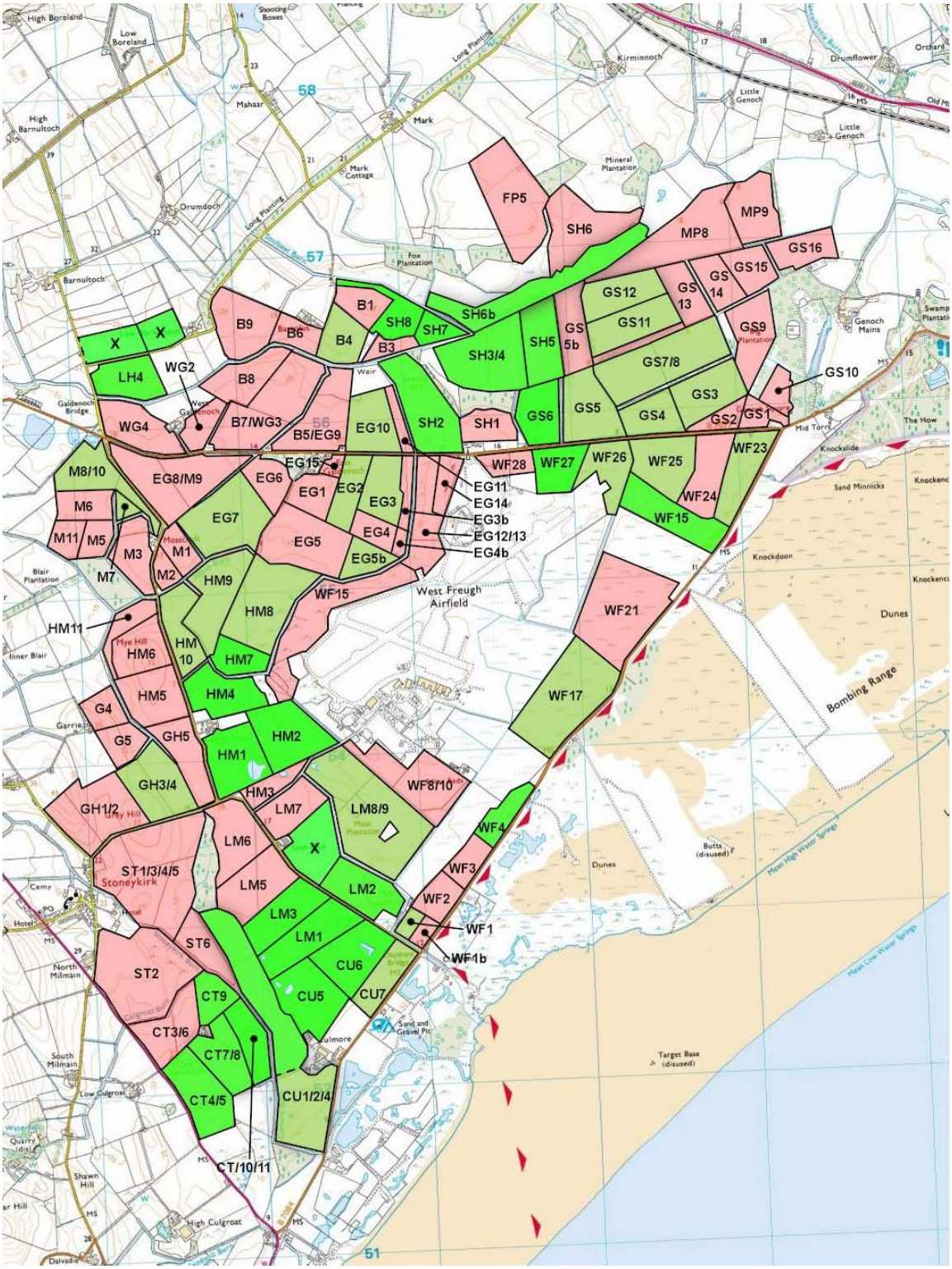
Stranraer - aerial image of southern area

Map of Stranraer area showing field numbers, including areas not fully surveyed in this project





Field/area numbers relate to details on associated spreadsheet.



Areas most frequently used by Greenland White-fronts (bright green = most often or most frequent; dull green = records exist) and fields surveyed (pink)

Site photographs (Stranraer)

Mains of Genoch area, February 2005

Mains of Genoch area, February 2005

Feeding and roosting locations used by geese

Stubble feeding in autumn, but an array of grassland types is used throughout the winter, especially improved grassland and reseeds. They show some preference for certain regularly used areas which may suffer less disturbance. The main feeding grounds of this flock consist of intensively managed agricultural lands on the Stair Estates (north of the Piltanton Burn), around Genoch Mains (NX137565), Culmore (NX103522), Mye, in the fields surrounding West Freugh airfield to Galdenoch Bridge, around Droughduil and at Cults Loch immediately south east of Lochinch, with areas around Stoneykirk used to a lesser extent and some reports from as far south as Ardwell.

Roosting sites: The principal roost for this flock has been White Loch (NX1160) which is also used by larger numbers of Greylag and Pink-footed Geese *Anser brachyrhynchus* using the surrounding farmland. In a detailed study (Thomson & Harding 1994), this site was regularly used in December, but in January, it was suspected that the birds were also roosting on fields behind Lochinch Castle as had been reported in other years. By February, much of the flock had switched to roosting on the sea at Clayshant Beach (NX1252), although some birds persisted in the Lochinch area, and this continued to be the case into March, although again, the possibility remains that some birds were still using the White and Black Lochs for overnight roosting. Checks were made of Soulseat Loch (NX101589), Magillie Loch (NX097595) and Loch Connel (NX017683) but these were not used at the times of visits, and it was concluded that although there were temporal shifts between the two, the geese in the area roosted either at Lochinch (Black & White Lochs) or Clayshant Beach (Thomson & Harding 1994) – mainly the latter site since the 1990s.

Characteristics of fields and other habitats and visit notes

A subset of habitat variables is presented below, derived from data collected in the field. All fields with available area values in hectares (derived from SIACS information) are included. The variables selected are those thought most likely to show differences between sites, and which had data available consistently for most fields. The summaries below therefore characterise certain aspects of the site. They are only approximations, though, due to data complexities.

Total area of fields analysed (ha)	1373
Average field area across site (ha)	12

Habitats	ha	%
Arable/Cereal	409.6	29.8
Ploughed	108.5	7.9
Mixed Arable/sown with grass	18.5	1.3
heathland/scrub	50.1	3.6
RIP (recently improved pasture)	208.4	15.2
OIP (old improved pasture)	519.95	37.9
PP or PG (permanent grass/pasture)	42.2	3.1
unknown (L?) or n/a	16.3	1.2

Feature	Area of fields showing feature (ha)	%
Not recorded or n/a	503.6	36.7
Short sward (<5cm)	356.1	25.9
Medium	350.6	25.5
Long sward (>15cm)	163.2	11.9
No *Juncus*	1060.8	77.3
Little *Juncus* (score 1)	83.2	6.1
Some *Juncus* (score 2)	120.9	8.8
Widespread *Juncus*	59	4.3
Not recorded or n/a	50	3.6
No standing water (score 1)	887.051	64.6
Some seasonal inundation (score 2)	399.102	29.1
Permanent water	8.53	0.6
Not recorded or n/a	50.06	3.6
Permanent and seasonal	28.8	2.1

Stranraer is the most agriculturally improved of the small sites, with more cultivated and ploughed land (including maize and kale), and little marsh, bog or moor. Grass swards are mostly short or medium (sometimes very heavily grazed), and most fields have little or no *Juncus* or no inundation or standing water for much of the year (with some drainage), though there can be local and seasonal inundation. Areas of semi-natural habitat are present nearby but most feeding takes place on improved land.

Habitat change and land use history

Some pastures have been ploughed up and put over to crops such as kale and in many cases maize so the amount of pasture available in the traditional areas has probably declined over time.

Agri-environment measures in place

Based on frequency, the following measures are in place over fields at this site:

Agri-environment measure	% frequency
Water Margins - reduce diffuse pollution	92.9
Open Grazed or Wet Grassland for Wildlife	4.8
Restructuring agricultural businesses	2.4
	100.0%

Due to the multiple occurrence of measures in single fields, differing field boundaries, and some discrepancies in grid references, it is not possible to analyse the information according to the area covered.

Disturbance issues

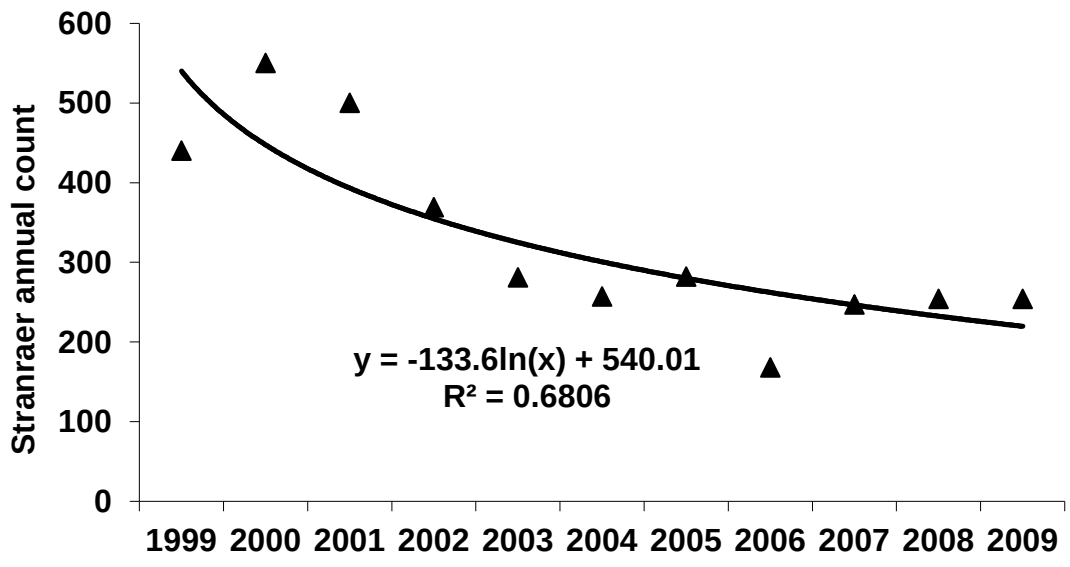
Aircraft disturbance: Sudden appearance of low-flying jets has been seen to cause flocks to take flight very briefly, other planes using West Freugh airfield have not caused such a response.

Hunting disturbance: Since 1991, much regular commercial shooting of Greylags (up to 18 guns per day in the area) has very severely affected the White-fronts and there have been problems with hunting in and around this site in the past. It may be that the considerable hunting pressure on the Pink-footed and Greylag Geese with which the White-fronted Geese associate has had an effect both on the distribution of the geese and their abundance.
Agricultural disturbance: Apparently more of a problem that at many resorts in Scotland. Thompson & Harding (1994) reported deliberate scaring at four different farms and concerted spring scaring to keep the Greenland White-fronted Geese off the spring flush at favoured feeding areas around Genoch. It is not clear to what extent such activity could have contributed to declines. Water margin creation and management may also prevent geese accessing water in places.

Conservation designations and site protection
The geese frequently roost on the intertidal flats of Torrs Warren-Luce Sands NCR SSSI and Loch of Inch and Torrs Warren SPA. Here, there may be disturbance from shell firing. Usually the flock uses inland lochs from October (especially the Black & White Lochs at Lochinch Castle) and the shore at Sandhead in spring. The core feeding area is West Freugh airfield between the A715 and Piltanton Burn, and to the south of Stoneykirk to the west and is not currently protected.

Assessment of possible adverse influences on goose numbers
Some local hunting of Pink-footed and Greylag Geese may cause potential disturbance, wounding and accidental killing of White-fronted Geese at this site, the latter having been reported on occasion.

Site vulnerability



Population trend since 1999

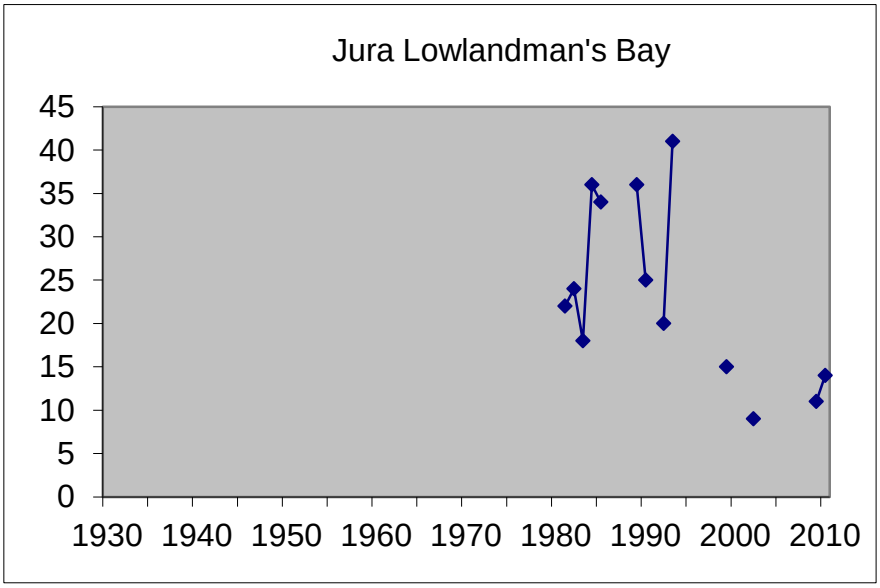
This site is considered to be at high risk of extinction due to rapid decline and should be considered a high priority for appropriate conservation action.

Recommendations for management
Agreements should be sought with farmers not to plant more land with maize or kale. Undersowing stubbles with grass would also be helpful to maintain feeding areas as part of the rotation. Creation of areas of standing water to compensate losses due to fencing off watercourses should also be considered.

Jura (Lowlandman's Bay)

General status, population summary, graph of trends and age ratios
Most recent international census count: ***13*** *(March 2011)*
General trend: Decline since late 1980s.

It seems that 20-40 Greenland White-fronted Geese have been here certainly since the 1980s. However, this flock needs more regular coverage to better understand numbers here.



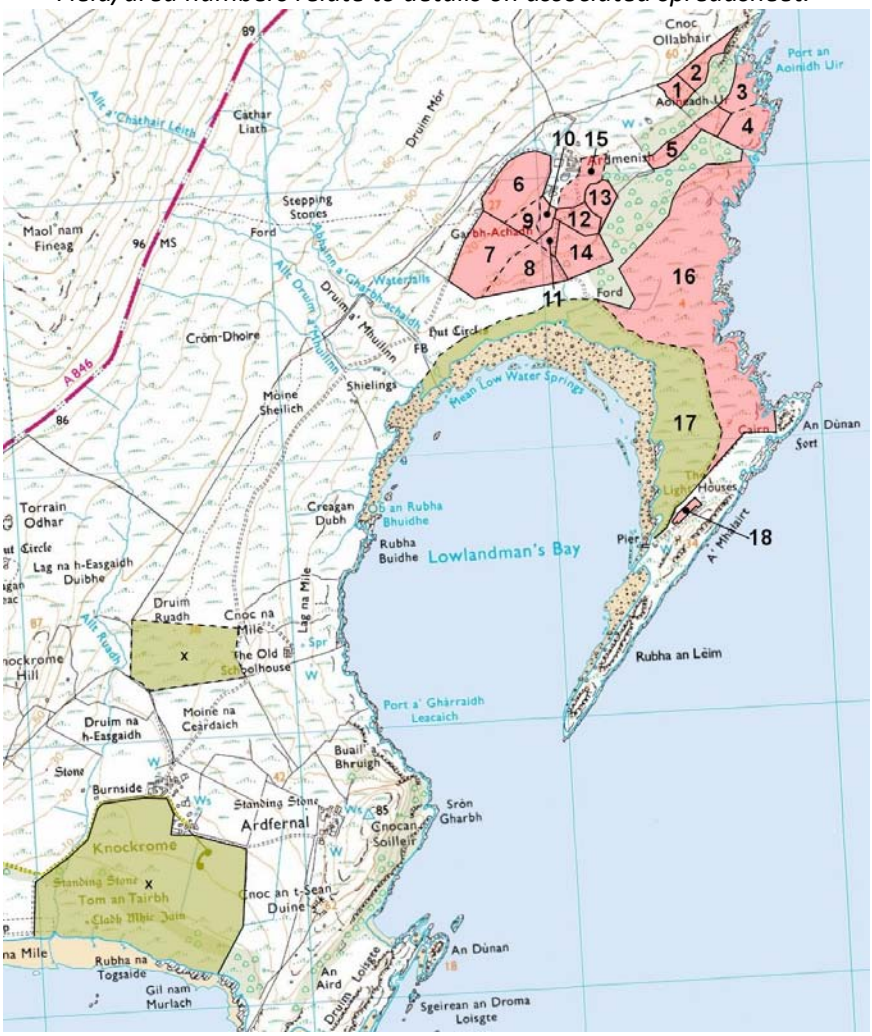
Breeding success: Assessment of breeding success has not been regular enough on Jura to provide a run of data from the island.

Any other relevant population information – inter-site movements, collars
There have been no reports of marked birds from this part of the island.

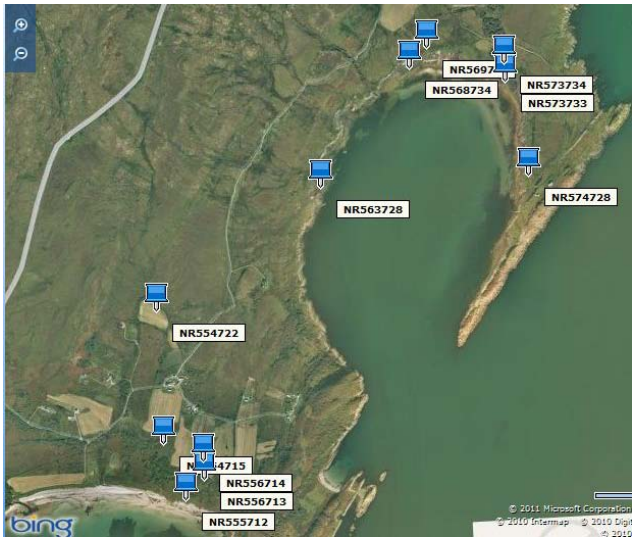
Long-term history
History: Berry (1939) mentions White-fronted Geese on Jura and A-W (1963) recorded the species as occurring annually, numbering 20-30 individuals. R&O (1979) considered this group as an "offshoot from the main haunt of Islay close by" but even then described the count coverage as sporadic. Despite the close proximity to Islay, it has remained difficult to obtain annual counts of this small flock, about which we know historically next to nothing. Recent counts have also been sporadic, and in some cases, is not always clear when a count from "Jura" is returned whether these numbers refer to this or the following group. As a result, the status of this flock is poorly known. Over the years, however, it seems more and more likely that this flock is not part of the Islay winter population, since this flock is more or less constantly present whenever their known feeding areas are visited. There seems little suggestion that individuals are commuting between the two islands, so we feel justified in considering this a discrete independent group, similar to other small island flocks and probably of long standing.

Map of Jura, Lowlandman's Bay surveyed area

Field/area numbers relate to details on associated spreadsheet.



Areas used by Greenland White-fronts (green) and fields surveyed (pink)



Areas slightly further south, around Knockrome and Ardfernal, also used by the geese (records shown above), were not surveyed in detail. They are mostly Recently Improved Pasture, usually with low rush cover, but with some patches of dense rush, and areas of bog/moorland and scrub.

Site photographs (Jura, Lowlandman's Bay)

Lowlandman's Bay, February 2009

Lowlandman's Bay, December 2010

Lowlandman's Bay, December 2010

Lowlandman's Bay, December 2010

Greenland White-fronts and Wigeon grazing on saltmarsh grassland at Ardmenish, Nov 2009 (Malcolm Ogilvie)

Greenland White-fronts, Canada and Greylag Geese in fields at Knockrome, March 2011 (Malcolm Ogilvie)

Feeding and roosting locations used by geese

Feeding sites and habitat: The main feeding site has been the rough *Juncus* pasture around Ardmenish House and the saltmarsh (merse) at the head of Lowlandman's Bay (NR5673 and NR5773). Uprooted *Eriophorum angustifolium* stalks indicated bog feeding in a small wet flush near to the roost site (see below, NR564769). Fields are also used at Knockchrome (NR5571), with records in the fields between Knockrome and Ardfernal (8 in March 2010 and 13 in March 2011). These fields are good goose habitat, being used by Greylags and, in March 2011, Canada Geese too. There were small numbers of both in the same field as the White-fronts in March 2011 - and more of both in a field just west of Knockrome (M.A. Ogilvie, pers. comm.).

Roosting sites: In 1981/2, this flock of geese roosted on the south end of Loch nam Breach (NR563762). At that time, there was evidently a regular midday roost flight north over Ardmenish Farm, with birds returning later in the afternoon, noted again in April 1983. Although these geese were noted flying in the direction of the loch, there was no evidence of feeding around the loch edge.

There are also unconfirmed reports of White-fronted Geese using the Small Isles in Craighouse Bay which may refer to this flock. Goose droppings on Eilean Mhor (NR6675) and Corr Eilean (NR6775) just across the Sound of Jura from this little flock are almost certainly to originate from the roosting Danna flock (see site 64), but may suggest some connectivity with that wintering group. However, with some of these records, there is the possibility of confusion with other goose species.

Characteristics of fields and other habitats and visit notes

A subset of habitat variables is presented below, derived from data collected in the field. All fields with available area values in hectares (derived from SIACS information) are included. The variables selected are those thought most likely to show differences between sites, and which had data available consistently for most fields. The summaries below therefore characterise certain aspects of the site. They are only approximations, though, due to data complexities.

Total area of fields analysed (ha)	202
Average field area across site (ha)	12

Habitats	ha	%
Bog/Moorland	28.9	14.3
BM/OIP	67.5	33.4
Recently Improved Pasture	27.9	13.8
Old Improved Pasture	78.2	38.7

Feature	Area of fields showing feature (ha)	%
Not recorded or n/a	28.9	14.3
Short sward (<5cm)	87.5	43.3
Long sward (>15cm)	86.1	42.6
Little *Juncus* (score 1)	23.6	11.7
Some *Juncus* (score 2)	4	2.0
Juncus widespread	145.97	72.3
Not recorded or n/a	28.9	14.3
No standing water (score 1)	147	72.8
Some seasonal inundation (score 2)	55.5	27.5

Lowlandman's Bay is a complex area with a small number of old improved fields with short swards and variable *Juncus* cover mixed with large areas of bog, moor and fen. There is also some short-cropped grassland subject to saline influence on the edge of the bay, within the *Juncus* and moorland grassland. The area around Knockchrome was not classified in this study, and this remains an outstanding task.

Habitat change and land use history
None known to affect the geese.

Agri-environment measures in place
There appear to be no agri-environment measures operative at this site.

Disturbance issues
Aircraft disturbance: Not known.
Hunting disturbance: Not known, but not thought a problem.
Agricultural disturbance: Not known, but not thought significant.

Conservation designations and site protection
None.

Assessment of possible adverse influences on goose numbers
Not known.

Site vulnerability
There are insufficient data to assess extinction risk, but clearly numbers here are very low and management action, where appropriate, should be considered as a medium priority.

Recommendations for management
The only management that could be recommended here is to expand suitable goose feeding areas through cutting of *Juncus*. This could only operate at a relatively small scale though. The use of the Knockrome and Ardfernal areas by the geese may offer a wider range of feeding habitat and reduce the need for management intervention around the bay.

B. Sites with stable, fluctuating or very recently declining numbers over the last 26 years

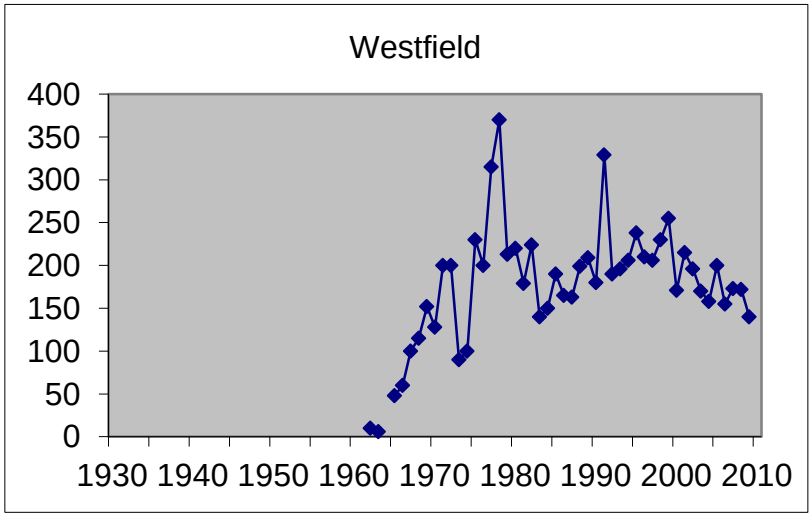
Caithness (Westfield, Broubster)

General status, population summary, graph of trends and age ratios
Most recent international census count: ***135*** *(March 2011)*
General trend: roughly stable since the late 1970s, then a slight decrease in the last ten years.

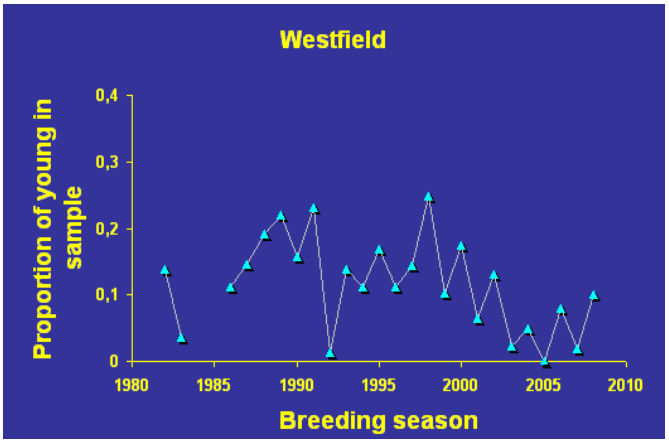
Numbers have shown a gradual increase to peak in the late 1990s, with evidence of a very recent decline. The flock has numbered 100-200 since the 1970s. It may be that the flock became more and more evident from the 1960s to the 1990s as the geese spent less and less time on the boglands and flows further west in Caithness and particularly as observation effort increased; certainly it seems highly likely that this group absorbed those geese using the Loch Meadie area. Unusually high peak counts in the late 1970s and 1991 probably involve either staging birds from elsewhere, or brief amalgamation with the other main Caithness flock. Through much of the 1970s and early 1980s the flock roosting in the Loch Meadie area on the peatlands, regularly flighted to, and from, the Loch Heilen area, i.e. a 26km NE-SW flightline, (see R&O 1979). At times the flock used Loch Toftingall and also Loch Scarmclate and fed in both these areas, both of which are close to the above Heilen/Meadie flightline.

During the 1990s flighting to roost by the Broubster Leans flock, into the peatlands SW of Broubster Leans was discovered: a flightline also NE-SW, i.e. parallel to, and c11km NW of, the Loch Meadie/Loch Heilen flightline. Both of these peatland roosts, it should be noted, were used only for a month or so after arrival and before the peatlands began to freeze up, and again during the month or so before departure, presumably taking advantage of the *Eriophorum* growth.

This group has always been the most discrete sub group in Caithness, feeding on a well defined area of agricultural land south-west of Thurso. The cohesiveness of the flock has confirmed over many years by the consistency of numbers and the appearance of marked individuals, although in addition to regular birds, some marked geese have appeared for short periods on migration.



Breeding success: Good age ratio data over many years shows variable breeding success, but a there has been a decline in productivity since the late 1990s (see below).



Any other relevant population information – inter-site movements, collars

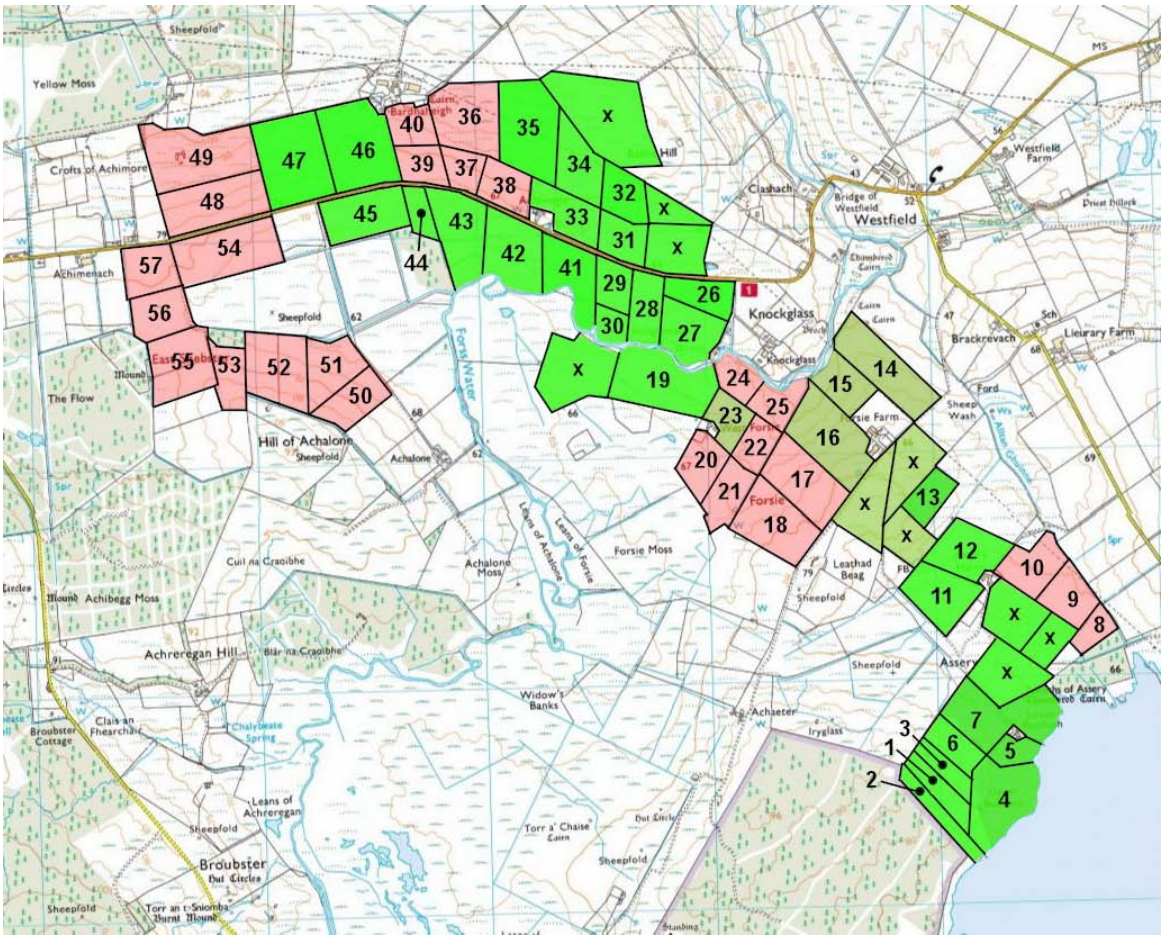
Nine different individuals ringed in Eqalungmiut Nunaat on the breeding grounds have been recorded in winter at the resorts used by this flock. Three birds ringed in Isunngua on the breeding grounds in 1992 have wintered amongst this group, as has another bird ringed there in 1997. Given the very large numbers of birds ringed at Wexford, it is perhaps surprising that only three Wexford ringed geese have been reported here. These were F8X which was a Wexford regular seen at Dale, Harpsdale in October 1997, clearly off course, as it turned up later in October at Wexford, where it remained the rest of that winter. F9H wintered at Wexford 1994/5-1995/6, briefly staged on Islay in October 1996 before continuing to Wexford that season, where it wintered every year until 2002/3. It was amongst the Westfield flock in November 2003 but was not seen subsequently. Finally, 2RT did apparently shift from Wexford to winter in Caithness. It was caught at Wexford in 1985/6 and wintered there in 1986/7 (last seen March 1987) but was seen at Oust on 5th April 1987. t was seen at Loch of Mey and Oust in winter 1987/8, Loch Heilen and Loch of Mey in 1988/9 and at Loch of Mey, Loch Scarmclate and Charleston in winter 1989/90, the last year it was seen. This bird is the only one to be seen at Scarmclate, but given that it also shifted between the Mey/Heilen and Westfield resorts, this bird may have been unusual in its behaviour. Also, as 2RT was recorded both at Loch Heilen area and at Loch Scarmclate, it may be it represents the movements of the wintering flock now using Loch of Mey/Loch Heilen area, not the Broubster Leans flock.

Long-term history in Caithness

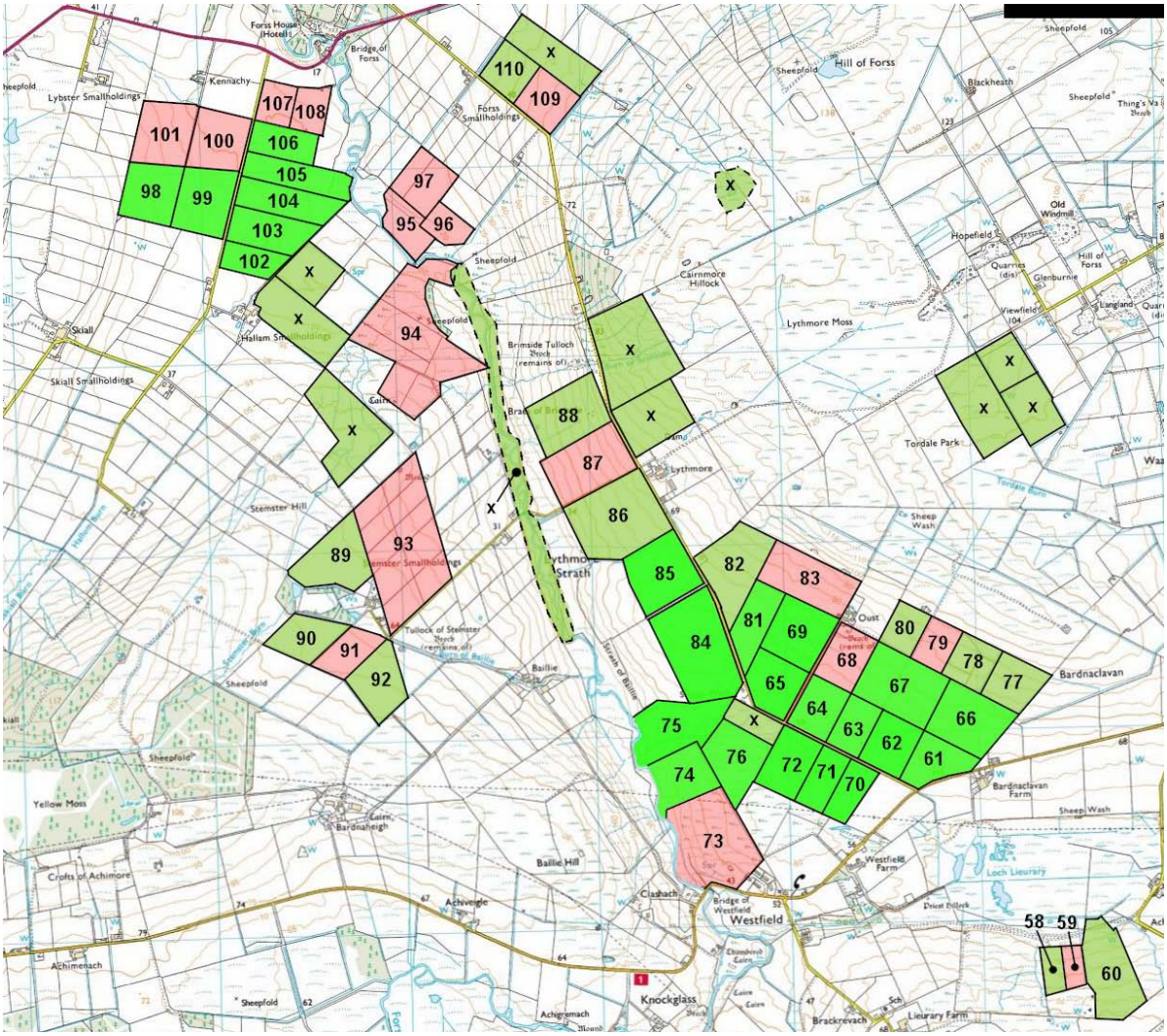
History: White-fronted Geese were "not uncommon" in Caithness at the end of the 1800s (Harvie-Brown & Buckley 1887), but little was known of their status before the early 1960s, by which time they were recognised as belonging to the Greenland race (A-W 1963). Intriguingly, Berry (1939) states "none of the observers in this area makes any mention of the white-fronted goose, nor was the writer able to hear of any wintering in Caithness in 1931-32". Nevertheless, some 500 were present throughout the 1970s, with a simultaneous count of 640 in 1978/79. Numbers have been falling ever since, with maxima of 464 in spring 1983 and 358 in February 1985 and there seems to have been a contraction of range, with abandonment of peatland areas important for feeding, desertion of the Loch of Winless and Loch Scarmclate areas which formally supported substantial numbers, although potentially only as alternative feeding areas to those used currently. Even accounting for the declines, the county totals remain of international importance and the overall declines since the late 1990s have been less dramatic than elsewhere in Scotland. A full account of the geese at the time of the mid 1980s is presented in Laybourne and Fox (1988). Extensive survey work carried out by Stan Laybourne over many years has identified the major core areas and feeding sites used by the geese, although in some cases the relationship between feeding flocks and their specific roost sites is not always clear. In more recent years, the contraction of range has made these relationships more obvious, and all observations seem to support the view that there are now only two major discrete flocks in the county. See other comments in 'General status', above.

Map of Caithness (Westfield) area surveyed

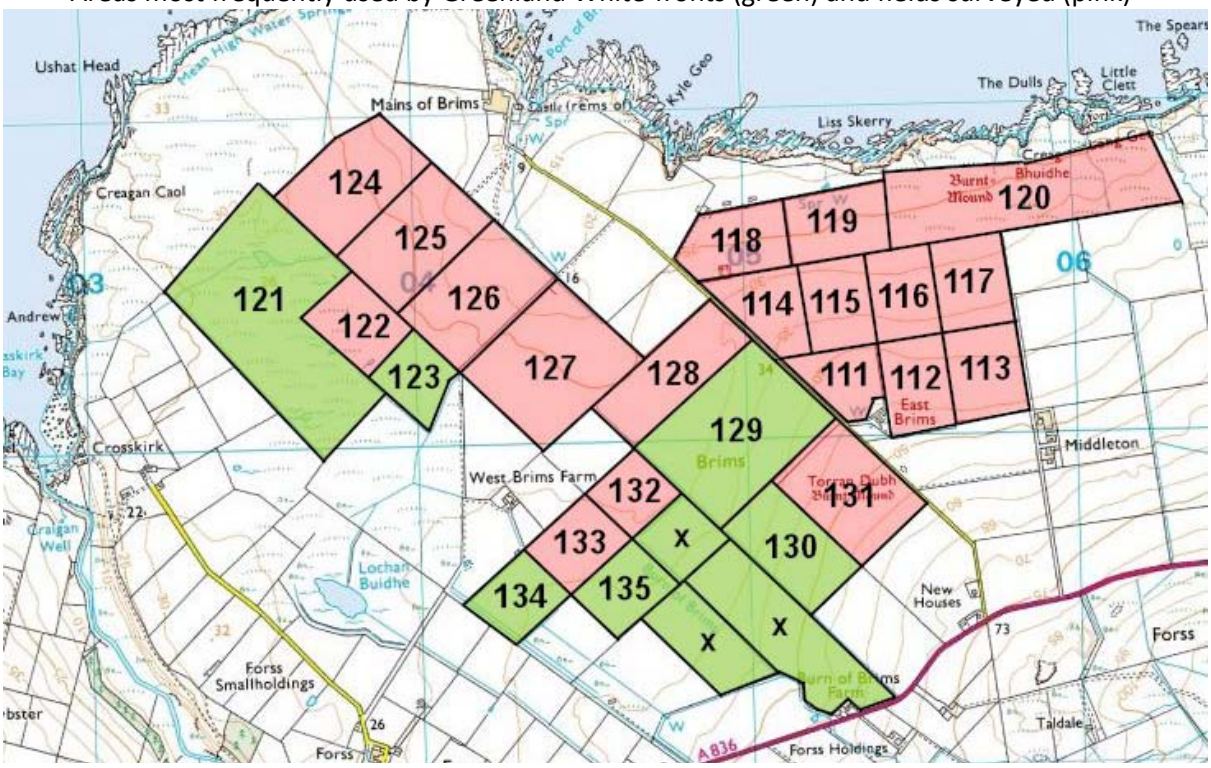
Field/area numbers relate to details on associated spreadsheet.



Areas most frequently used by Greenland White-fronts (green) and fields surveyed (pink)



Areas most frequently used by Greenland White-fronts (green) and fields surveyed (pink)



Site photographs (Caithness, Westfield)

Broubster Leans, March 2005

Broubster Leans, March 2005

Assery, March 2005

Assery, March 2005

Caithness (Westfield) area - Broubster Leans, Westfield and Loch Calder, Google Earth, 2005

Feeding and roosting locations used by geese

Feeding sites and habitat: The range of the flock covers an extensive area of intensive and more marginal agricultural land in the valley of the Forss Water as it runs from Loch Calder to the sea, south-west of Thurso. Over 100 fields may be used by the geese. Cereal fields and permanently reseeded grassland characterise much of the area used by the flock, which especially feed on stubble on arrival in autumn. Later, the geese switch to feeding on rough pasture and reseed, especially the rough pasture and bog of the valley floor in Forss Water, eventually grazing high quality reseed in the winter and ultimately in the spring prior to departure, when they may resort to new sown barley. The flock feeds at a number of sites such as Assery (ND0662), Lythmore (ND0565), Knockglass (ND0463), Stemster (ND0365), Bardnaheigh (ND0365) and Hallam (ND0367). During periods of prolonged freezing, birds may resort to areas closer to the sea, as at Balmore (ND0068), where 120 were present in snow-free fields in February 1979.

Roosting sites: **Broubster Leans**. This flock seems regular and consistent in its use of Broubster Leans (ND0360) as a night time roost and occasionally as a refuge from daytime disturbance. This site is a complex base-rich valley mire with a range of developing wetland plant communities, ranging from open water, swamp and fen to willow carr. Geese will remain and graze the wetland during the day, especially in the boggy areas and the peripheral agricultural land immediately surrounding the main wetland. The area is protected as an SSSI, RSPB reserve and the major part of the wetland is extremely wet and difficult to drain. For reasons not entirely understood, this flock will also roost on the northern end of **Loch Calder** (ND0661), a large lowland loch fringed by rough pasture and moorland. This is often during prolonged freezing conditions. It has been suggested that this site is used as a safe refuge for birds disturbed from Broubster Leans, although it is not clear what source of disturbance may be involved. In the past, the area seems to have been used more for feeding, before the core area of the feeding range switched further down the Forss Water valley. In earlier times, it seems likely that there was some exchange with the Loch Meadie group, because geese were reported flighting to and from the south-east from Loch Calder. They also roost at Loch Lieurary and it was discovered in the early 1990s that at both ends of the season, as mentioned above, roosting was also occurring on Lochs Saorach and Thormaid to the west at 110m altitude, two lochs now surrounded by Sitka plantation planted in the 1980s. Further investigating led to the discovery that the flock at times over flew these roosts, and a further 2km of plantation, on a bearing of c240 degrees magnetic, to roost in the peatland, although the exact pool systems have not yet been ascertained.

Characteristics of fields and other habitats and visit notes

A subset of habitat variables is presented below, derived from data collected in the field. All fields with available area values in hectares (derived from SIACS information) are included. The variables selected are those thought most likely to show differences between sites, and which had data available consistently for most fields. The summaries below therefore characterise certain aspects of the site. They are only approximations, though, due to data complexities.

Total area of fields analysed (ha)	1118
Average field area across site (ha)	8.4

Habitats	ha	%
Arable/cereal	115	10.3
Ploughed	47	4.2
Mixed arable/sown with grass	20	1.8
Recently Improved Pasture	23	2.1
Old Improved Pasture	913.3	81.7

Feature	Area of fields showing feature (ha)	%
Not recorded or n/a	157.5	14.1
Short sward (<5cm)	829.3	74.2
Short-medium	121.8	10.9
Medium	9.9	0.9
No *Juncus*	945	84.5
Little *Juncus* (score 1)	33.6	3.0
Some *Juncus* (score 2)	27.7	2.5
Juncus widespread	112.2	10.0
No standing water (score 1)	1071.6	95.8
Some seasonal inundation (score 2)	46.8	4.2

Much of the Westfield area consists of improved pasture and arable ground, with little bog, moor or marsh. Fields are mostly short, with no or very little *Juncus* and little standing water or inundation.

Habitat change and land use history

Some rough grazing has been agriculturally improved on the ridge slopes in the late 1980s, and field drainage has also created more extensive areas of permanently reseeded grassland which may have benefited the geese. Rough pasture at Bardnaheigh was improved in this way in spring 1984 and similar work was carried out south of Stester in February/April 1985 and continued work in 1985/86 may have been partly responsible for pressing geese further east towards Scrabster in that year.

Agri-environment measures in place

Based on frequency, the following measures are in place over fields at this site:

Agri-environment measure	% frequency
Mown Grassland for Wildlife	31.0
Open Grazed or Wet Grassland for Wildlife	13.8
Water Margins - Enhance biodiversity	13.8
Hedgerows - 3 years for biodiversity benefits	10.3
Creation and Management of Species Rich Grassland	6.9
Extended hedges	6.9
Maintenance of organic farming - arable	3.4
Management of Habitat Mosaics	3.4
Management of Species Rich Grassland	3.4
Management of Wetland	3.4
Wild Bird Seed Mix/Unharvested Crop	3.4
	100.0%

Due to the multiple occurrence of measures in single fields, differing field boundaries, and some discrepancies in grid references, it is not possible to analyse the information according to the area covered.

Disturbance issues

Aircraft disturbance: Low-flying RAF aircraft activity in the areas may affect the geese. *Hunting disturbance:* Shooting has taken place in the area in spring, due to the heavy passage of Greylag Geese (A35 ringed in Greenland in 1979 was shot here prior to protection), and in the 1980s, licenses for shooting to protect crops were issued but little-used. Shooting disturbance may be less common now, and it is not known if licences to shoot other grey geese in spring are still issued here. *Agricultural disturbance:* Many farmers feed ewes in the in-bye fields once a day. Increased access and some pasture drainage may have contributed to geese remaining away from traditional areas after drainage.

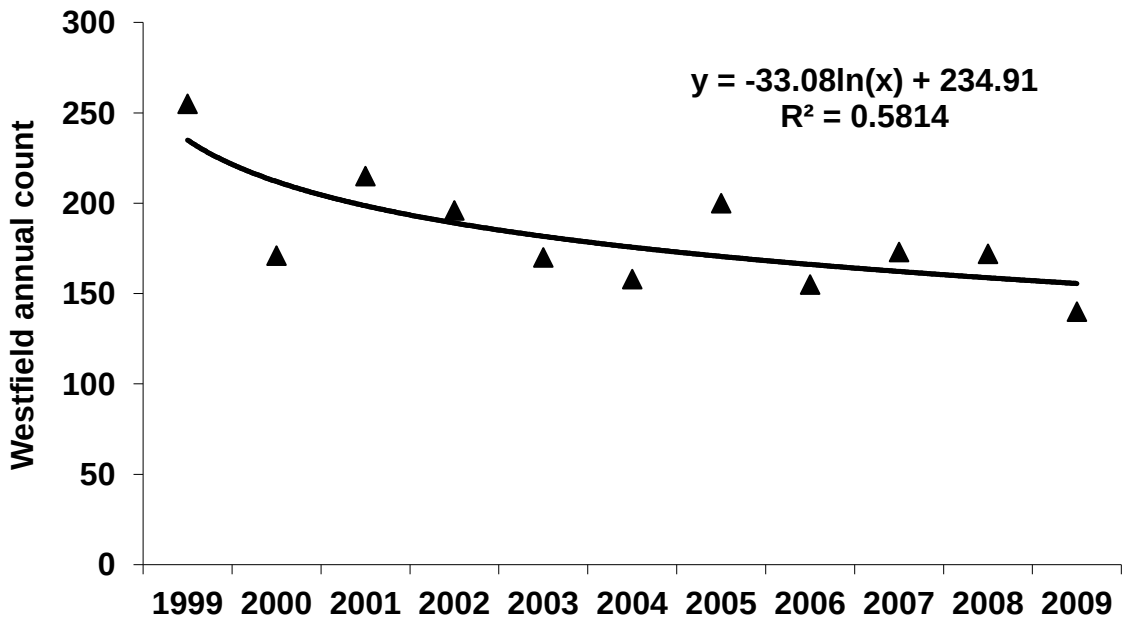
Conservation designations and site protection

The roost and feeding area at Broubster Leans is designated as an NCR SSSI and is a component of the Caithness Lochs SPA and Ramsar Site. It is also an RSPB reserve.

Assessment of possible adverse influences on goose numbers

Drainage, agricultural improvement and disturbance continue in the area, which may have some adverse effects on the geese and certainly modifies their distribution locally. Windfarm developments in the area may also become a threat as their numbers proliferate; the turbines at Baillie Hill may prove damaging, as they line on a major goose flight line; see Laybourne & Legg (1994); Harding & Laybourne (1995); Laybourne (1997).

Site vulnerability



Population trend since 1999

This site is considered to be at moderate risk of extinction due to slow decline and should be considered a medium priority for appropriate conservation action.

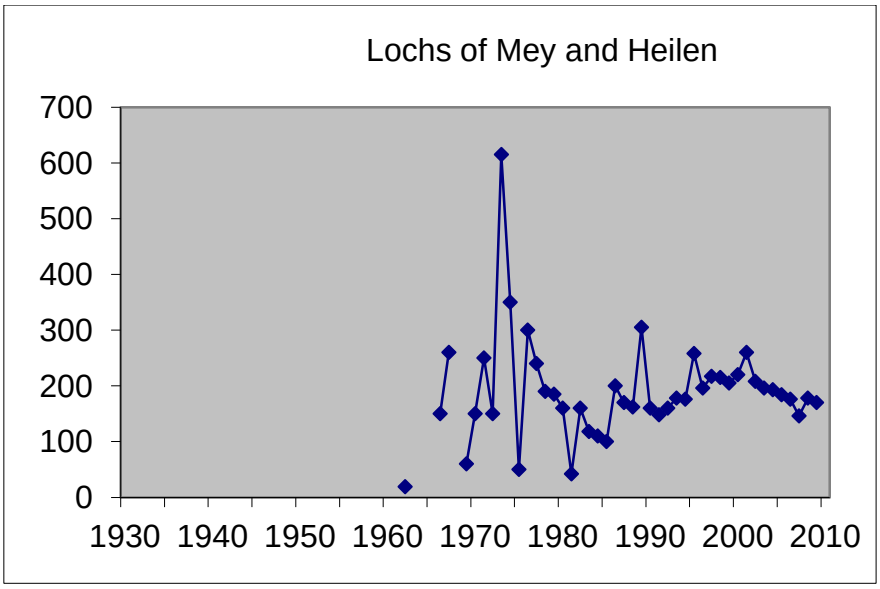
Recommendations for management

The birds feed on a variety of habitats and fields, but information on the most frequently used areas could be used for specific targeted management. Management aimed at benefiting Greenland White-fronts should take into account likely effects on other goose species present, in an attempt to avoid potential goose conflicts in general.

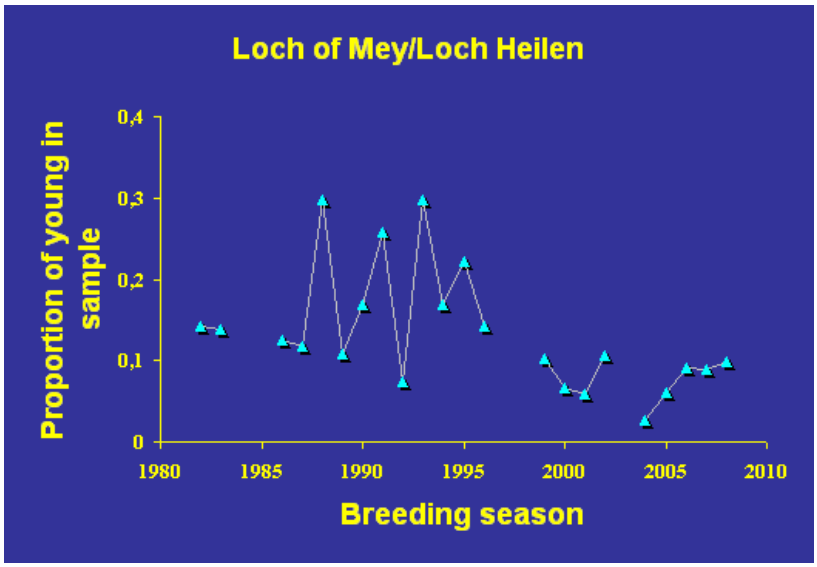
Caithness (Loch of Mey)

General status, population summary, graph of trends and age ratios
Most recent international census count: ***118*** *(April 2011)*
General trend: a slow increase from late 1980s to late 1990s, then gradual decline.

Since the mid-1980s, this flock has consistently numbered 100-250 birds, and the trend has mirrored the nearby Westfield flock (see above) - a very gradual increase to peak in this case in 2001, with signs of recent declines. This is now the only other and second important flock of the two which now regularly frequent northern Caithness. Re-sightings of marked birds have confirmed the use of several areas around the vicinity by this group of birds, which clearly seems to be distinct from the Westfield group, with which there has been interchange of only one (unusual) marked individual.



Breeding success: Good age ratio data over many years shows variable but reasonably good breeding success, but with much lower output since the late 1990s.



Any other relevant population information – inter-site movements, collars

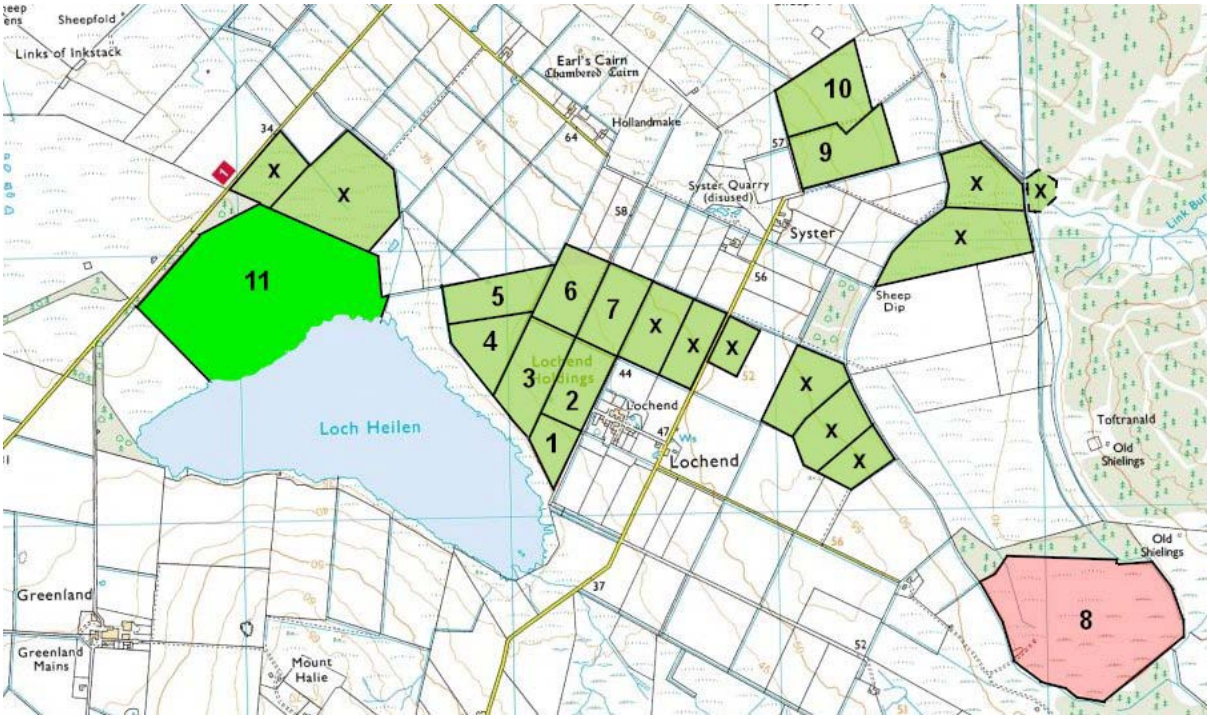
Two different individuals ringed in Eqalungmiut Nunaat on the breeding grounds have been seen in winter here, but interestingly, neither these birds nor those seen at Westfield shifted between the feeding areas used by the two flocks suggesting they are discrete. Four birds ringed in Isunngua on the breeding grounds in 1992 have wintered amongst this group. Only one Wexford ringed bird, 2RT, has been seen in this flock. That bird apparently shifted from Wexford to winter in Caithness. It was caught at Wexford in 1985/6 and wintered there in 1986/7 (last seen March 1987) but was seen at Oust in April 1987. It was present at Loch of Mey and Oust in winter 1987/8, Loch Heilen and Loch of Mey in 1988/9 and at Loch of Mey, Loch Scarmclate and Charleston in winter 1989/90, the last year it was seen. This bird is the only one to be seen at Scarmclate, but given that it also shifted between the Mey/Heilen and Westfield resorts, this bird may have been unusual in its behaviour. 14 collared birds have been recorded in this flock to date. 2RT remains the only Wexford marked bird, the rest being marked in Greenland except for a family of six marked at Hvanneyri in Iceland, and T8J in winter 2010/11 which was marked at Loch Swilly, Ireland. This dearth of Wexford marked birds is perhaps unsurprising, given the general high degree of site faithfulness of Greenland White-fronts, and also that Ireland and Caithness are towards the opposite edges of the wintering range. However, site changes are commoner between winters, perhaps as a result of mate changes, and Caithness winterers have wintered elsewhere before and after their spell here. The exception is C6J, marked in West Greenland in 1992, which was at Loch of Mey on 10 March 2008, then spent winter 2009/10 here, but over the years has wandered throughout the entire wintering range.

Long-term history

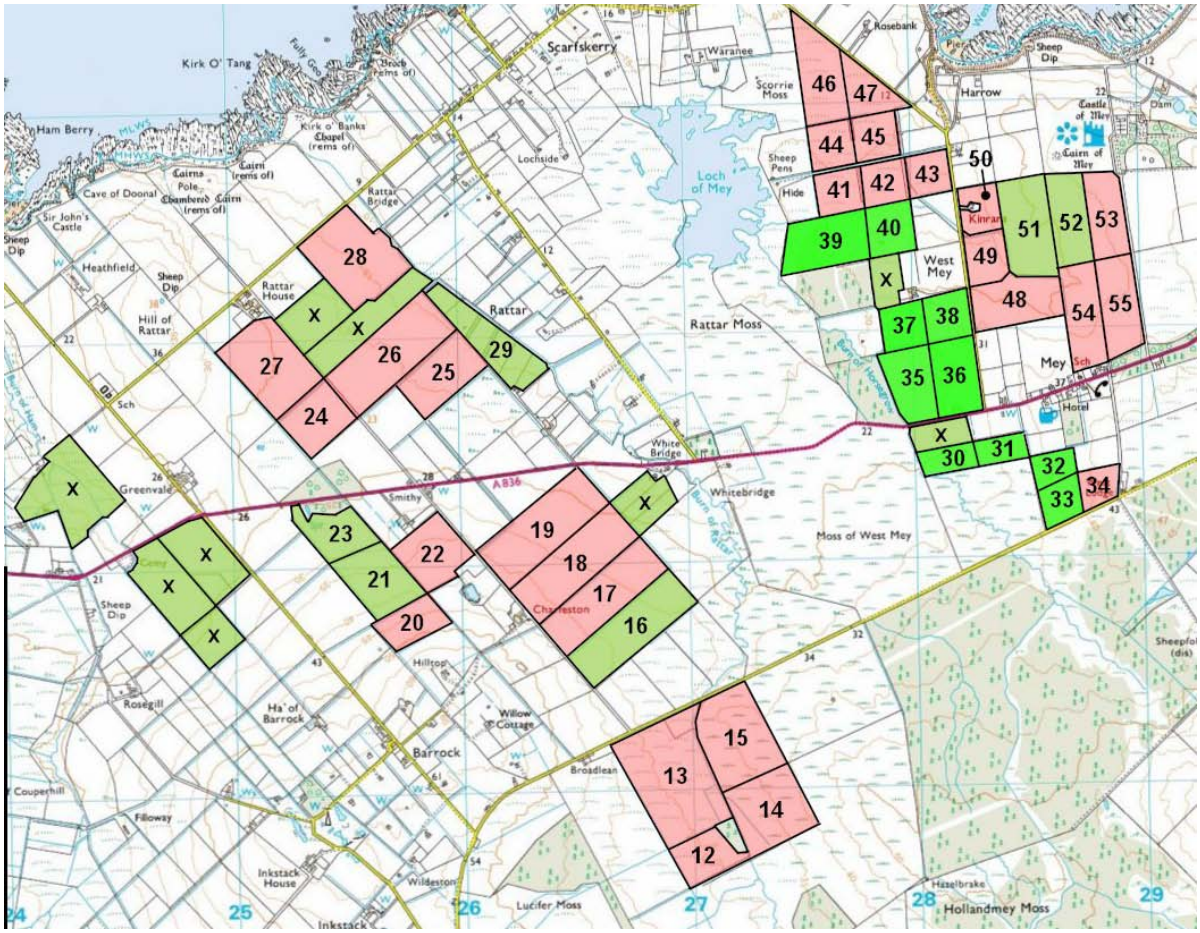
Irregular counts in the 1960s and 1970s showed highly variable numbers, perhaps because this flock was dispersed in earlier times in smaller units throughout, using rather more feeding areas than is currently the case. More recently in the early 1980s, some of these changes may relate to the absorption of birds that were formerly using the Loch Scarmclate and Loch of Winless areas. See also comments under the Westfield/Broubster site above.

Map of Caithness (Loch of Mey) surveyed area

Field/area numbers relate to details on associated spreadsheet.



Areas most frequently used by Greenland White-fronts (green) and fields surveyed (pink)



Areas most frequently used by Greenland White-fronts (green) and fields surveyed (pink)

Site photographs (Caithness, Loch of Mey)

Loch of Mey, March 2005

West Mey, March 2005

Loch Heilen, March 2005

Loch Heilen, March 2005

Loch of Mey area, Bing Maps, 2010 imagery?

Loch Heilen area, Google Earth, 2005 imagery

Feeding and roosting locations used by geese

This flock has a feeding range distributed throughout north-east Caithness, using a number of alternative feeding sites near and around Loch Heilen (ND2568) and adjacent areas, such as Schoolary (ND2968) and Syster (ND2769). In addition, birds use Loch of Mey (ND2773) and adjacent areas, such as Rattar (ND2673), Charleston (ND2671), and Wester, by St. John's Loch (ND2272). The geese again use stubble fields in the early winter from arrival, especially in the Lyth Valley on

Blackpark Farm (ND2864), moving to rough pastures during the majority of the winter. Loch of Mey, with its peripheral wetlands, shallow water areas and wet grassland seems to be attractive from January onwards, but the geese move to reseeded grassland in the spring. The geese may also move as far as Loch of Toftinghall (ND1952) in some winters.
Roosting sites: Loch Heilen was thought to be the regular roost when birds are feeding in this area, but this seems to have been abandoned since the mid 1990s, perhaps because of disturbance caused by heavy dawn shooting pressure on the large numbers of Greylag Geese which roosted on the loch and fed in nearby farmland (Laybourne 1997). Loch of Mey seems increasingly to be the most commonly used roost site, used exclusively when feeding in the fields adjacent, especially in spring, when they seem to favour the eastern side of the loch as the night time resting place. There is also a possible peatland roost used by this flock. Flightline sightings suggest that a pool system at ND308708, surrounded since the 1980s, though not closely, by plantation, might be used at times.

Characteristics of fields and other habitats and visit notes
A subset of habitat variables is presented below, derived from data collected in the field. All fields with available area values in hectares (derived from SIACS information) are included. The variables selected are those thought most likely to show differences between sites, and which had data available consistently for most fields. The summaries below therefore characterise certain aspects of the site. They are only approximations, though, due to data complexities.

Total area of fields analysed (ha)	5369
Average field area across site (ha)	9.9

Habitats	ha	%
Arable/Cereal	47.91	8.9
Ploughed	74.14	13.8
Mixed Arable/sown with grass	15.9	3.0
Bog or Moor or Marsh or moorland or fen	36.7	6.8
RIP (recently improved pasture)	5.1	1.0
OIP (old improved pasture)	238.35	44.5
PP or PG (permanent grass/pasture)	117.9	22.0

Feature	Area of fields showing feature (ha)	%
Not recorded or n/a	110.69	20.7
Short sward (<5cm)	365.7	68.2
Short medium	14.9	2.8
Medium	8.07	1.5
Long sward (>15cm)	36.66	6.8
No *Juncus*	253.8	47.4
Little *Juncus* (score 1)	8.07	1.5
Some *Juncus* (score 2)	147.04	27.4
Juncus widespread	100.06	18.7
Not recorded or n/a	27.06	5.0
No standing water (score 1)	499.4	93.2
Some seasonal inundation (score 2)	36.7	6.8

As at Westfield, this site shows a high proportion of arable and ploughed land, as well as improved grassland, most of which has a short sward and no *Juncus*. Most fields have little waterlogging. There is very little bog, moor or marsh within the areas surveyed.

Habitat change and land use history
Rough grazing at the north end of Loch Heilen has been drained and agriculturally improved in recent years and may have lost some of its attraction to the geese for feeding.

Agri-environment measures in place
Based on frequency, the following measures are in place over fields at this site:

Agri-environment measure	% frequency
Mown Grassland for Wildlife	38.5
Grass Margins and Beetlebanks - mixed arable	23.1
Water Margins - Enhance biodiversity	15.4
Hedgerows - 3 years for biodiversity benefits	7.7
Open Grazed or Wet Grassland for Wildlife	7.7
Wild Bird Seed Mix/Unharvested Crop	7.7
	100.0%

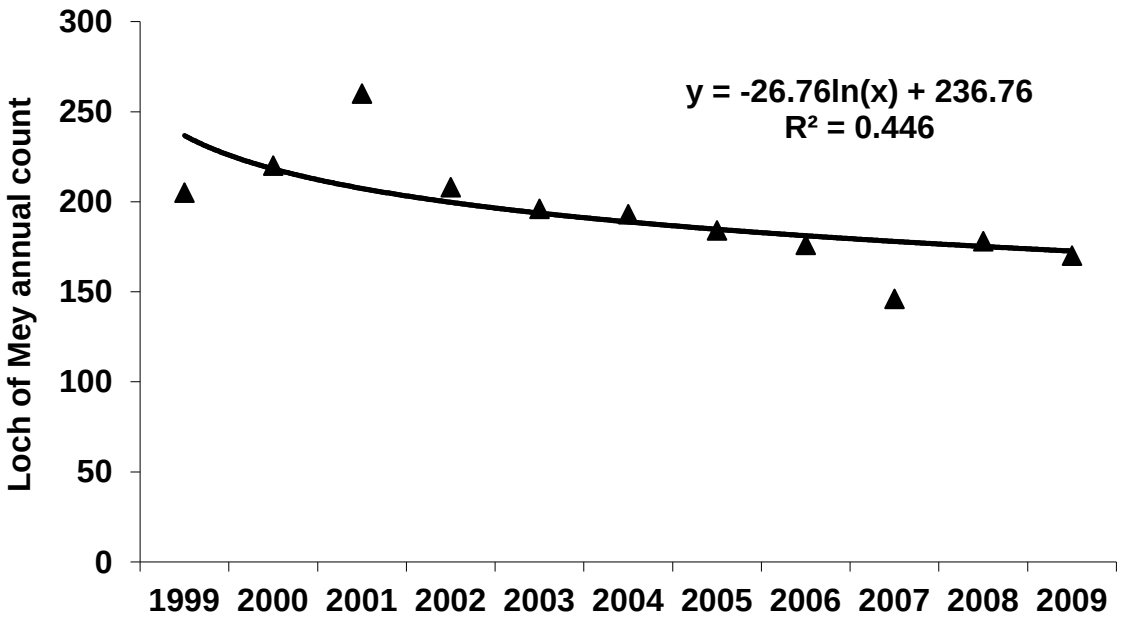
Due to the multiple occurrence of measures in single fields, differing field boundaries, and some discrepancies in grid references, it is not possible to analyse the information according to the area covered.

Disturbance issues
Aircraft disturbance: None known.
Hunting disturbance: Spring shooting licences for Greylag Geese have been issued here. For a period in the 1980s and 1990s, these geese attracted large numbers of wildfowlers which caused disturbance to the White-fronted Geese. With the declines in numbers of Greylags, this has become less of a problem in recent years. There has, though, been suspicion of some illegal hunting in recent years.
Agricultural disturbance: Where ewes are fed daily, there is inevitable disturbance, but with ample feeding in the vicinity, this is unlikely to be a major problem. Two local Loch of Mey farmers are not at all concerned with the presence of the geese but there have been several local incidents involving individual farmers causing deliberate disturbance to Greenland White-fronted Geese at this site.

Conservation designations and site protection
Lochs Heilen (now no longer used a roost), Mey and Watten are all SSSIs and are components of the Caithness Lochs SPA and Ramsar Site, along with Lochs Heilen and Mey, which are alternative roosts for what appears to be the same group of birds (based on individual markings).

Assessment of possible adverse influences on goose numbers
There is a high level of shooting in the Heilen area, especially of Greylags that have been shot under license during the spring. Such disruption during the period of rapid fat accumulation for White-fronts could be detrimental. Duck shooting on Loch of Mey may also cause disruption. Rough grazing in the northern area around Loch Heilen was drained in the early 1980s, making the area less attractive to geese, with White-fronts showing a preference for the older, non-reseeded areas. Some of the base-rich wet grassland of the area has also become drier through wind-blown sand accumulation, reducing the attractiveness of the immediate area around the roost at Loch Heilen. There may also be a conflict between the presence of the geese and their effects on the chances for windfarm developments on farmland – it can be perceived that the geese will prevent this, hence leading to a greater potential for the birds to be deliberately scared away.

Site vulnerability



Population trend since 1999

This site is considered to be at moderate risk of extinction due to steady decline and should be considered a medium priority for appropriate conservation action.

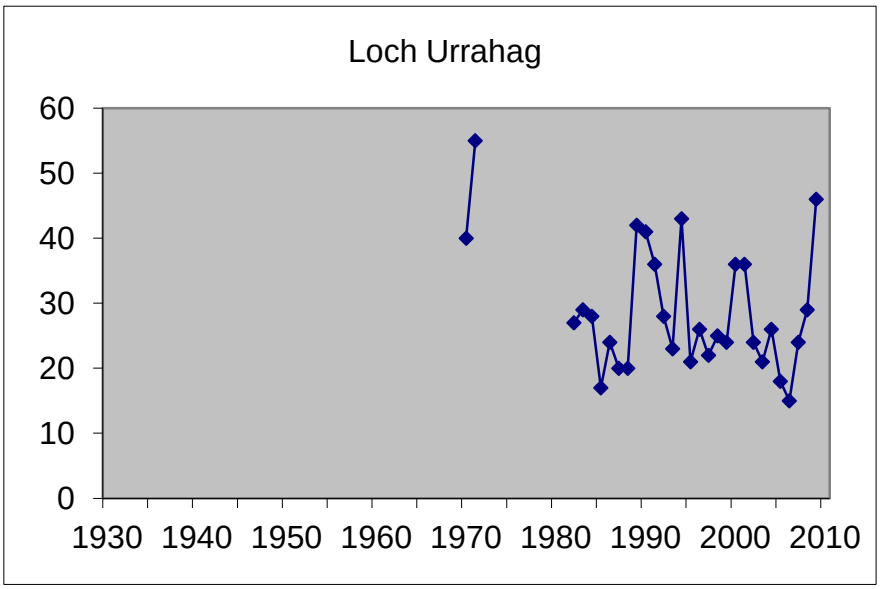
Recommendations for management

The birds feed on a variety of habitats and fields, but information on the most frequently used areas could be used for specific targeted management. Management aimed at benefiting Greenland White-fronts should take into account likely effects on other goose species present, in an attempt to avoid potential goose conflicts in general.

Lewis (Loch Urrahag)

General status, population summary, graph of trends and age ratios
Most recent international census count: ***19*** *(March 2011)*
General trend: Roughly stable and variable at low numbers.

This is an apparently new site, not recorded by either A-W (1963) or R&O (1979), although Berry (1939) did mention a flock on Lewis. The site has been regular since at least 1971, when 55 were present. There were 20-40 birds present throughout most of the 1980s and 1990s, with evidence of a slow, long-term decline during that time until a slight increase in the past few years.



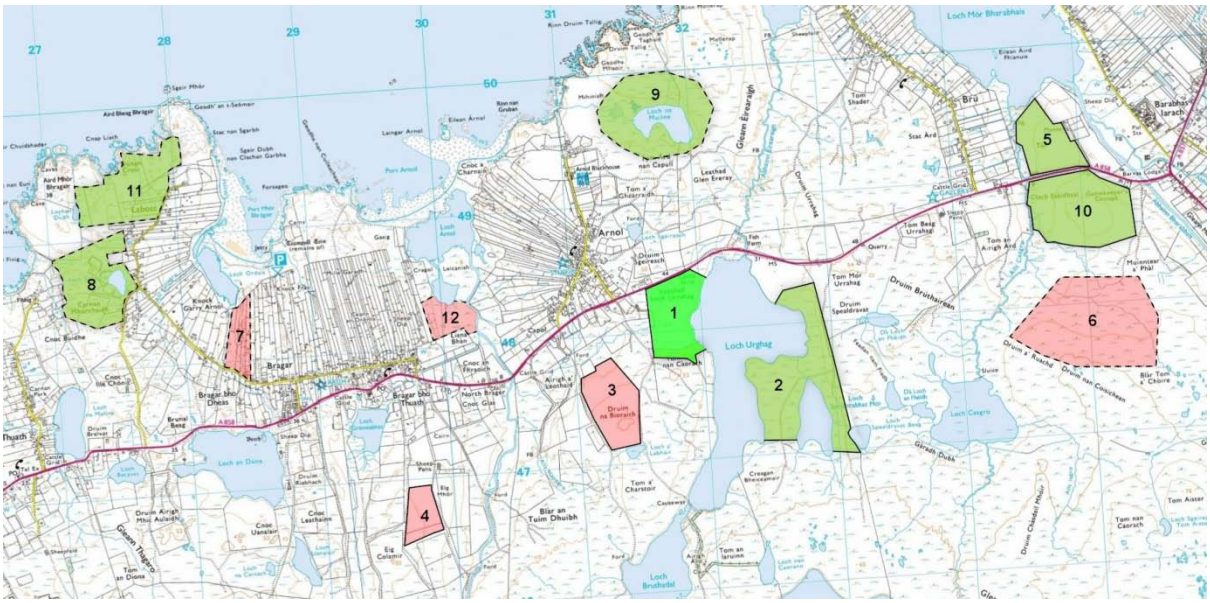
Breeding success: There are no consistent production data from this site.

Any other relevant population information – inter-site movements, collars
Linkages with other sites: None, no marked birds have ever been seen at this site.

Long-term history
Apparently a relatively new site.

Map of Lewis (Loch Urrahag) area surveyed

Field/area numbers relate to details on associated spreadsheet.



Areas most frequently used by Greenland White-fronts (green) and fields surveyed (pink)

Site photographs (Lewis, Loch Urrahag)

Loch Urrahag, Feb 2007

Loch Urrahag, Feb 2007

Loch Urrahag, Feb 2007

Loch Urrahag, Feb 2007

Favoured fields at Loch Urrahag, Bing Maps, 2010 imagery? No good Google Earth imagery.

Feeding and roosting locations used by geese

Rough sheep-grazed pasture with a little bogland is used, although the geese do resort to the elevated short maritime saltmarsh turf of local headlands (e.g. at Aird Mhor Bragair, Bragar (NB2749)), where they seek refuge from disturbance and probably roost. The flock mostly uses rough pasture with rushes and grazing land in the croftlands between Barvas and Shawbost, including Barvas Glebe (NB352495) and Bragar, and the wet rushy valley between the two townships at Shawbost (NB265475). However, they have most often been seen on reseeded grassland (e.g. NB317483) around Loch Urrahag (NB3450), to which they will frequently resort if disturbed. The geese use rolling fields and are frequently out of sight from vantage points. The birds are not always easily found. The lack of many known alternative feeding sites suggests that the variable numbers observed from year to year indicate there are other, as yet undiscovered, feeding sites.

Roosting sites: Not known, but almost certainly Loch Urrahag to which they frequently resort if disturbed by day. There are abundant lochs in the immediate vicinity.

Characteristics of fields and other habitats and visit notes

A subset of habitat variables is presented below, derived from data collected in the field. All fields with available area values in hectares (derived from SIACS information) are included. The variables selected are those thought most likely to show differences between sites, and which had data available consistently for most fields. The summaries below therefore characterise certain aspects of the site. They are only approximations, though, due to data complexities.

Total area of fields analysed (ha)	6,765
Average field area across site (ha)	966

Habitats	ha	%
Bog/Moorland	113.3	1.7
Old Improved Pasture	5314.3	78.6
Permanent Grassland	1337.8	19.8

Feature	Area of fields showing feature (ha)	%
Long sward (>15cm)	6765	100
Little *Juncus* (score 1)	113.2	1.7
Some *Juncus* (score 2)	6652.1	98.3
No standing water (score 1)	5315	78.6
Some seasonal inundation (score 2)	1337	19.8
Permanent water	113.2	1.7

Some large areas of open old and permanent grassland on marginal moorland were included in some of the areas surveyed, giving very large area figures. Most of these were old improved pasture with some *Juncus* and generally no or little standing water.

Habitat change and land use history

The geese seem to favour reseeded grassland, and associate with Greylag Geese in the area to exploit such managed grasslands.

Agri-environment measures in place

Based on frequency, the following measures are in place over fields at this site:

Agri-environment measure	% frequency
Cropped Machair - with FYM/seaweed	50
Management of Species Rich Grassland	50
	100.0%

Due to the multiple occurrence of measures in single fields, differing field boundaries, and some discrepancies in grid references, it is not possible to analyse the information according to the area covered.

Disturbance issues

Aircraft disturbance: None known.

Hunting disturbance: Formerly a considerable problem with poachers in the 1980s and later, but less of a problem now.

Agricultural disturbance: Not known, there is much background agricultural disturbance, but it seems unlikely that this constitutes a problem at current levels.

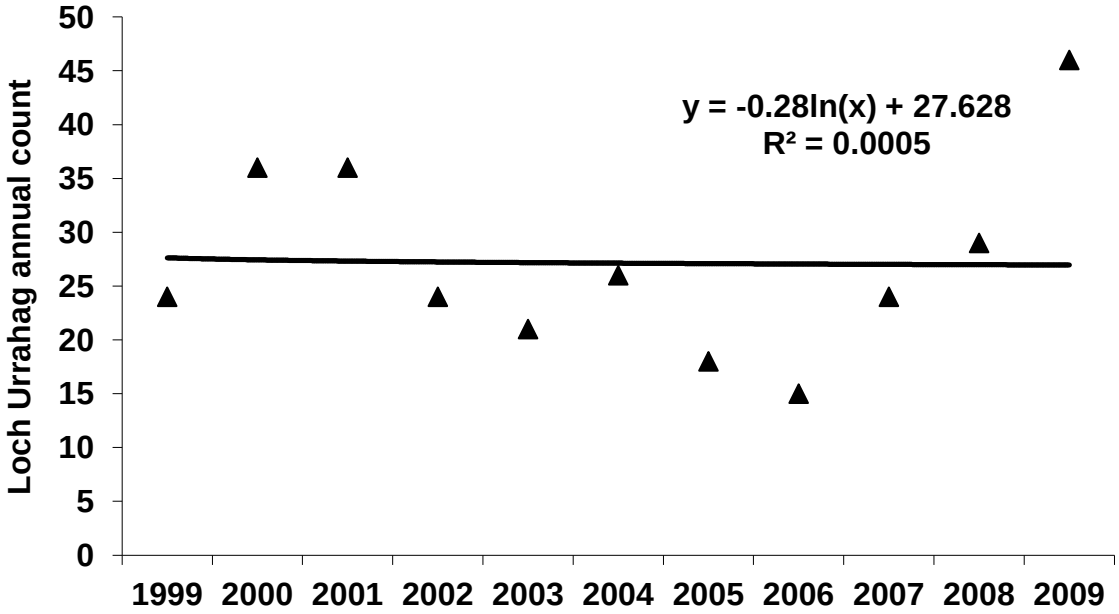
Conservation designations and site protection

None.

Assessment of possible adverse influences on goose numbers

In the early 1980s, poaching was a problem, and in 1982/3, the flock was heavily disturbed by local hunting. This gave considerable cause for concern at the time, with reports of geese being shot out of this flock as late as winter 1993/4, but seems to be less of a problem in recent years (see Cunningham *et al*. 1990). The prospect of a wind farm in the area, right next to favoured fields, has receded for the moment.

Site vulnerability



Population trend since 1999

Extinction appears unlikely in near future due to numerical stability, but numbers are low, so the site should be considered a medium priority for any appropriate conservation action.

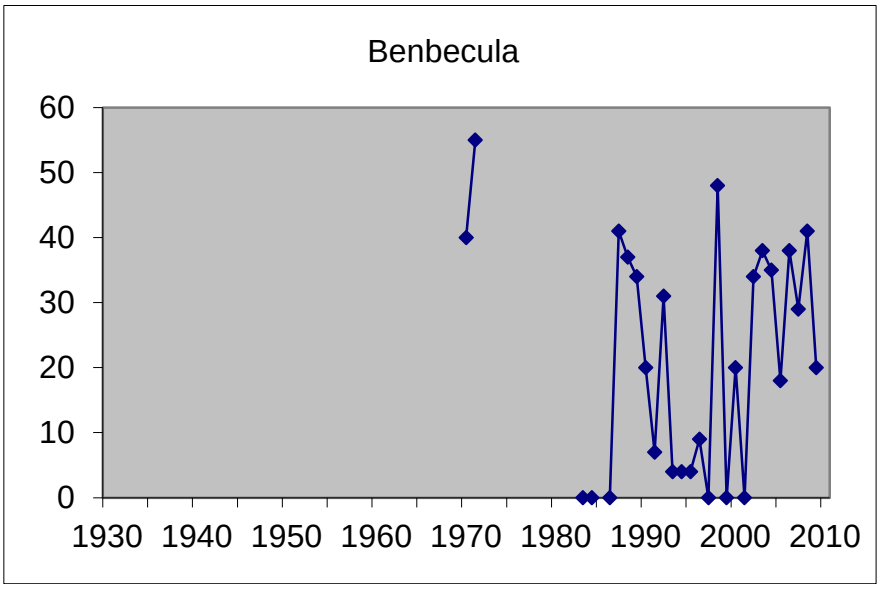
Recommendations for management

This flock is so small, and feeds within such a large, suitable landscape that no management recommendations can be made.

Benbecula (Nunton)

General status, population summary, graph of trends and age ratios
Most recent international census count: ***20*** *(March 2011)*
General trend: Variable at low numbers.

Thought rarely seen in the late 1990s, it seems that this flock has again become regular after a period when the geese were difficult to find and were thought to have ceased wintering regularly here. Although few were reported in the early 1980s, there does seem to have been a decline in numbers after the late 1980s. There have been very few records of these birds at all during the 1990s and early 2000s, but the erratic appearance of geese in this area could suggest geese feed in many out-of-view areas and appear only when seen on fields near to the roads and crofts. Despite being reasonably well watched by ornithologists, suggesting that if there were other flocks in the area they would be seen with far greater frequency, not all casual records are submitted.



Breeding success: There are no consistent production data from this site.

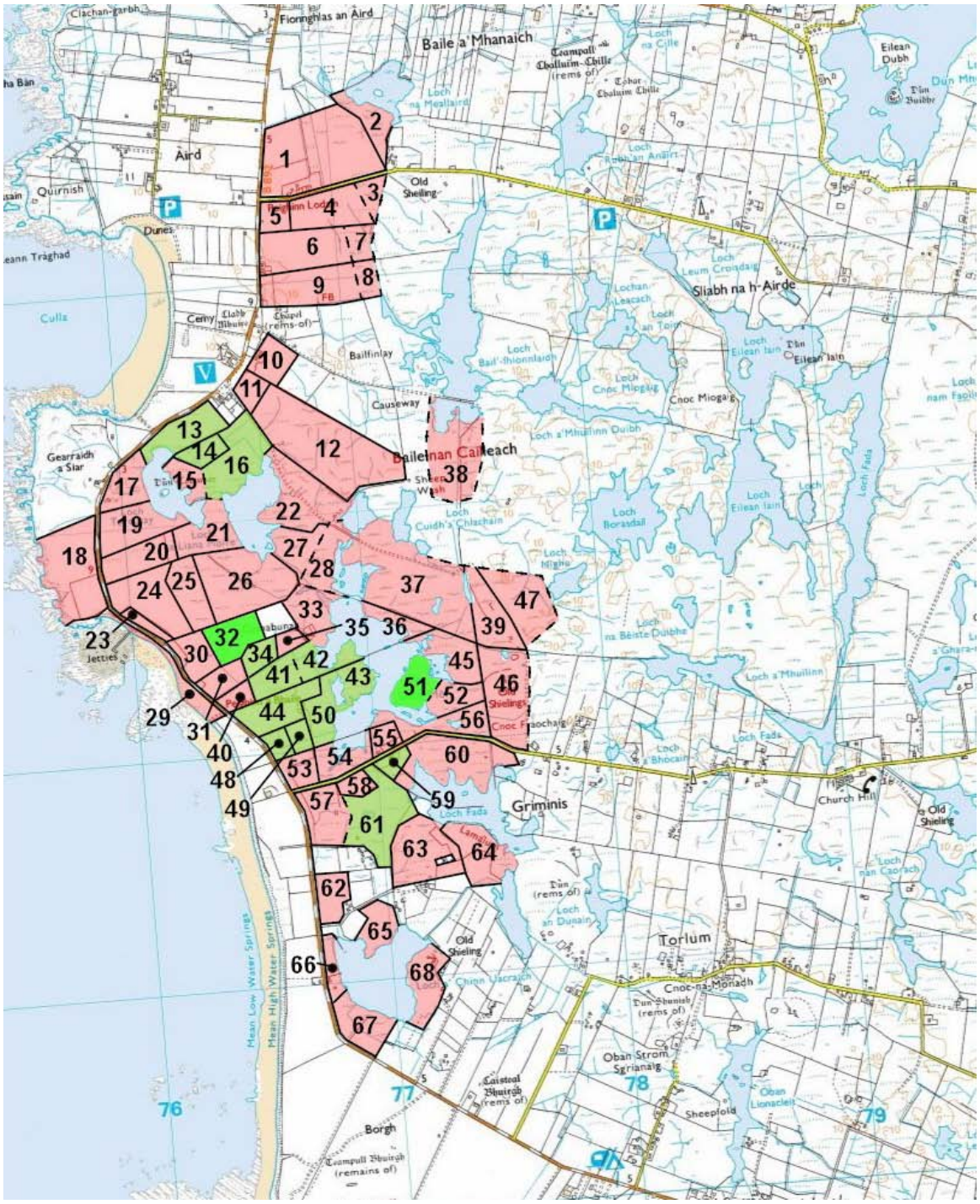
Any other relevant population information – inter-site movements, collars
Local views suggest that birds here may be linked with those at Loch Bee to the south.

Long-term history
Between 50 and 120 had been recorded on the island prior to the early 1960s (A-W 1963), but R&O (1979) reported 25-50 and declining. These may have been part of the North Uist flock which was thought to have ceased to occur as a regular flock, but which showed a brief recovery in the late 1980s with a flock appearing in winter 1998/99. However, apart from one large flock on North Uist in 1981 (probably weather related), most records from the island seem scattered and casual, implying the lack of any kind of regular site here in recent decades. North Uist now appears to be abandoned.

Map of Benbecula (Nunton) area surveyed

Field/area numbers relate to details on associated spreadsheet.

Shaded annotations indicate areas thought to be favoured by the geese.



Areas most frequently used by Greenland White-fronts (green) and fields surveyed (pink)

Site photographs (Benbecula, Nunton)

All photographs of areas around Loch Mor (top two October 2005, bottom two February 2010). Google Earth image from 2005, showing example of complex habitat mosaic around Loch Mor.

Feeding and roosting locations used by geese
Not clearly understood.

Characteristics of fields and other habitats and visit notes
A subset of habitat variables is presented below, derived from data collected in the field. All fields with available area values in hectares (derived from SIACS information) are included. The variables selected are those thought most likely to show differences between sites, and which had data available consistently for most fields. The summaries below therefore characterise certain aspects of the site. They are only approximations, though, due to data complexities.

Total area of fields analysed (ha)	2,982
Average field area across site (ha)	46

Habitats	ha	%
Bog/Moorland	2,497	83.7
Recently Improved Pasture	21	0.7
Old Improved Pasture	462	15.5
Permanent Grassland	2	0.1

Feature	Area of fields showing feature (ha)	%
Short sward (<5cm)	134	4.5
Long sward (>15cm)	2,848	95.5
Little *Juncus* (score 1)	153	5.1
Some *Juncus* (score 2)	2,829	94.9
No standing water (score 1)	482	16.2
Some seasonal inundation (score 2)	2,500	83.8

The data analysed show that the Benbecula 'small site' has much more bog and moorland habitat, and the general area is therefore ranker, with more *Juncus* and is more seasonally inundated than many of the other small sites. Shorter, grazed grass fields are intermingled with this semi-natural habitat here, amidst many lochs.

Habitat change and land use history
Little information: mainly machair and low-intensity farmland. All the land is in crofting tenure, some as individual crofts some as Common Grazings. Historically (late 19th C) the area was much wetter but drainage was improved around this time by the 'Benbecula Main Drain' which runs the length of the west side of the island through the lochs and marshes. (Reputedly historically after this drainage it was possible to take a hay crop off Loch Mor in dry years!). However there has been little change to the extent of marshes and lochs in the 20th C and the livestock has always been a mix of cattle and sheep, although sheep numbers may have been higher previously when subsidy was better in the 1980s. Most reseeding to improved grassland probably stems from the 1980s when the first EU agricultural support schemes came into the islands.

Agri-environment measures in place
Based on frequency, the following measures are in place over fields at this site:

Agri-environment measure	% frequency
Open Grazed or Wet Grassland for Wildlife	41.7
Cropped Machair - with FYM/seaweed	16.7
Management of Species Rich Grassland	12.5
Management of Wetland	8.3
Conservation Management for Small Units - Individual	4.2

Grazed Grassland for Corncrakes	4.2
Grazing Management of Cattle - Introduction	4.2
Management of Cover for Corncrakes	4.2
Mown Grassland for Corncrakes - 1 Aug	4.2
	100.0%

Due to the multiple occurrence of measures in single fields, differing field boundaries, and some discrepancies in grid references, it is not possible to analyse the information according to the area covered.

Disturbance issues

Apparently heavily shot over in 1993/94, the flock probably joined the North Uist or Kilaulay flocks for most of this (and maybe preceding) winter(s). Interchange between these flocks may explain the earlier variation in year to year numbers. Disturbance currently relates to normal crofting/agricultural activities mainly checking and feeding livestock, and there is still wildfowling and snipe shooting in the area (part of South Uist estate which although now in community ownership under Storas Uibhist continues its previous sporting activities). There is no evidence of any recent change in levels of shooting in the area.

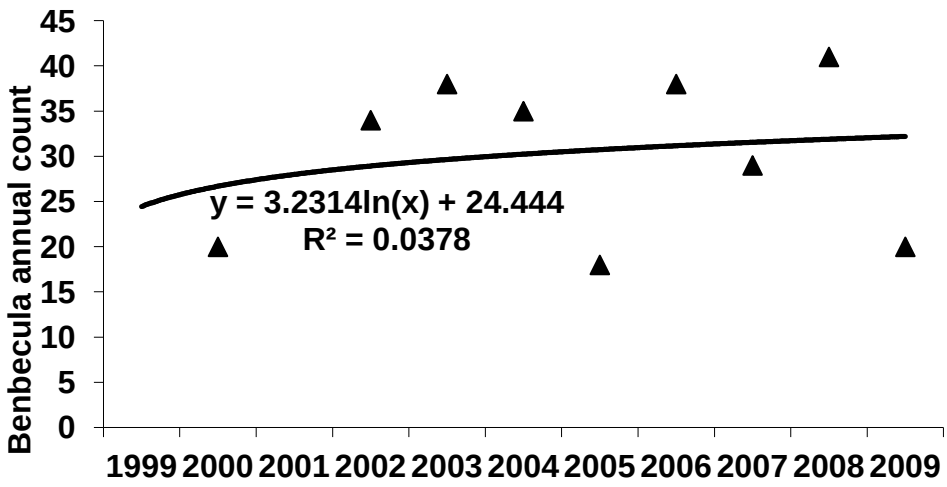
Conservation designations and site protection

Much of the site lies within one or other of two designated sites, Aird & Borve SPA (for Corncrakes) and West Benbecula Lochs SSSI (for freshwater, botanical and breeding bird interests) The marshes in this area probably hold some of the highest densities of breeding wildfowl and waders in Scotland, whilst the area around Loch Mor has recently been identified as major site for Irish Ladies Tresses *Spiranthes romanzoffiana*. Therefore there are number of other conservation interests to be balanced if considering any management for White-fronts in this area.

Assessment of possible adverse influences on goose numbers

Not known.

Site vulnerability



Population trend since 1999

Extinction appears unlikely in near future due to numerical stability, but numbers are low, so the site should be considered a medium priority for any appropriate conservation action.

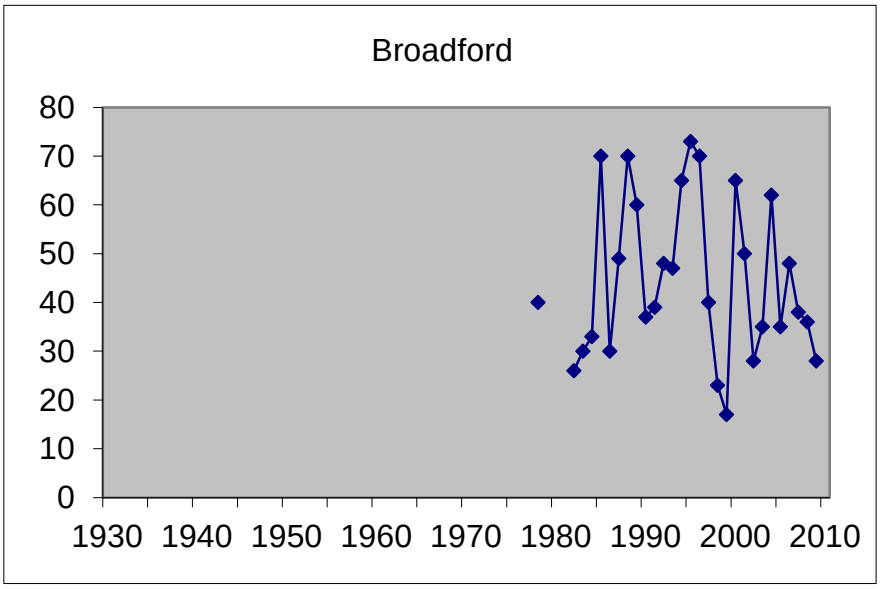
Recommendations for management

There is a great deal of bog and loch habitat with suitable feeding and roosting areas. Some of the fields used may benefit from rush cutting to open up more potential feeding areas.

Skye (Broadford)

General status, population summary, graph of trends and age ratios
Most recent international census count: ***17*** *(March 2011)*
General trend: fluctuating, roughly stable at low numbers.

Despite very large annual fluctuations in numbers, this flock shows no overall trend in numbers, numbering from 30-70 since counts first started. However, because the geese move between two offshore islands, they are often elusive for counters based on land. For this reason, we should be very cautious about interpreting trends in this flock which has been difficult to census and often absent from regular resorts. Locally, the flock is viewed as being in decline, and some peak numbers are attributed to occasional counts of passage birds (B. McMillan, pers. comm.). They clearly exploit a very wide range of feeding areas and seem to fragment into smaller groups more frequently than do many flocks. This group would merit further study to understand the relationship of the birds to the differing feeding areas they exploit.

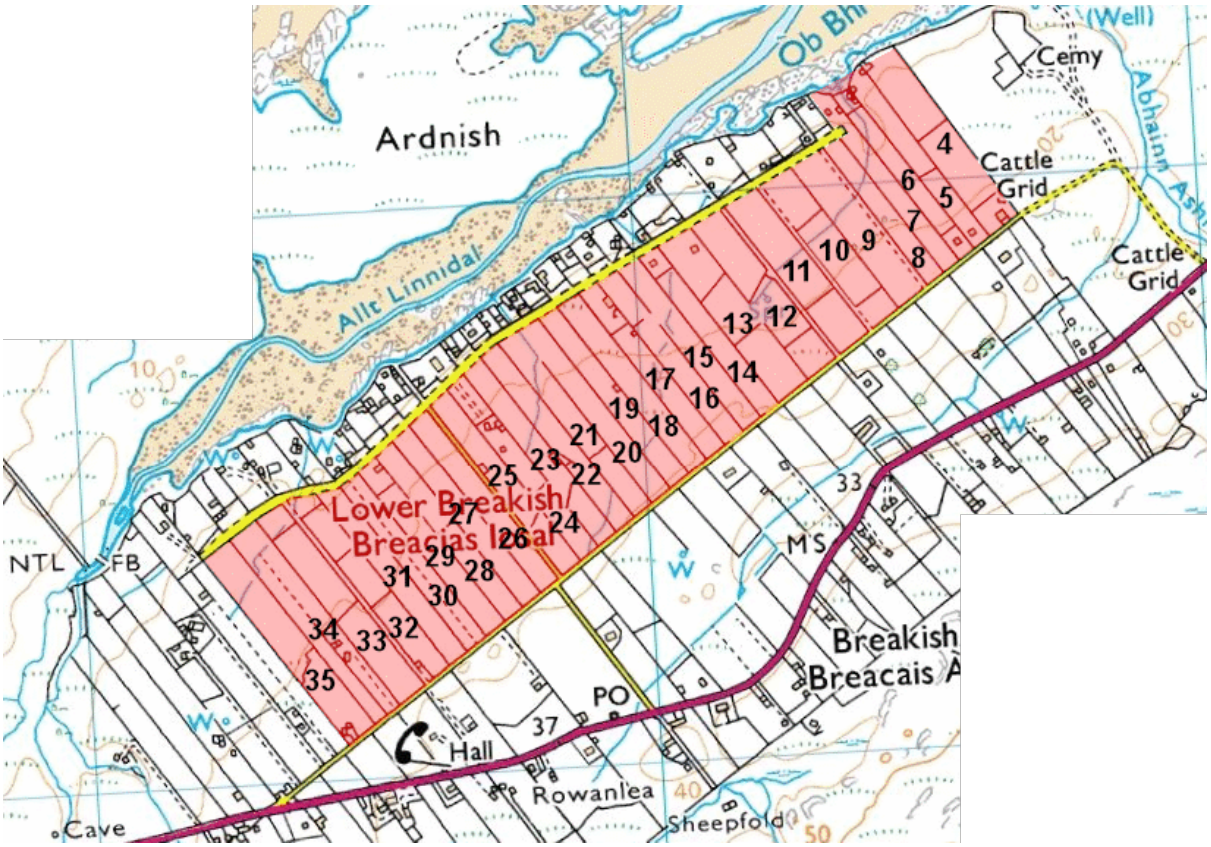


Breeding success: There are no consistent production data from this site.

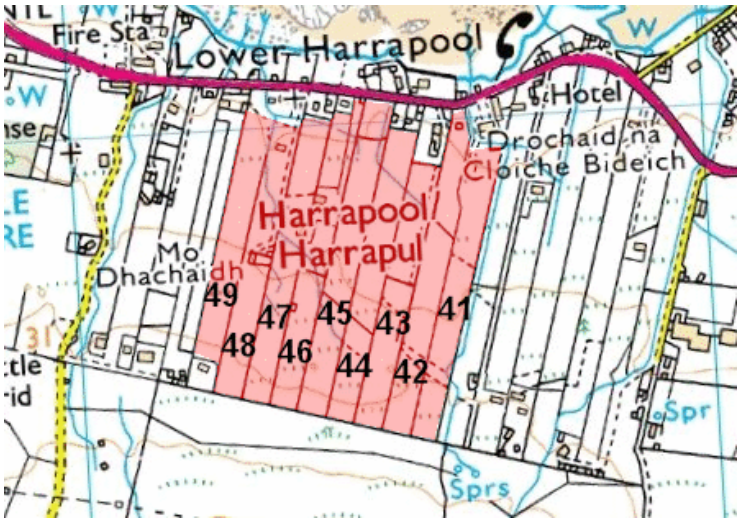
Any other relevant population information – inter-site movements, collars
None, as with the Skeabost site, there have been no reports of marked birds amongst the Skye flocks to aid in identifying linkage between sites.

Long-term history
There is no early documented evidence of this flock. It is not mentioned by A-W (1963), although 29 and 36 birds were recorded every winter from 1970 until 1981, with 60 present in the winter of 1978/79. The flock was thought to use Pabay mostly as a nocturnal roost, flighting to Scalpay and mainland Skye during the daytime. This unusual pattern of roosting on an offshore island and using another island for feeding undoubtedly caused this flock to be overlooked in the past and helps explain the erratic numbers and presence of the species at the better watched resorts used by the flock on the mainland.

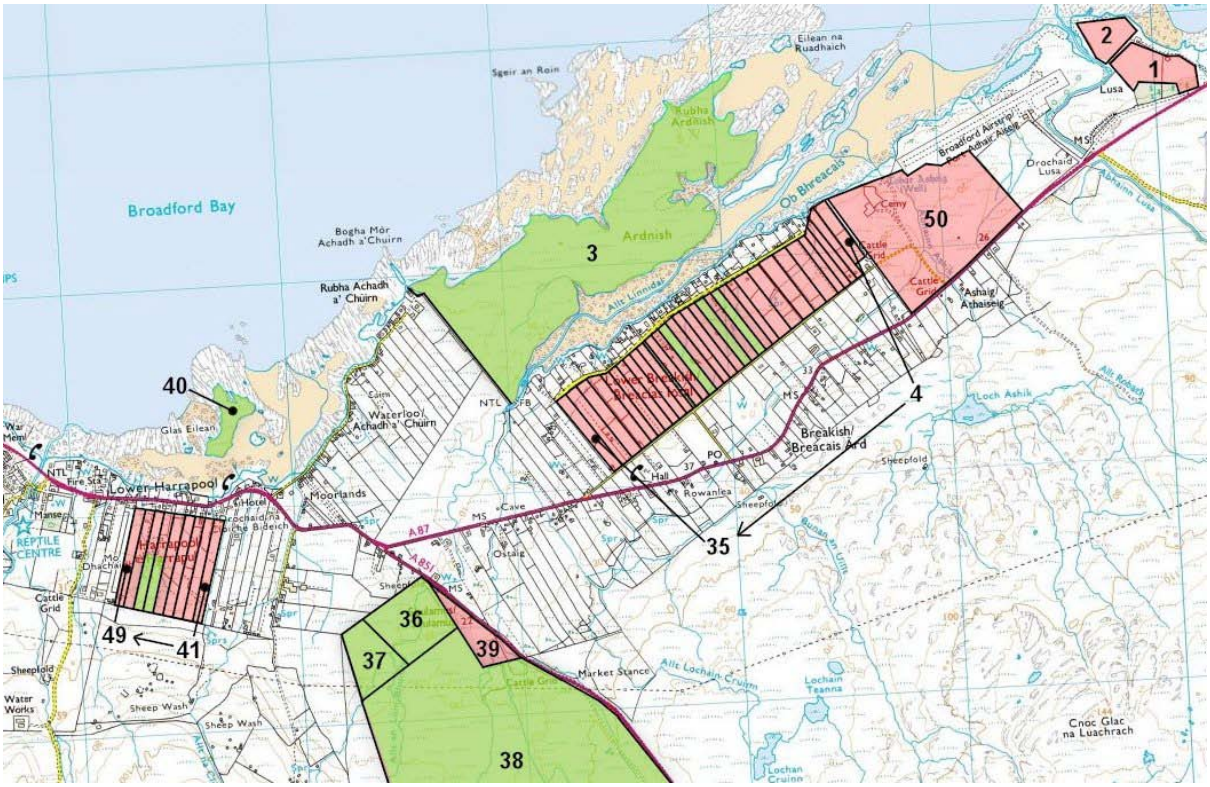
Map of Skye (Broadford) – detailed field numbers in area surveyed



Field/area numbers relate to details on associated spreadsheet.



Skye (Broadford) - field/area numbers relate to details on associated spreadsheet.

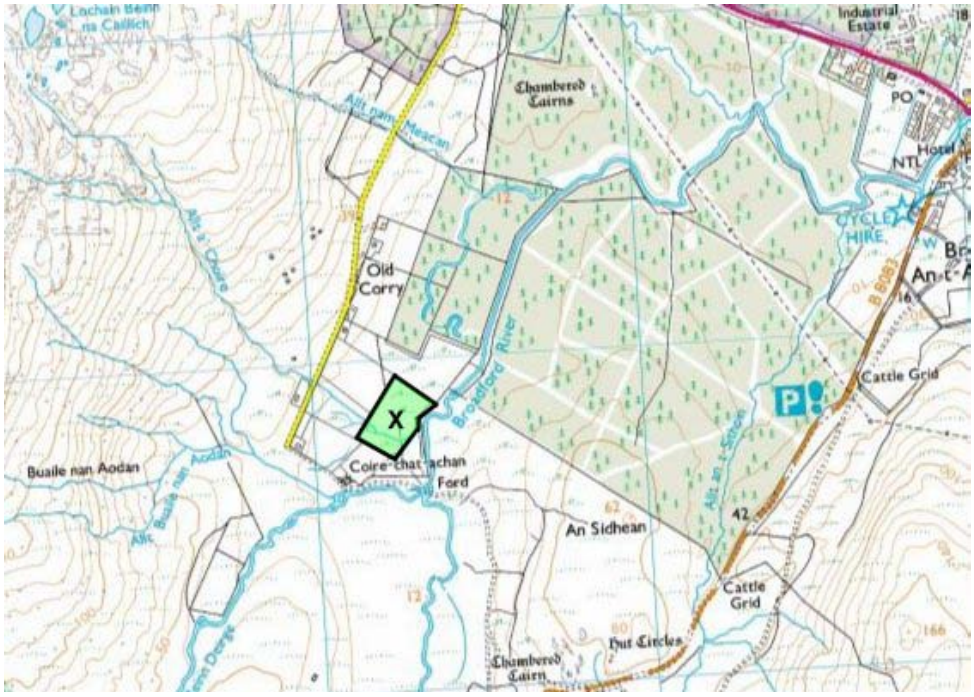


Areas most frequently used by Greenland White-fronts (green) and fields surveyed (pink)

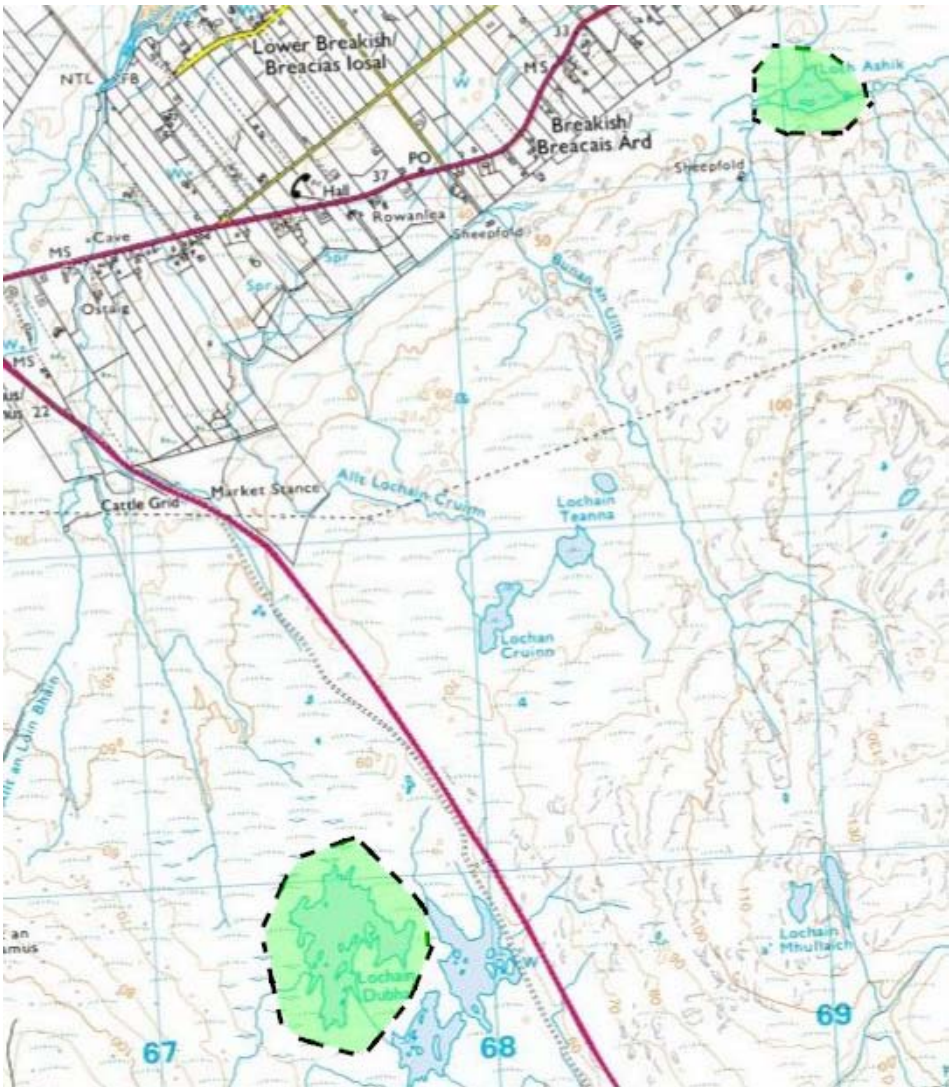
Site photographs (Skye, Broadford)

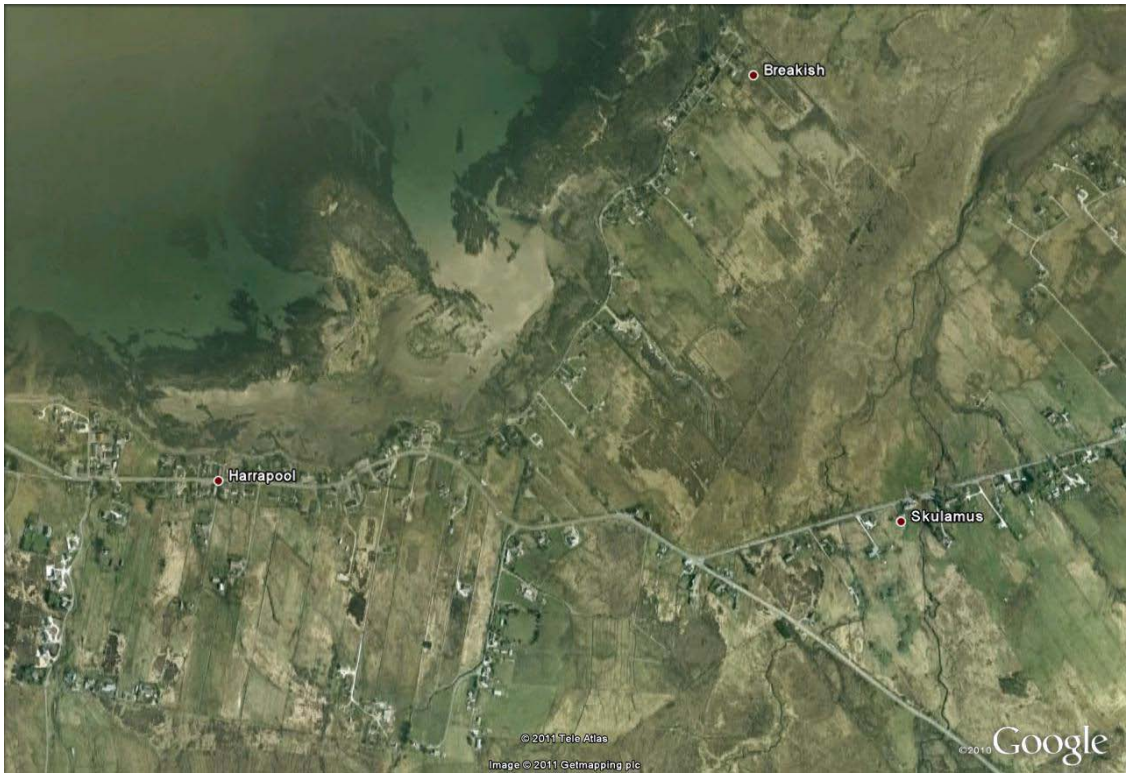
Broadford, March 2003

Broadford, March 2003



Areas used by Greenland White-fronts (green) south and south-west of Broadford





Broadford area, Google Earth, 2005

Feeding and roosting locations used by geese

The flock has been reported feeding at a range of sites along the entire coast of Broadford Bay, in the Broadford and Waterloo areas out to Breakish, Strollamus, Skullamus and Ardnish Point. However, they will feed on Pabay and have been seen feeding on Scalpay and the small adjacent Guillamon Island. This flock feeds mainly on in-bye fields and managed grassland areas within the crofting lands immediately inland from Broadford Bay as well as the rough pasture of the Ardnish Peninsula. The birds also use fields at Old Corry and areas round the Black Lochs (B. McMillan, pers. comm.). They also use saltmarsh and merse around the Harrapool area.

Roosting sites: The roost site very likely continues to be Pabay, although there is little recent information on this. Geese do resort to Loch Ashaig (Ashik) (NG690233) when disturbed during the daytime and may seek drinking water there, so this may represent an alternative roost site.

Characteristics of fields and other habitats and visit notes

A subset of habitat variables is presented below, derived from data collected in the field. All fields with available area values in hectares (derived from SIACS information) are included. The variables selected are those thought most likely to show differences between sites, and which had data available consistently for most fields. The summaries below therefore characterise certain aspects of the site. They are only approximations, though, due to data complexities.

Total area of fields analysed (ha)	414
Average field area across site (ha)	18.8

Habitats	ha	%
Bog/Moorland	70.48	17.0
Bog/Moor/OIP	325.8	78.6
Old Improved Pasture	5.503	1.3
OIP/Permanent Grassland	12.536	3.0

Feature	Area of fields showing feature (ha)	%
Short sward (<5cm)	12.536	3.0
Medium	3.058	0.7
Medium long	70.481	17.0
Long sward (>15cm)	323	78.0
Other	5.24	1.3
Little *Juncus* (score 1)	374.17	90.3
Some *Juncus* (score 2)	38.76	9.4
Juncus widespread	1.38	0.3
No standing water (score 1)	316	76.4
Other wetland scores uncertain		

Many of the fields identified on the ground here did not match official identified units so some were discarded, so affecting the analysis above. This is a complex area and difficult to describe. There is a complex mosaic of old improved pasture and bog and moor, with generally long swards and scattered *Juncus*. Most fields appear not to have much inundation.

Habitat change and land use history
Not known.

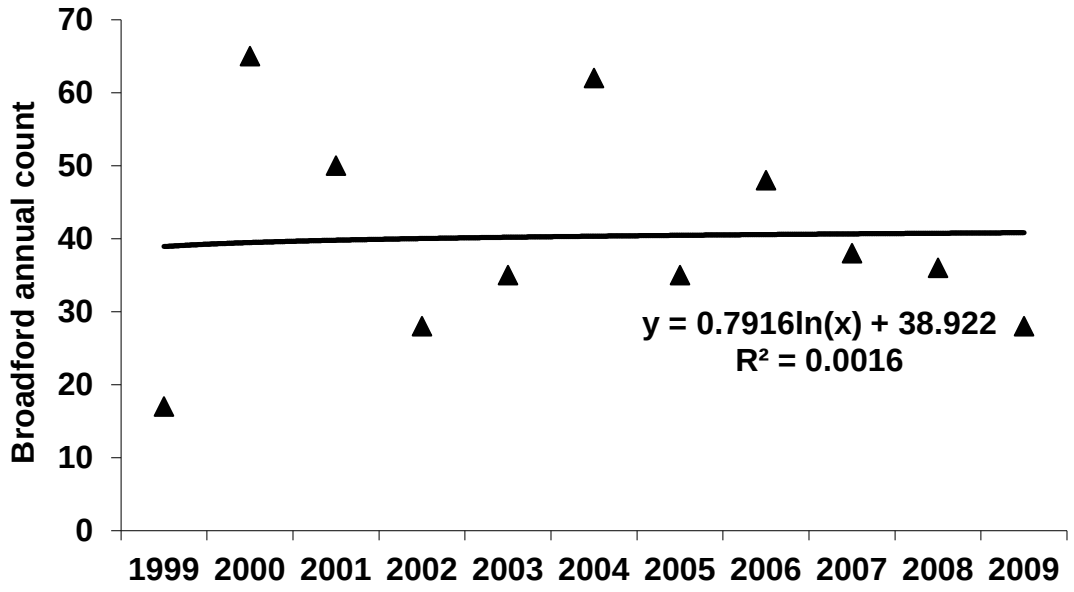
Agri-environment measures in place
There appear to be no agri-environment measures operative at this site.

Disturbance issues
Aircraft disturbance: Some low-flying aircraft affect this flock, but rarely to disturb them for long periods.
Hunting disturbance: Wildfowling and rough shooting takes place, but to what extent that affects these birds with so many alternative feeding areas is unknown.
Agricultural disturbance: No more than in any comparable area of such farmland, but there is additional disturbance from winkle gathers along the shore.
Recreational disturbance: The Broadford site is much disturbed by walkers and dogs and new houses are frequent. Disturbance from these and more cars has surely increased in the last 30 years.

Conservation designations and site protection
None.

Assessment of possible adverse influences on goose numbers
Not known.

Site vulnerability



Population trend since 1999.

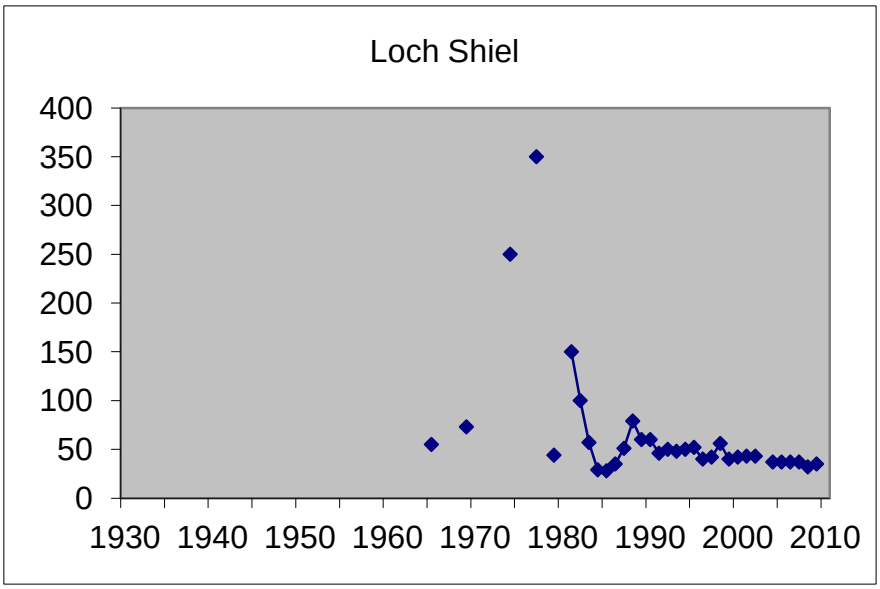
This site is considered to be at moderate risk of extinction in the near future due to recently stable numbers and should be considered a medium priority for appropriate conservation action despite relatively low population size.

Recommendations for management

The three fields at Lower Breakish (16, 18 and 23) and two at Harrapol (46 and 47) may be regular feeding areas and are in the middle of long strip fields used for grazing and some limited cropping. The continuation of the current low level grazing intensity would seem appropriate. The birds may spend more time on Ardnish (3) and Glas Eilean (40), suggesting that development here should be deterred if possible and seasonal grazing maintained. However, our knowledge of the usage of all the fields in the Broadford area is insufficient to make clear recommendations.

Loch Shiel

General status, population summary, graph of trends and breeding success
Most recent international census count: **34** (December 2010)
General trend: slow gradual decline in past 20 years following larger numbers (several hundreds) in 1970s, but numbers maintained within range 35-50 since early 1990s.
Status: One of the last Scottish flocks away from Islay that still regularly uses patterned oceanic raised bog vegetation and probably one of the very few to feed on raised bogs persistently through the winter by day.



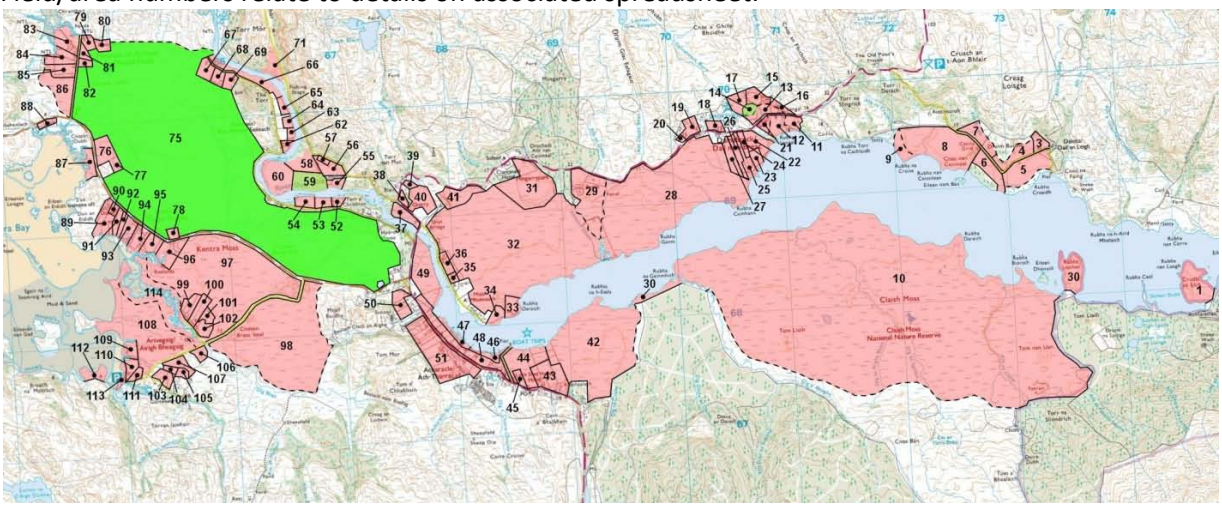
Breeding success: There are some age ratio records but not known in a general sense due to small flock size and few data; on the bogs geese can be difficult to age with confidence.

Any other relevant population information – inter-site movements, collars
No marked birds have been reported from this site. 30km from next nearest flock (Lismore).

Long-term history
History: Almost nothing is known of the early history of this little flock at this site (see GWGS web inventory). R&O (1979) indicate an increase in numbers to perhaps 250 birds at the time of their review so numbers recently are considerably less than these.

Maps of Loch Shiel area surveyed

Field/area numbers relate to details on associated spreadsheet.



Areas most frequently used by Greenland White-fronts (green) and fields surveyed (pink)

Site photographs (Loch Shiel area)

Kentra Moss from the west 2010

Kentra Moss from the east 2010

Kentra Moss and marginal farmland 2010

Loch Shiel and Claish Moss 2010

Kentra Moss, Loch Shiel and Claish Moss, 2007 imagery (Google Earth)

Feeding and roosting locations used by geese

Feeding sites and habitat: Kentra (NM6570) and Claish Mosses (NM7168) are both used as feeding sites, along with adjoining farmland. Reseeded grassland at Dalilea (NM732691) and rough pasture at Cliff (NM668695) are especially favoured, as is an old improved field at Newton of Ardtoe (NM648703) which directly abuts Kentra Moss. There have been other reports of the Greenland White-fronted Geese from Achnanellan (NM747679), Shielfoot (NM657707) and in flooded fields in Acharacle village.

Roosting sites: Kentra (NM6570) and Claish Mosses (NM7168) are both used as feeding and roost sites, whilst the shores of Loch Shiel may also be used as a roost.

Characteristics of fields and other habitats and visit notes

A subset of habitat variables is presented below, derived from data collected in the field. All fields with available area values in hectares (derived from SIACS information) are included. The variables selected are those thought most likely to show differences between sites, and which had data available consistently for most fields. The summaries below therefore characterise certain aspects of the site. They are only approximations, though, due to data complexities.

Total area of fields analysed (ha)	1246
Average field area across site (ha)	54

Habitats	ha	%
Bog or Moor or Marsh or moorland or fen	440.061	35.3
BMMMF/OIP	11.96	1.0
RIP (recently improved pasture)	3.86	0.3
OIP (old improved pasture)	17.74	1.4
OIP (old improved pasture) and BMMMF	715.85	57.5
PP or PG (permanent grass/pasture)	54.88	4.4
OIP/RIP	2.412	0.2

Feature	Area of fields showing feature (ha)	%
Not recorded or n/a	440.06	35.3
Short sward (<5cm)	64.05	5.1
Short/medium	1.07	0.1
Medium	4.45	0.4
Long sward (>15cm)	737.136	59.2
Little *Juncus* (score 1)	58.157	4.7
Some *Juncus* (score 2)	19.7	1.6
Juncus widespread	728.868	58.5
Not recorded or n/a	440.06	35.3
No standing water (score 1)	23.4	1.9
Some seasonal inundation (score 2)	783.3	62.9
Permanent water	440.1	35.3

Only a sample of fields was analysed here due to much confusion over identified units on the ground and the official units as recognised in government field data. There is a great deal of bog and moorland scattered all over the general area and this is reflected in the habitat breakdown. Most swards are long, *Juncus* is widespread and many areas have seasonal or permanent water.

Habitat change and land use history

Habitat change: Although many areas of peatland around Loch Shiel have been drained in recent historical times, the main raised mire complexes of Kentra and Claish Mosses seem to have survived in a hydrologically intact state. An extensive area of bog outwith the boundaries of the Claish Moss National Nature Reserve was deep ploughed for commercial afforestation in 1983; while it is not known if the geese ever used this particular area for feeding, this loss of habitat through destruction undoubtedly reduced the area of potentially suitable habitat in the immediate area. The use of farmland in the past few decades is in contrast to R&O's (1979) statement that "no farmland feeding has been observed", so this is presumably a very recent phenomenon.

Agri-environment measures in place

Based on frequency, the following measures are in place over fields at this site:

Agri-environment measure	% frequency
Mown Grassland for Wildlife	50.0
Control of invasive non-native species - Rhododendron	16.7
Open Grazed or Wet Grassland for Wildlife	16.7
Water Margins - Enhance biodiversity	16.7
	100.0%

Due to the multiple occurrence of measures in single fields, differing field boundaries, and some discrepancies in grid references, it is not possible to analyse the information according to the area covered.

Disturbance issues

Aircraft disturbance: This appears to have been an issue in the 1980s but it is not clear whether this has any impact now.

Hunting disturbance: Not known.

Recreational disturbance: Not known, but not likely to be significant. Walkers were observed moving along the road some 400m from the geese when feeding on Kentra Moss; there was no discernible effect at all.

Agricultural disturbance: Not known, but not thought significant.

Conservation designations and site protection

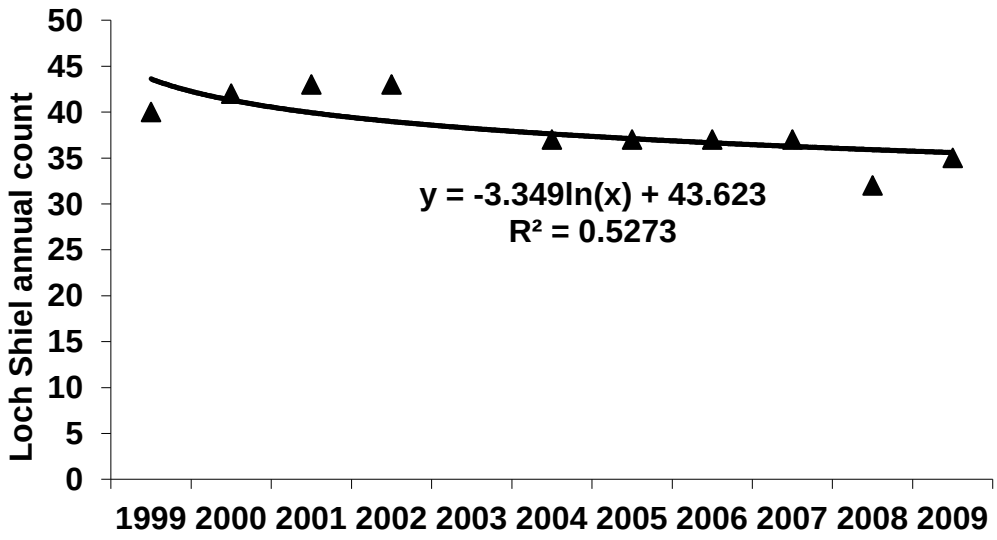
Site safeguard: Kentra Moss and Claish Moss are both protected as Special Areas of Conservation (SAC); Kentra Moss is a Grade 2 NCR SSSI and a proposed Ramsar Site. Claish Moss is a Grade 1 NCR SSSI, NNR and Ramsar site, and is recognised as a UNESCO Biosphere. It was purchased by the then Nature Conservancy Council in 1978 when threatened with destruction by forestry and declared a National Nature Reserve. Loch Shiel is also an NCR SSSI and Special Protection Area (SPA).

Assessment of possible adverse influences on goose numbers

Threats: Reclamation and afforestation of peatlands areas has slowed in recent years, but has removed considerable areas of suitable habitat from the range of this flock. Some suggestion of agricultural conflict with crofters was reported in the mid 1980s. One factor thought locally to affect them is the large flock of Greylags which are centred on the fields at Dalilea, NM 732 692. This flock now numbers over 250, plus about a dozen Canada Geese. The Greylag flock has put pressure on feeding sites at Langal and Dalilea so that the White-fronts may have been pushed westwards to Cliff and Kentra Moss. Occasionally a few Greylags are shot, but not sufficient to affect the numbers.

Otherwise, gradual changes on farmland may be the only land use variable that could influence site use. Drainage, reseeding, rush invasion, tree planting and other actions may cause subtle changes in sward characteristics and feeding opportunities. However, there is no information on this and none of these stands out as being obviously influential.

Site vulnerability



Population trend since 1999

Extinction appears unlikely in the immediate future due to slow decline, but numbers are low, so the site should be considered a medium priority for any appropriate conservation action.

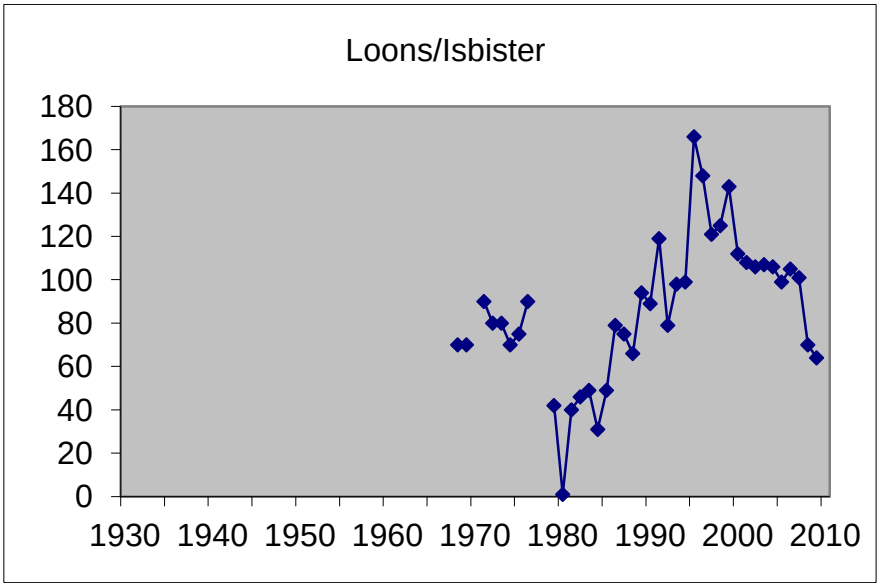
Recommendations for management

No clear recommendations can be made for this wintering site. There appears to be sufficient undisturbed feeding habitat of good enough quality to easily support many tens of Greenland White-fronts in the area. The quality and type of grassland, coupled with the uniquely extensive patterned mires and roosting lochs suggest that habitat does not in any way limit numbers here. No other factors stand out as adversely affecting the birds at the Loch Shiel site.

Orkney (Loons)

General status, population summary, graph of trends and age ratios
Most recent international census count: ***55*** *(March 2011)*
General trend: increase from 1980s to peak in mid-1990s, followed by steep decline.

Regional importance (new since R&O 1979). Apparently showed a dramatic increase from c.40 birds in the early 1980s to over 100 in the early 1990s, a change mirroring the decline in the Tankerness flock, perhaps suggesting interchange between the two areas. In recent years, the flock has become very elusive, and the fluctuations in the annual count suggest hitherto unlocated alternative feeding areas in the vicinity. In very recent years, they have fed rather more in the Hundland and Swannay areas further east of their former range. The flock seems more and more to fragment into smaller groups that scatter over a very wide area of potential feeding sites, making monitoring of the overall abundance and assessment of the relative importance of feeding areas difficult. Many of the early records referring to Birsay (site unspecified) probably refer to the Loons area. In some years larger numbers in October and April than are present throughout the winter would suggest that migrating flocks stage in this area and temporarily swell local wintering numbers. There may well have been exchange between this flock and the Holm site, since on 18 March 1983, 46 geese were watched arriving at the Loons from the south-east, flying very high. Since 2000, numbers have declined to around 60 individuals.



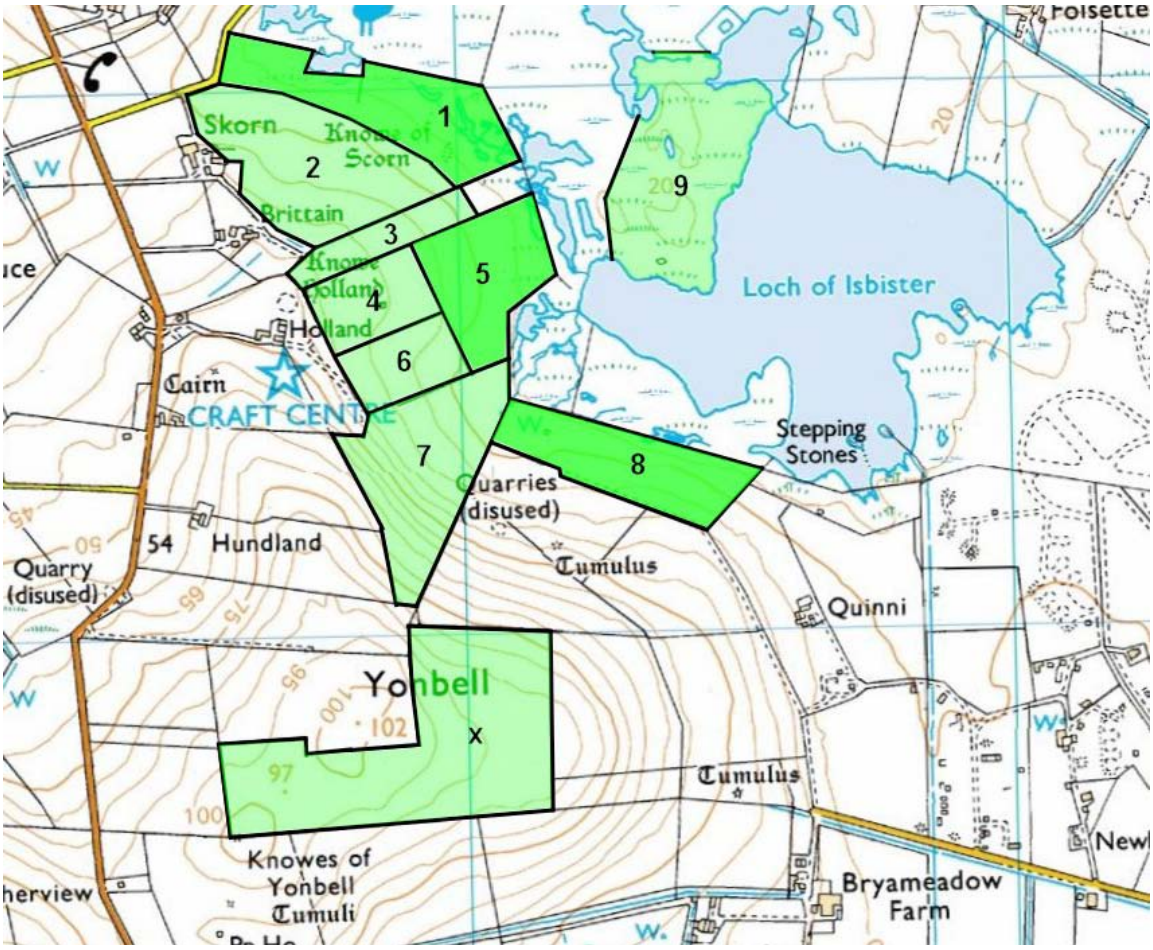
Breeding success: No figure provided because of the small flock size and few data.

Any other relevant population information – inter-site movements, collars
A leg ringed and collared bird 4XC was ringed in November 1990 at Wexford where it wintered 1990/91-1994/95 inclusive. It was subsequently found long dead in the Bay of Skaill, Sandwick in February 1999, although it was not seen alive in the area beforehand. Another collared bird (N8H) has wintered at the Loons for the past three winters. It was first caught in Wexford in 2003/04 then wintered twice on Islay before coming to Orkney.

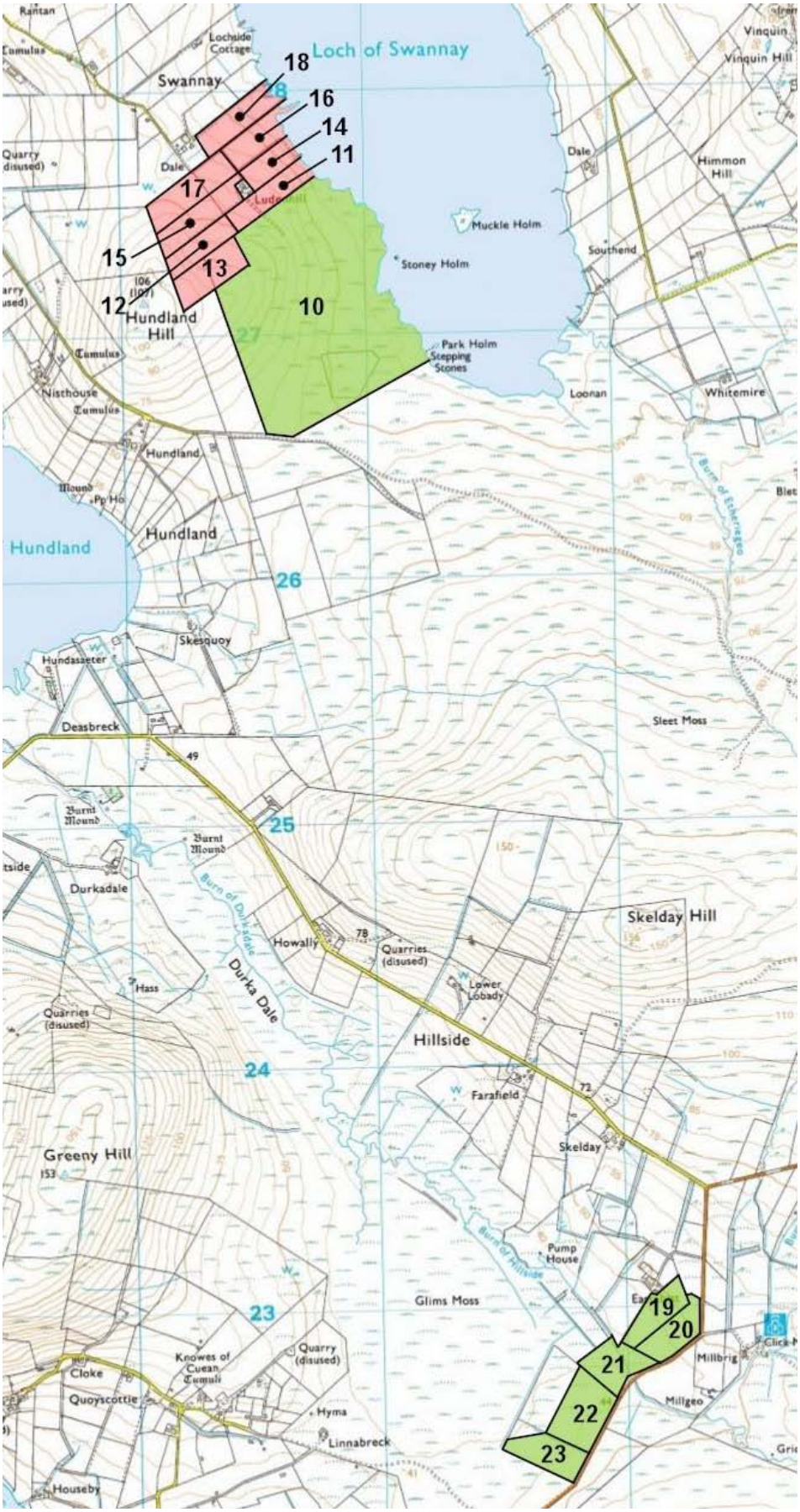
Long-term history
Not known.

Map of Orkney (Loons) area surveyed

Field/area numbers relate to details on associated spreadsheet.



Areas most frequently used by Greenland White-fronts (green) and fields surveyed (pink)



Areas most frequently used by Greenland White-fronts (green) and fields surveyed (pink)

Site photographs (Orkney, Loons area)

The Loons, March 2000

Durkadale, March 2000

The Loons, Bing Maps, 2010 imagery?

Loch of Swannay, Bing Maps, 2010 imagery?

Orkney, Loons area - Durkadale, Bing Maps, 2010 imagery?

Feeding and roosting locations used by geese

The geese have used a variety of habitats, including bogland with open water, rough pasture and reseeded grassland (main usage) as well as denser marshland vegetation in the Loons area. Agricultural change and drainage is not considered a problem in the area in recent years. This flock seems to exploit a number of feeding sites in north-west Orkney, which has made accurate census difficult, not least because the flock may divide into several smaller groups and feed in different areas. The key areas seem to be improved pasture, inundated wet fields and a small raised area of transitional mire habitat surrounded by bog and open water at the Loons (HY2524) and nearby Tufta, which forms the core of the range of this flock. The edges of Loch of Sabiston (HY288223) and improved pasture nearby are also grazed. There does seem to be regular movement between the Loons, Loch of Ibister (HY2523 and HY2524) and a bog area at the head of Loch of Swannay (HY3126), and the area around Dounby, Eastabist and Click Mill (HY3122-HY3223) seems to be used much in the spring. Less frequently used are areas around Ivrigar (HY3524). In 2010-11, Yonbell Hill was used, a short way to the south of Field 7 at HY250229.

Roosting sites: Not known; possibly open water areas associated with the Loons or Loch of Isbister, and sometimes Swannay loch.

Characteristics of fields and other habitats and visit notes

A subset of habitat variables is presented below, derived from data collected in the field. All fields with available area values in hectares (derived from SIACS information) are included. The variables selected are those thought most likely to show differences between sites, and which had data available consistently for most fields. The summaries below therefore characterise certain aspects of the site. They are only approximations, though, due to data complexities.

Total area of fields analysed (ha)	149
Average field area across site (ha)	12.5

Habitats	ha	%
Bog/Moorland	65.35	43.7
Old Improved Pasture	84.25	56.3

Feature	Area of fields showing feature (ha)	%
Not recorded or n/a	56.17	37.5
Short sward (<5cm)	84.246	56.3
Short, medium and long	9.184	6.1
No *Juncus*	84.246	56.3
Some *Juncus* (score 2)	9.184	6.1
Not recorded or n/a	56.168	37.5
No standing water (score 1)	84.246	56.3
Some seasonal inundation (score 2)	9.184	6.1
Not recorded or n/a	56.168	37.5

The Loons and Isbister fields analysed show a roughly division into bog and moor and old improved pasture, the latter mostly of short sward with little *Juncus* and little inundation or pools.

Habitat change and land use history

Over the last 100-120 years, there have been many unsuccessful attempts to drain the Loons, and the site is now protected as an RSPB reserve. Around Loch of Sabiston, there has been general and gradual reclamation of semi-natural habitats but it is not clear how these may affect the geese.

Agri-environment measures in place

Based on frequency, the following measures are in place over fields at this site:

Agri-environment measure	% frequency
Mown Grassland for Wildlife	50
Water Margins - Enhance biodiversity	37.5
Management of habitat mosaics	12.5
	100.0%

Due to the multiple occurrence of measures in single fields, differing field boundaries, and some discrepancies in grid references, it is not possible to analyse the information according to the area covered.

Disturbance issues

Aircraft disturbance: None known

Hunting disturbance: Some shooting occurs at Sabiston, but hunting elsewhere is not considered an important source of disturbance. Informal, no-shooting agreements are in place around the margins of the Loons reserve.

Agricultural disturbance: Very little at the sites used by the flock.

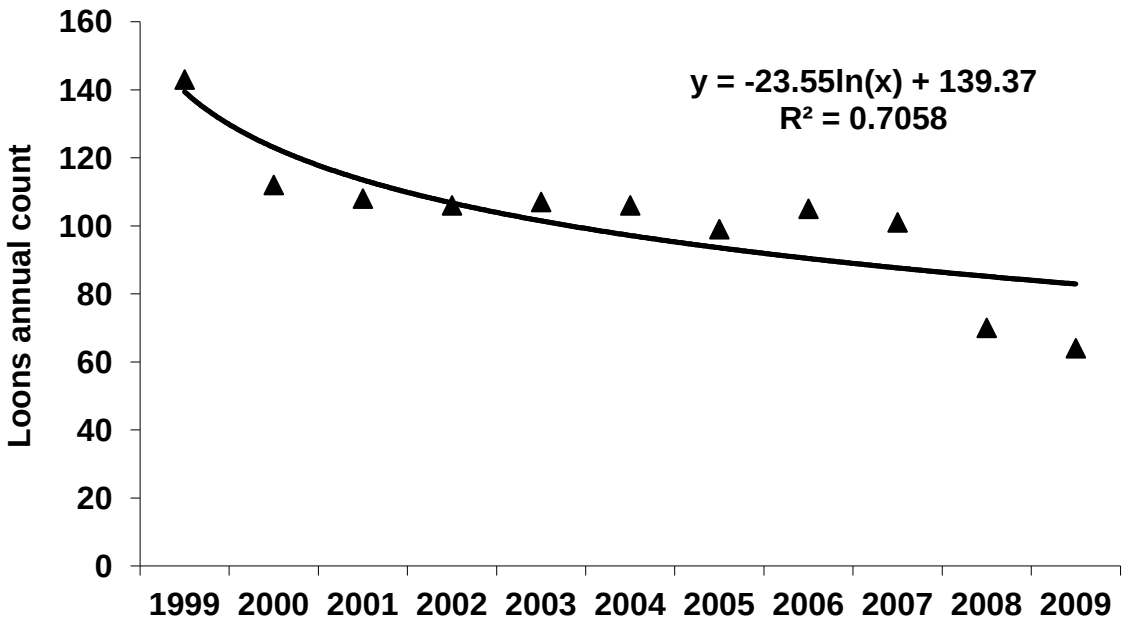
Conservation designations and site protection

Areas used by the geese lie within the Loch of Isbister and the Loons SSSI and RSPB reserve.

Assessment of possible adverse influences on goose numbers

Not known.

Site vulnerability



Population trend since 1999.

This site is considered to be at high risk of extinction due to steep decline and should be considered a high priority for appropriate conservation action.

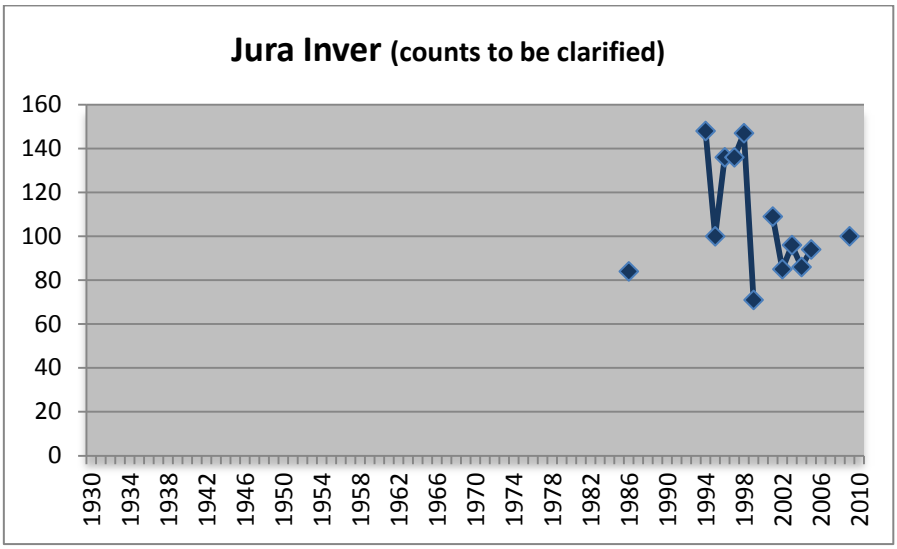
Recommendations for management

There are few clear management recommendations for this site. The birds appear to use relatively few fields (e.g. 1 and 2), which are improved.

Jura (Inver)

General status, population summary, graph of trends and age ratios
Most recent international census count: ***88*** *(March 2011)*
General trend: Not clear – fluctuating and probably linked with Islay.

This flock has been inconsistently counted over the years and is certainly linked to some degree with birds only a short distance away on Islay. It probably does not qualify as a discrete small flock, but the steady use of the same favoured areas over time at least shows that the land concerned is an important part of the birds' range in the general area.



Berry (1939) mentions White-fronted Geese on Jura and A-W (1963) recorded the species as occurring annually, numbering 20-30 individuals. R&O (1979) considered this group as an "offshoot from the main haunt of Islay close by" and in referring to this flock, they could be correct. Numbers do seem to fluctuate and there are grounds for believing that this group of birds was a newly established group that started using Jura in 1980/1, perhaps by birds moving from Islay. Irregular counts, sometimes not separated from Islay counts nearby make it impossible to analyse the change in abundance in numbers using these feeding areas or to say very much about their status and distribution. We do not have regular counts from this flock to present here, though in recent years efforts have been made to view and count the area from Islay, suggesting that coverage of at least parts of the fields may have improved.

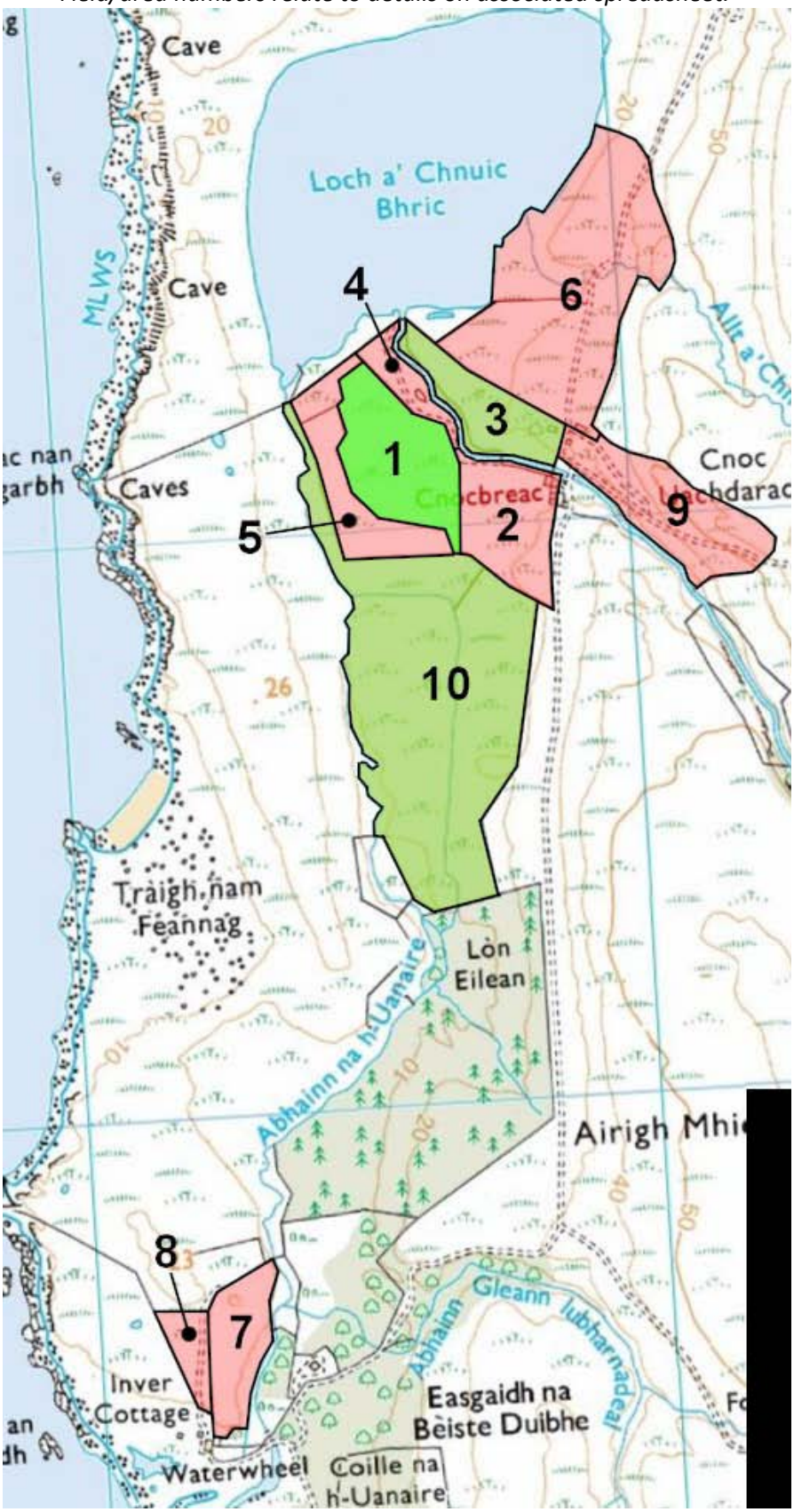
Breeding success: Assessment of this is too intermittent to provide a run of data from the island.

Any other relevant population information – inter-site movements, collars
D0S was a Wexford ringed goose caught as a first winter female in 1994/5. She was seen on Islay in the next winter, frequenting several parts of the island. In winter 1996/7, she was seen at Cnoc Breac on Jura amongst this flock, but was not seen on Islay that year to cement the use of specific fields on the larger island to use by birds from this little flock.

Long-term history
Local information indicates that the flock became established in the winter of 1980/81 with about half a dozen birds over-wintering, there being about twice that number the following winter. Since then, numbers have consolidated and increased progressively, so most often there have been 40-100 birds using the area in winter.

Map of Jura, Inver surveyed area

Field/area numbers relate to details on associated spreadsheet.



Areas most frequently used by Greenland White-fronts (green) and fields surveyed (pink)

Site photographs (Jura, Inver)

Loch a' Chnuic Bhric from Islay, March 2009

Fields by Loch a' Chnuic Bhric, January 2011

Fields by Loch a' Chnuic Bhric, January 2011

Moorland by Loch a' Chnuic Bhric, January 2011

Inver and Loch a' Chnuic Breac, Bing Maps, 2010 imagery?

Feeding and roosting locations used by geese

This flock feeds upon permanent pasture and (possibly, in the past) undersown stubble adjacent to the south and east of Loch a'Chnuic Bhric (NR4473). Two improved pastures near the loch are isolated and surrounded by heather and *Molinia* dominated moorland, with few alternative feeding sites nearby. Birds feeding at Keills on Islay have been watched flying to this area, confirming the link between the two resorts, but also suggesting that this flock also feeds on pasture on the larger island. This movement seems to have become more common as the flock has grown in numbers.

Roosting sites: This flock uses Loch a' Chnuic Bhric (NR4473) as a daytime feeding area and disturbance refuge as well as a night-time roost, probably along the southern shore. Birds seen feeding on stubble at Kiells on Islay have been seen flying to roost in the direction of Loch a' Chnuic Bhric in November, which may suggest that this flock on Islay splits between this roost site and others on the east side of the larger island. Suitable looking roosting areas in Gleann Astaile (NR490715, southeast of the loch) contained no evidence of droppings or feeding when searched in April 1983. When disturbed, geese fly initially to the loch, but may indulge in extended flying over the Sound of Islay and may settle on the larger island to feed. They can also settle and feed on the ridge between field 10 and the sea, when disturbed (M.A. Ogilvie, pers. comm.) There have also been reports of birds roosting in bog pools on Jura around and inland from Inver.

Characteristics of fields and other habitats and visit notes
Due to some major conflicts between fields identified on the ground and those recorded under the official field identifiers, it was not possible to establish field areas and calculate habitat cover variables. Most of the fields used are old or more recently improved pasture with short sward, low *Juncus* cover and few areas of water. Some areas are often grazed by highland cattle and deer.

Habitat change and land use history
None known to affect the geese. Fish cages were present in the loch but were removed a few years ago, reducing any possible disturbance that servicing these might have caused.

Agri-environment measures in place
There are apparently no agri-environment measures operative at this site.

Disturbance issues
Aircraft disturbance: Low flying jets fly north-east up the coast of Jura and this has flushed the geese in the past.
Hunting disturbance: Unlikely to be significant.
Agricultural disturbance: Variable, but generally low. The nearby area is uninhabited, and the only disturbance source comes from the estate manager at Inver Cottage, checking stock.

Conservation designations and site protection
None.

Assessment of possible adverse influences on goose numbers
None known.

Site vulnerability
There are insufficient data to establish risk of extinction. This would appear unlikely in near future due to reasonably high numbers and potential link with main Islay flocks, so the site should be considered a low priority for any appropriate conservation action.

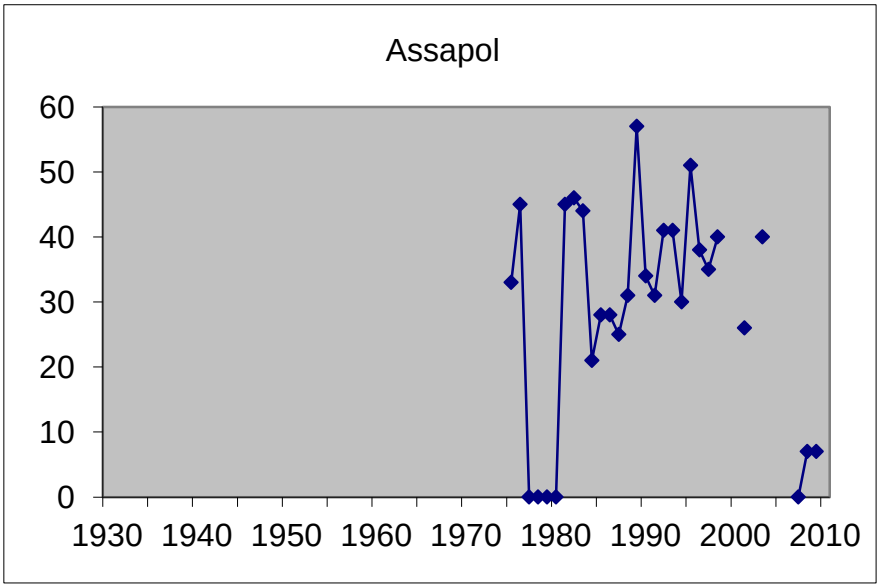
Recommendations for management
This flock is probably an overshoot of the main Islay groups. The fields here are relatively undisturbed, have short swards with low rush cover and at least one may have been recently improved, so it is difficult to propose management that would make them more attractive.

C. Other recently abandoned sites

Mull (Loch Assapol)

General status, population summary, graph of trends and age ratios
Most recent international census count: ***7*** *(March 2010)*
General trend: Possibly abandoned. Major decline in past few years after variable use by around 30-40 birds in 1980s and 1990s.

This has probably ceased to be a regular resort since the early 2000s. This flock was always considered a separate group from those that resorted to Loch Fidden, but ever since the first counts from this resort, numbers have fluctuated widely with no obvious trend, suggesting that there may well have been interchange between the two groups and/or that other feeding sites used by this flock remain to be discovered, not least on Iona where this flock has been noted to resort. Although there have been marked birds seen on Mull, they have not been helpful in enlightening exchange between the feeding areas. Numbers at this resort have only twice exceeded 50 in the time since 1975 when birds have been counted at this resort.



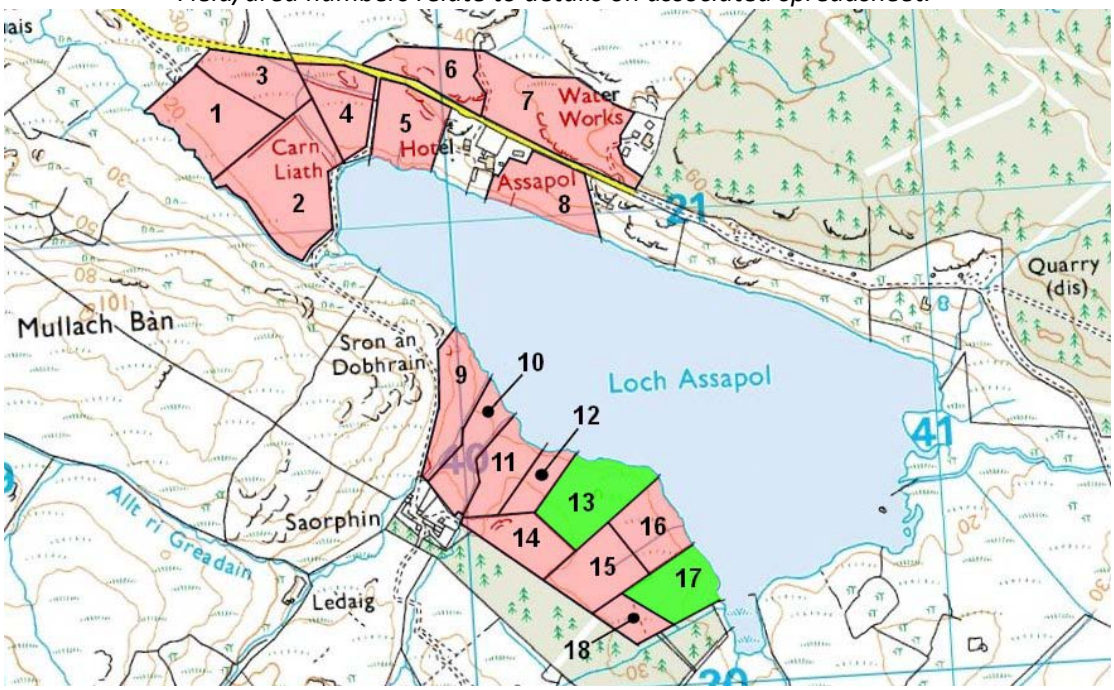
Breeding success: No figure provided because of the small flock size and few data.

Any other relevant population information – inter-site movements, collars
Nine collared birds have been seen amongst the Fidden flock, but there was no interchange with this group apparently.

Long-term history
Neither Berry (1939), A-W (1963) nor R&O (1979) reported White-fronted Geese from Mull at all, so there is no extended history of this flock beyond the time of Richard Coomber, who recorded geese from the Ross of Mull since 1975.

Map of Mull, Loch Assapol area surveyed

Field/area numbers relate to details on associated spreadsheet.



Areas most frequently used by Greenland White-fronts (green) and fields surveyed (pink)

Site photographs, Loch Assapol

Loch Assapol, Feb 2002 – Greenland White-fronted Geese feeding

Loch Assapol (top left), Feb 2006

Loch Assapol, Bing Maps, 2010 imagery?

Feeding and roosting locations used by geese

Geese fed mostly at Saorphin Farm (NM401203) south west of Loch Assapol on reseeded, improved and rough pasture. There is much rough pasture and seemingly good feeding habitat on the loch margin, but the birds remain on the improved pasture more than other land types. In the mid-1970s, the geese were seen in wet moorland east of Bunessan, but since around 1977/78, they have apparently ceased to use this area. In November 1982, the flock was seen flying to land on moorland at Torr Mor (NM383244) when disturbed, but no other alternative feeding sites are known.

Roosting sites: The geese roosted on Loch Assapol, along the western shore, less than 200 m from their favoured feeding area on the adjacent farmland. The geese also had a favoured loafing, bathing and preening site at the southeast end of the loch.

Characteristics of fields and other habitats and visit notes

A subset of habitat variables is presented below, derived from data collected in the field. All fields with available area values in hectares (derived from SIACS information) are included. The variables selected are those thought most likely to show differences between sites, and which had data available consistently for most fields. The summaries below therefore characterise certain aspects of the site. They are only approximations, though, due to data complexities.

Total area of fields analysed (ha)	79
Average field area across site (ha)	5.3

Habitats	ha	%
Bog/Moorland	38.765	48.8
Old Improved Pasture	34.065	42.9
Permanent Grassland	6.654	8.4

Feature	Area of fields showing feature (ha)	%
Short sward (<5cm)	18.76	23.6
Short medium	15.3	19.3
Medium	3.99	5.0
Long sward (>15cm)	41.42	52.1
Little *Juncus* (score 1)	27.45	34.5
Some *Juncus* (score 2)	8.78	11.0
Juncus widespread	43.24	54.4
No evidence of flooding (score 1)	79.48	100.0

The small areas of fields used here are composed of old improved and permanent grass mixed with bog and moor. Many swards are long, though some are short, and *Juncus* cover varies. Most fields are not regularly inundated.

Habitat change and land use history
None known to affect the geese.

Agri-environment measures in place
Based on frequency, the following measures are in place over fields at this site:

Agri-environment measure	% frequency
Conservation Management for Small Units - Individual	28.6
Grazing Management of Cattle - Retention	28.6
Mown Grassland for Corncrakes - 1 Sept	21.4
Management of Cover for Corncrakes	14.3
Open Grazed or Wet Grassland for Wildlife	7.1
	100.0%

Due to the multiple occurrence of measures in single fields, differing field boundaries, and some discrepancies in grid references, it is not possible to analyse the information according to the area covered.

Disturbance issues
Aircraft disturbance: The site is near a low-flying route, but effects on geese are not clear.
Hunting disturbance: Not known, some shooting used to take place at the neighbouring farm of Scoor, but not thought a problem.
Agricultural disturbance: Not known, but not thought significant.

Conservation designations and site protection
None.

Assessment of possible adverse influences on goose numbers
None known.

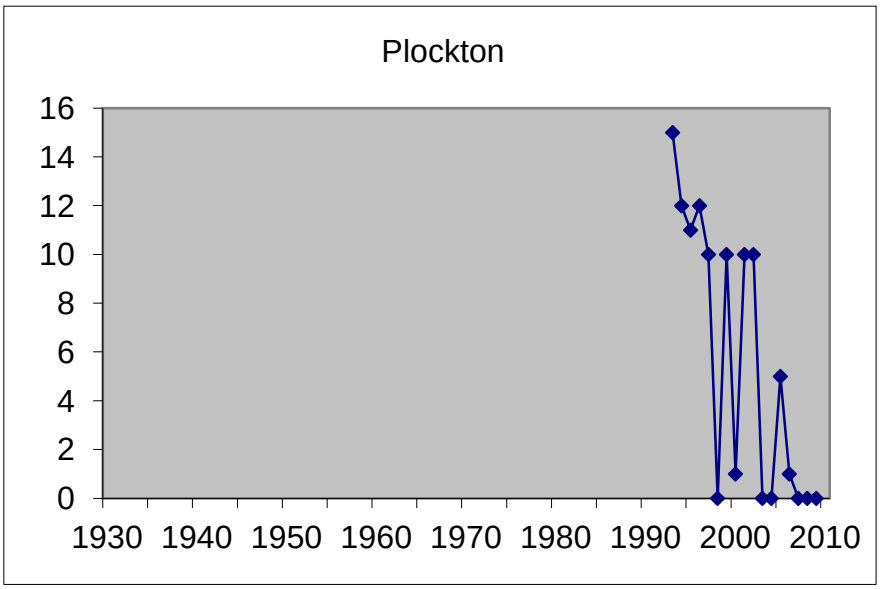
Site vulnerability
Numbers are very low and have declined, almost certainly to extinction. If continued presence can be established, the site should be considered a medium priority for any appropriate conservation action.

Recommendations for management
Feeding opportunities in managed grass fields appear to be rather limited. The fields around Loch Assapol look suitable and some had signs of cattle grazing. The farm at Saorphin may have had some development near the stackyard (possibly local disturbance?). Cutting rushes in some of the heavily infested fields may be beneficial.

Plockton

General status, population summary, graph of trends and age ratios
Most recent count: ***1*** *(March 2006)*
General trend: Probably abandoned.

First located in 1990, this flock has fluctuated considerably but has never exceeded 20 individuals, and is presently teetering on the edge of survival, but determination of its true status is hampered by use of alternative feeding sites, which doubtless contributes to the large between year variation in number and the fact that the geese have simply not been found in several recent winters.



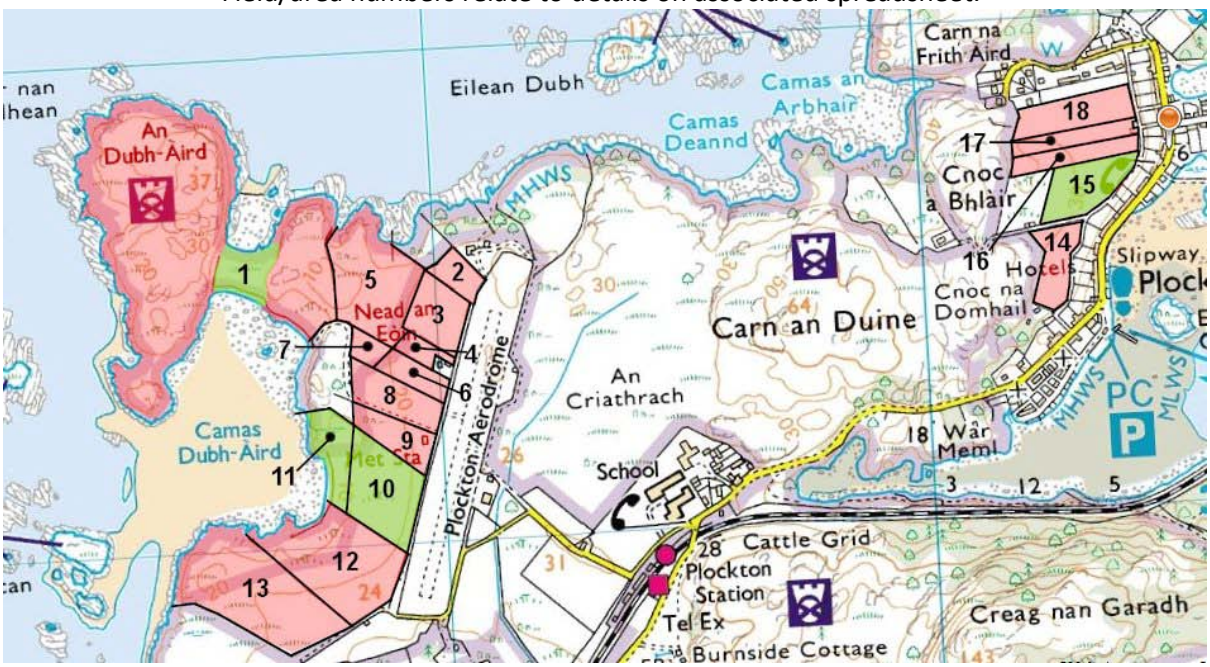
Breeding success: Age ratio data are not available for this flock.

Any other relevant population information – inter-site movements, collars
No marked individuals have been reported in this group.

Long-term history
Not very much historical evidence is available about this little flock. It is not mentioned in Berry (1939), A-W (1963) or R&O (1979), and was first discovered by Brian Neath in 1990.

Map of Plockton area surveyed

Field/area numbers relate to details on associated spreadsheet.



Areas most frequently used by Greenland White-fronts (green) and fields surveyed (pink)

Site photographs (Plockton)

Plockton, October 2005

Plockton, October 2005

Plockton, October 2005

Plockton, October 2005

Plockton and Duirinish, Google Earth, 2005 imagery

Feeding and roosting locations used by geese

The feeding range used by this flock is not clear and their regular disappearance in some years suggests that sites used by these birds remain to be discovered, if they are not gone. The core feeding site since discovery has been Camas Dubh-aird (NG787332) where the geese frequented an area of rushy unimproved pasture. They have used Kishorn Island in several winters at NG806376, so this is clearly one alternative feeding site not easy to see from the mainland. The flock has been seen at Drumbuie (NG774315) and Portaneorna (NG776319) where they have fed on a small area of stubble between ploughed strips amidst rough grazing. A single distinctively marked bird was seen at Kirkton Bay (NG830270) in 2000/1, 2001/2 and 2002/3 and another at Balmacara (NG818272) in 2002/3, and up to 8 have also been seen using improved pasture at Duirnish (NG778312). Most of the time, a Dubh-aird, they fed on rough pasture with rushes and some improved pasture.

Roosting sites: Unknown, but may include Kishorn Island.

Characteristics of fields and other habitats and visit notes

A subset of habitat variables is presented below, derived from data collected in the field. All fields with available area values in hectares (derived from SIACS information) are included. The variables selected are those thought most likely to show differences between sites, and which had data available consistently for most fields. The summaries below therefore characterise certain aspects of the site. They are only approximations, though, due to data complexities.

Total area of fields analysed (ha)	77
Average field area across site (ha)	4.5

Habitats	ha	%
Bog/Moorland	18.047	23.3
Recently Improved Pasture	59.4	76.7

Feature	Area of fields showing feature (ha)	%
Not recorded or n/a	18.047	23.3
Short sward (<5cm)	59.4	76.7
Little *Juncus* (score 1)	59.404	76.7
Not recorded or n/a	18.047	23.3
No standing water (score 1)	59.404	76.7
Not recorded or n/a	18.047	23.3

These small fields at Plockton show a mixture of bog and moor and recently improved pasture. Grass swards are short with little *Juncus* and are generally dry.

Habitat change and land use history
The area of rushy pasture favoured by the White-fronts was fenced off in 2000/1 and 2001/2. Excavation for a new sewer for Plockton also took place in winter 2000/1, immediately adjacent to the favoured feeding ground, but this was not seen to affect the Greylag Geese that were in the area at the time.

Agri-environment measures in place
There are apparently no agri-environment measures at this site now, but RSS/SRDP measures have operated on the NTS croftland in the past.

Disturbance issues
Aircraft disturbance: None known.
Hunting disturbance: Not known, but see below.
Agricultural disturbance: There has been pressure on the National Trust for Scotland (NTS) from local crofters to control the increasing numbers of Greylag Geese using the area also frequented by the White-fronted Geese. NTS are fully aware of the presence of the White-fronted Geese, so the favoured site should be protected, but more hunting pressure could occur at other sites in the vicinity.
Recreational pressure: The fields to the west of Plockton village must surely be more disturbed than 20 years ago. The fields look suitable, but dog walkers would potentially scare birds away.

Conservation designations and site protection
The favoured feeding area is owned by NTS.

Assessment of possible adverse influences on goose numbers
There has been enclosure of formerly open rough pasture in the area and there is pressure from increasing numbers of Greylag Geese which are causing some disquiet to local crofters.

Site vulnerability
There are insufficient data for this site to assess this, but clearly it has effectively almost certainly been abandoned, so cannot be considered a high priority for action.

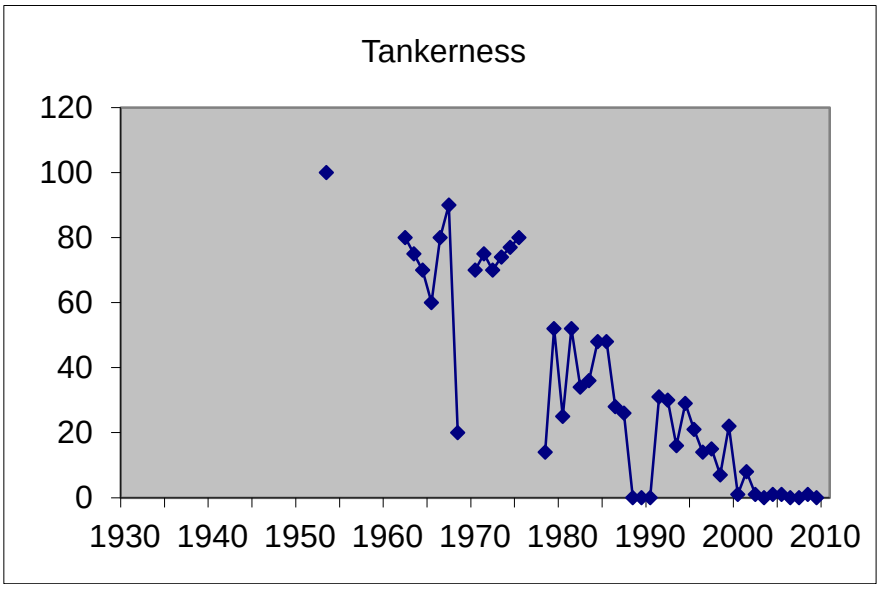
Recommendations for management
The site is almost certainly abandoned now and no management recommendations are feasible.

Tankerness (Orkney)

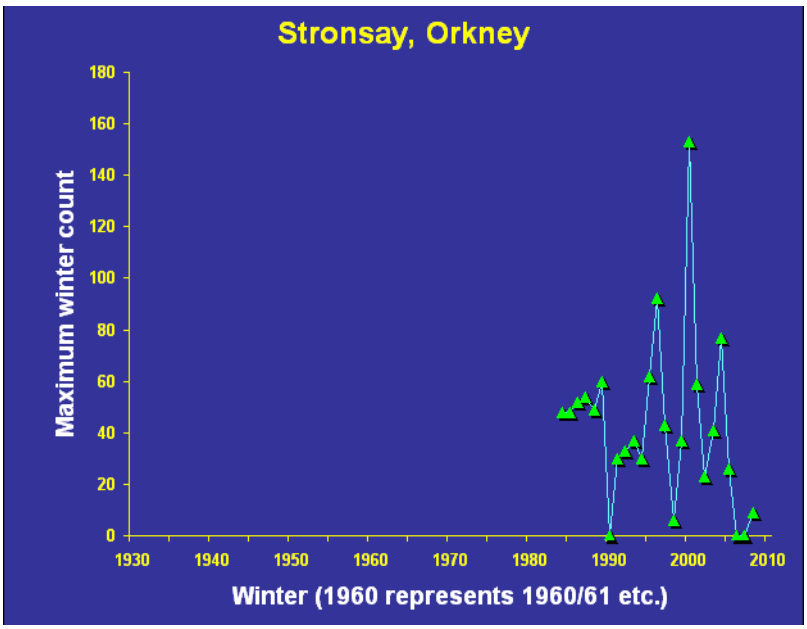
General status, population summary, graph of trends and age ratios

Most recent count: ***1*** *(March 2001)*
General trend: now abandoned after long decline, but may be linked to Stronsay flock.

Probably now abandoned as a regular wintering site. Fifty to 100 birds were here in the 1960s but since then there has been a continuous decline in the numbers of birds using this set of wintering areas. Variable numbers in the 1980s, then a rapid decline in the 1990s and apparently deserted for a while as a regular feeding area in recent years, the decline at this site seemed to match an increase in the regular wintering flock on Stronsay. These geese have also been seen on Sanday. The geese are still occasionally seen in this area of the Mainland, perhaps suggesting this was a preferred site, despite their movement to Stronsay (see below) and other areas. Please note, Stronsay was not covered in this small sites review.



Breeding success: No figure provided because of the small flock size and few data.



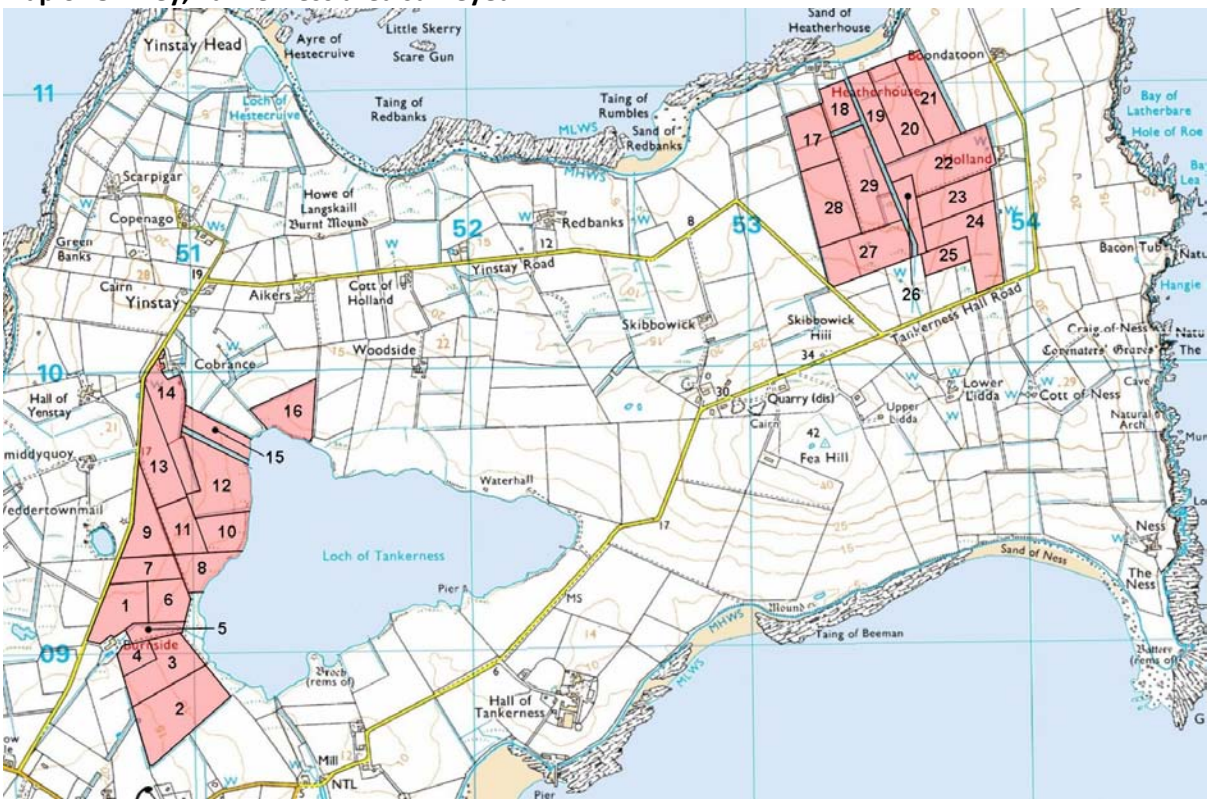
Any other relevant population information – inter-site movements, collars

A metal ringed goose, ringed as a juvenile in Sarqaqdalen on the south side of the Nussuaq peninsula on 25th July 1955 was recovered near Kirkwall on 29th October 1956. A leg ringed and collared bird 9KU was ringed in November 1985 at Wexford where it wintered 1985/86-1988/89. It wintered on Islay from 1989/90 until December 1996. It was seen in March 1997 at Tankerness, before being seen back on Islay the following winter where it wintered from 1998/99 until 2000/01.

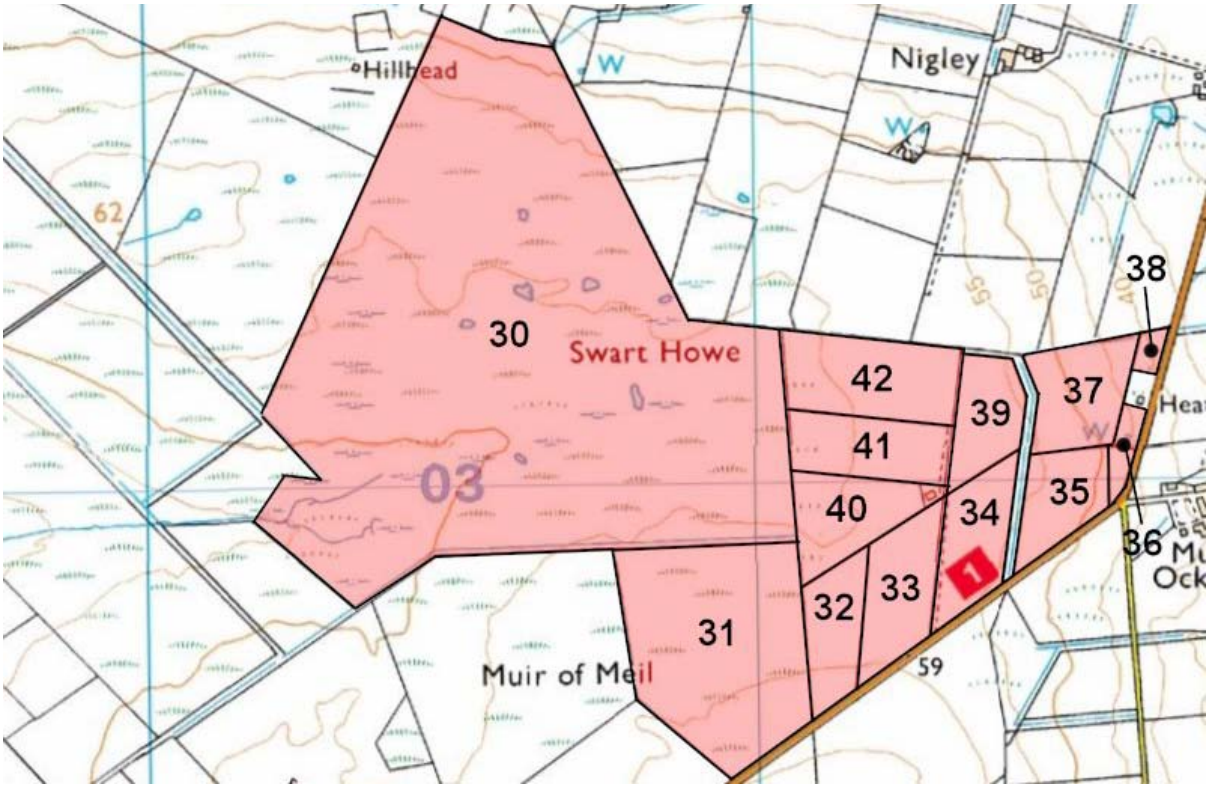
Long-term history

Formerly of regional importance (R&O 1979). They provided counts from Tankerness Loch from 1962/63, reporting a "sharp decline since 1974/75 appears to have been due to a combination of reclamation of moorland used by the geese, and an increase in shooting in the area. Both involved an increase in human activity and consequence disturbance. The decline may be linked with the increase in Caithness".

Map of Orkney, Tankerness area surveyed



No recent records of Greenland White-fronts in this area



Orkney (Tankerness) - field/area numbers relate to details on associated spreadsheet.
No recent records of Greenland White-fronts in this area.

Site photographs (Orkney, Tankerness)

No field photographs taken

Loch of Tankerness area (cloudy image), Google Earth, 2009

Feeding and roosting locations used by geese

Generally the farmland areas around the Loch of Tankerness were used for feeding, although the flock formerly ranged widely within the parishes of Holm and Toab. There are records of birds feeding at Swart Howe (HY510033) in an area of *Calluna* and *Juncus*-dominated rough pasture and improved leys with some temporary standing water. The geese formerly used areas of marginal moorland, rough pasture and reseeded grassland in this area of east Mainland Orkney, but there has been considerable land claim of semi-heath areas and rough pasture about the fringes of the areas used by the geese which may have precipitated their departure from the vicinity.

Roosting sites: Loch of Tankerness (HY5109), also reported from Swart Howe (HY510033).

Characteristics of fields and other habitats and visit notes

A subset of habitat variables is presented below, derived from data collected in the field. All fields with available area values in hectares (derived from SIACS information) are included. The variables selected are those thought most likely to show differences between sites, and which had data available consistently for most fields. The summaries below therefore characterise certain aspects of the site. They are only approximations, though, due to data complexities.

Total area of fields analysed (ha)	178
Average field area across site (ha)	4

Habitats	ha	%
Arable/Cereal	25.09	14.1
Mixed Arable/sown with grass	1.19	0.7
Bog or Moor or Marsh or moorland or fen	53.72	30.2
OIP (old improved pasture)	89.11	50.1
OIP (old improved pasture) and BMMMF	1.53	0.9
OIP/PP	4.756	2.7
unknown (L?) or n/a	2.937	1.7

Feature	Area of fields showing feature (ha)	%
Not recorded or n/a (e.g. ploughed field)	28.03	15.7
Short	13.43	7.5
Short Medium	64.9	36.5
Medium	11.97	6.7
medium long	4.75	2.7
Long	55.253	31.0
No *Juncus*	79.72	44.8
Little *Juncus* (score 1)	16.8	9.4
Some *Juncus* (score 2)	5.06	2.8
Juncus widespread	54.95	30.9
Not recorded or n/a	21.8	12.2
No standing water (score 1)	165.7	93.1
Some seasonal inundation (score 2)	9.7	5.4
Not recorded or n/a	2.9	1.6

The Tankerness fields show a division into arable, pasture and bog and moor, and these habitats are reflected in varying sward lengths and *Juncus* cover values, though most are relatively dry.

Habitat change and land use history

R&O (1979) considered that moorland reclamation was one of the causes of the declines in number of the flock in the 1970s, but there has been gradual agricultural 'improvement' of semi-natural habitats.

Agri-environment measures in place

Based on frequency, the following measures are in place over fields at this site:

Agri-environment measure	% frequency
Maintenance of organic farming - rough grazing	50
Management of Moorland Grazing	50
	100.0%

Due to the multiple occurrence of measures in single fields, differing field boundaries, and some discrepancies in grid references, it is not possible to analyse the information according to the area covered.

Disturbance issues

Aircraft disturbance: Disturbance from aircraft from the nearby civil airport at Kirkwall, which probably results in regular disturbance, although the regular nature of the disturbance and its orientation may enable some level of habituation. There has been a significant increase in air traffic since the 1980s associated with oil-related activities and the general increase in air traffic generally.

Hunting disturbance: R&O (1979) reported an increase in shooting in the area and subsequent disturbance, but there is no recent information on this.

Agricultural disturbance: R&O (1979) reported increase in moorland reclamation but there is no recent information.

Conservation designations and site protection

None.

Assessment of possible adverse influences on goose numbers

The reasons for this change in wintering site remain unknown. Generally there has been little disturbance in the area, apart from that from regular farm work, and no attempts to drive geese from fields. There do not appear to be any problems associated with shooting. Continuing land claim may have contributed to the temporary abandoning of this site, although assuming it is the same flock using Stronsay, they seem to be able to settle at alternative feeding areas.

Site vulnerability

Not applicable – abandoned.

Recommendations for management

There is still a suitable mix of grazing opportunities close to Tankerness, right next to a large roost. Like many places on Orkney, there has been considerable rural development with houses being built in the last 30 years. There are many new build houses in the area and this increases disturbance (especially through dog walking) and may have, indirectly, affected roosting opportunities on the loch (more house lights, more rural traffic, more dogs etc.). The fields at Muckle Ocklester also look suitable for Greenland White-fronts.

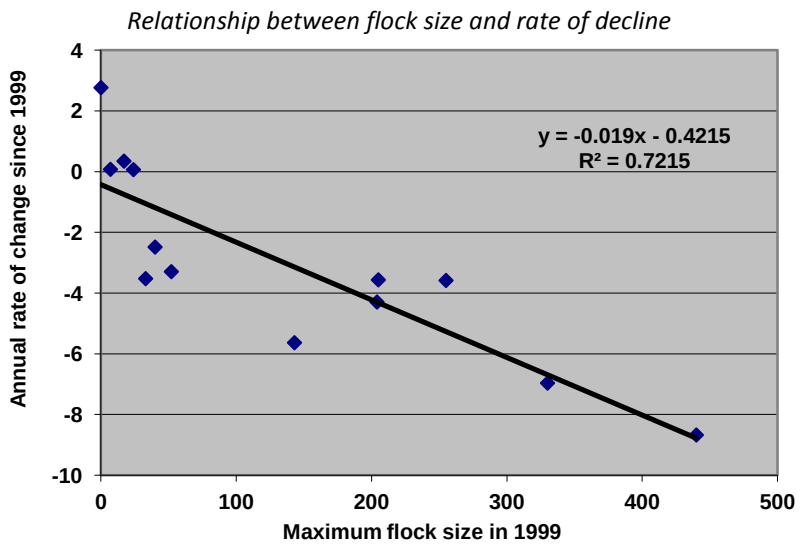
4.2 General analysis of site characteristics

4.2.1. Which sites may be most vulnerable to extinction?

One of the project aims was to attempt to produce a prioritised list of small sites for conservation action, with actions identified for each with timescale and estimated cost (see Section 6). Here we attempt to group sites that show greatest risk of extinction based on rate of decline (using the population trend data at each site) and flock size. The results are shown below, in order of subjective assessment of vulnerability. It was not possible to consider this for some sites with insufficient data.

Suggested vulnerability of small Greenland White-front sites based on decline and flock size

Site	Pop size, 2009	Decline/flock size?	Suggested priority grouping
Stranraer	254	High rate	HIGH
Colonsay and Oronsay	133	High rate	HIGH
South Uist (Kilpheder & Askernish)	20	Low rate but small	HIGH
Loch Ken (Galloway)	190	High rate	HIGH
Orkney (Loons)	64	High rate	HIGH
Moine Mhor (Lochgilphead)	18	Lower rate but small	HIGH
Skye (Broadford)	28		MEDIUM
Caithness – (Westfield, Broubster)	140	Lower rate	MEDIUM
Skye (Loch Snizort: Loch Chaluim Chille, Skeabost)	24	Stable, small	MEDIUM
Caithness (Loch of Mey)	170	Lower rate	MEDIUM
Loch Shiel (Lochaber)	35	Lower rate	MEDIUM
Mull (Fidden)	29	Lower rate	MEDIUM
Jura (Lowlandman's Bay)	11	Insufficient data, but small	MEDIUM
Benbecula (Nunton)	20	Stable, slight increase	LOW
Lewis (Loch Urrahag)	45	Stable	LOW
Jura (Inver)	100	Insufficient data	LOW
Mull (Loch Assapol)	7	Insufficient data	Poss. abandoned?
Plockton (Kyle of Lochalsh)	0	Insufficient data	Prob. abandoned
Orkney (Tankerness)	0	n/a	Abandoned



We were unable to derive a meaningful single index of vulnerability and this attempt at prioritisation must be viewed with caution. Both flock size and rate of decline are pertinent factors in assessment of vulnerability, but we cannot use a strict ranking based on either without difficulty. It appears that larger flocks are declining faster, and this relationship is statistically significant (see graph above). However, it is highly unlikely, for example, that the Stranraer, Colonsay or Loch Ken flocks will disappear within a very short time. Nevertheless, the current rate of change in their numbers is faster than others, and therefore we have to be concerned if this continues into the future.

Similarly, those flocks which number just a few tens of birds must clearly be of concern, even if relatively stable. For most of these small flocks we lack data on reproductive success (let alone survival), so PVA type population modelling is not possible. Clearly, sites which hold smaller numbers of birds and which are declining more rapidly would seem to be the most vulnerable, but in reality, any site declining very rapidly is of concern. In the table above, we have subjectively grouped sites which appear most vulnerable according to the regression line trend and flock size as 'red', with others as 'amber' or 'green'. Of the 'red' sites, Moine Mhor and South Uist have the smallest populations and so could be considered most vulnerable to chance events which might accelerate the current rate of decline.

4.2.2. Analysis of "cross-cutting" issues across all small sites

Another project aim was to analyse cross-cutting (general) issues relevant to the conservation of the geese at the suite of small sites and make recommendations to SNH, GWGS and the National Goose Management Review Group. Recommendations are considered further in Section 6, but below we summarise the general characteristics across sites, in terms of the main factors we examined.

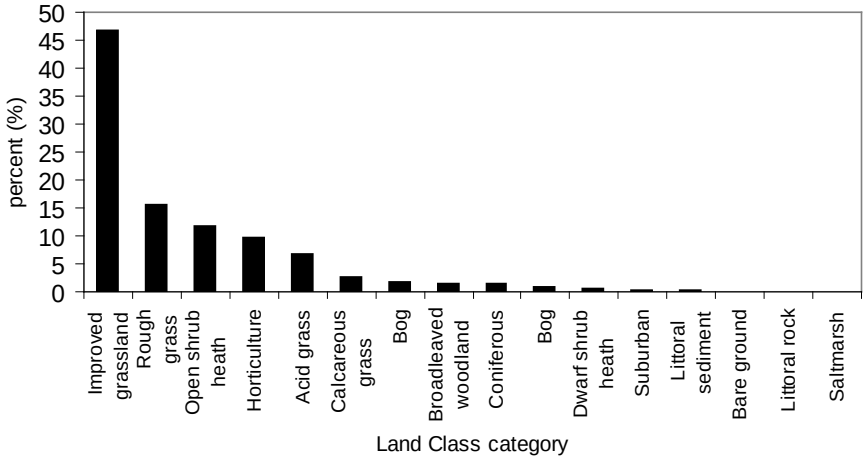
4.2.2.1. General habitat characteristics of all sites

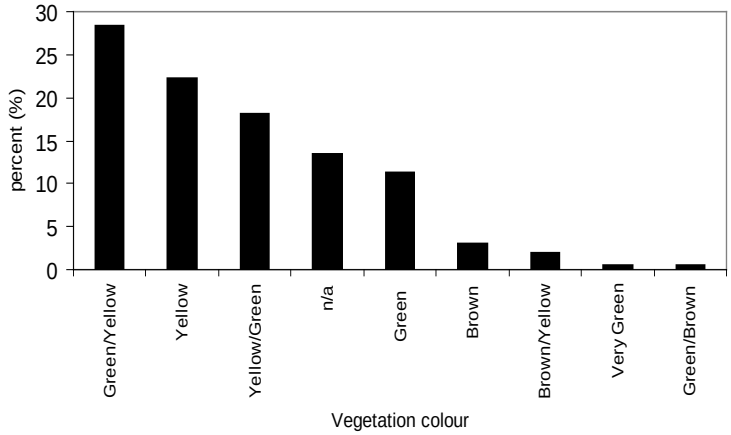
Using data supplied by SNH, the general characteristics of fields at small sites are presented below. The information sources were: Rural Priorities data to March 2010, SIACS field information and Land Cover of Scotland 2000 data. Please note that this analysis relates only to the 'fields' used. Analysing the 'non-field' habitats (blanket bog, lochs, moorlands, raised bog, fens and so on) would be very complex, lacking in data and was not possible to achieve within the framework of the project. However, it may be reasonable to assume that such areas are less likely to be subject to short-term management change and may remain more stable over time in terms of their fundamental characteristics used by the geese.

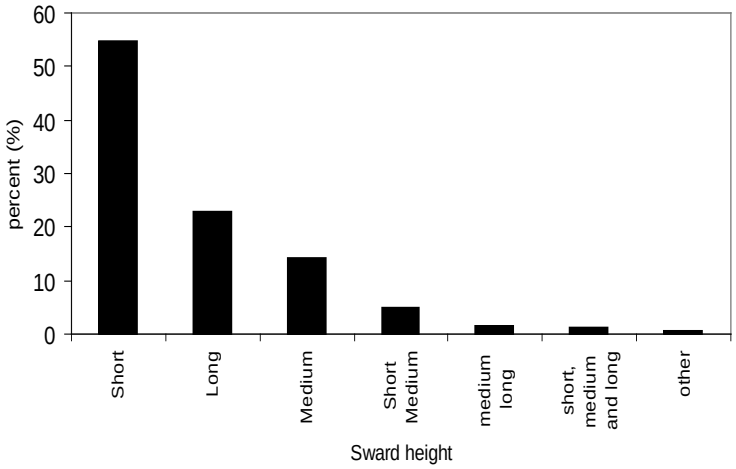
In summary, fields across all small sites were characterised as:

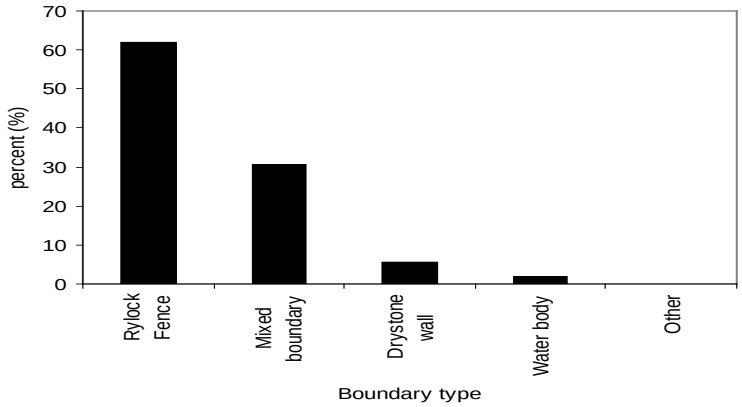
a) Being mostly improved grassland, with green/yellow grass (i.e. not as intensively improved as some fields) and a short sward,
b) Having no *Juncus* cover or less than 20% cover,
c) Having less than 20% cover of standing water,
d) Usually grazed, mostly by sheep, at less than 10 LSU/ha. However, most fields [71%] had no stock present during the winter survey visits, and complex movements of animals through the year, especially crofting areas, can make this difficult to assess without much more field-based information.,
e) Mostly bounded by rylock stock fencing.

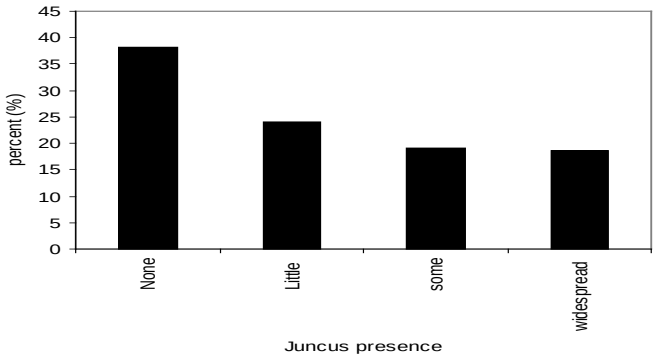
Summary of field characteristics across all fields at the suite of small sites

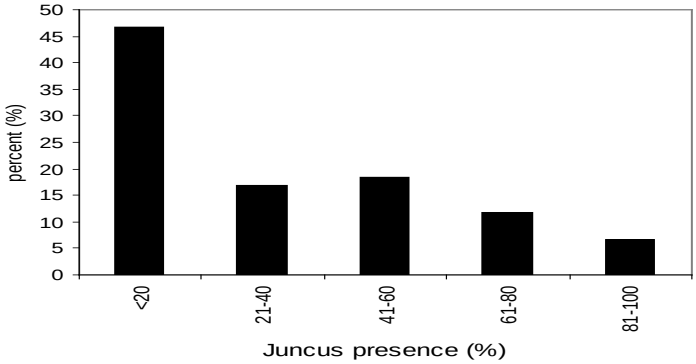


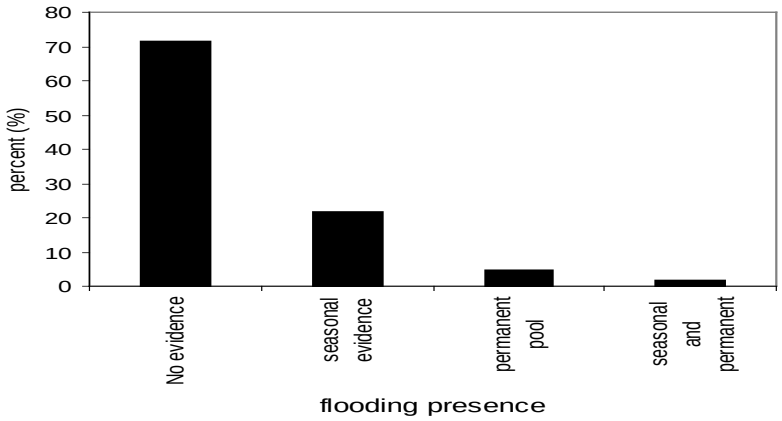


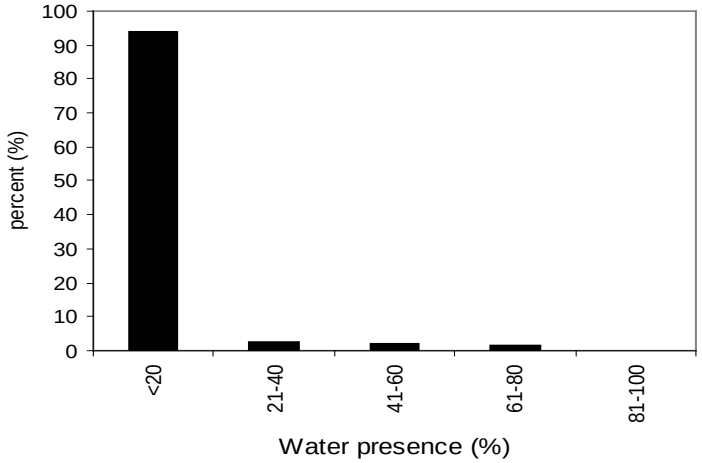


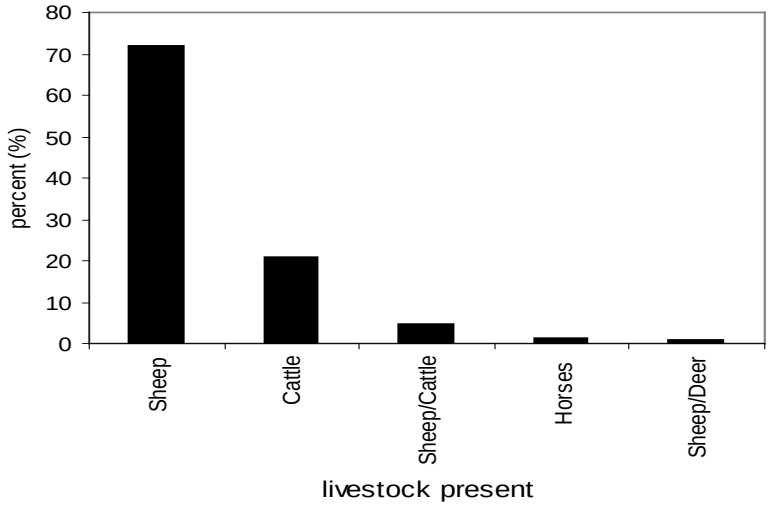

70
60
50
40
30
20
10
0
percent (%)
Rylock Fence
Mixed boundary
Drystone wall
Water body
Other
Boundary type

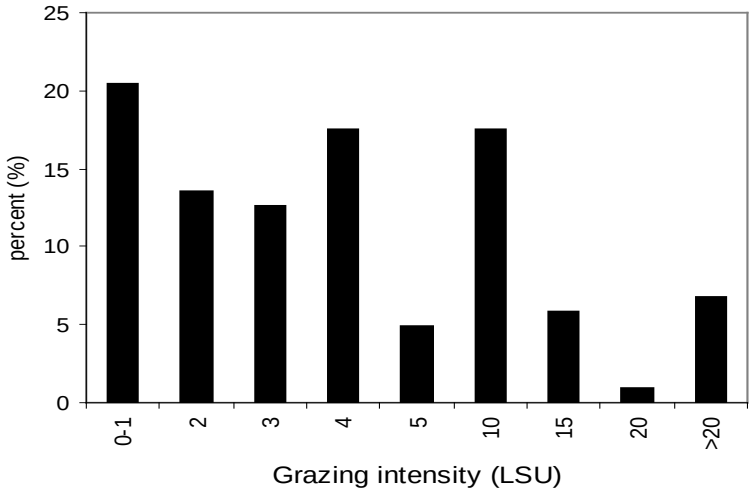

45
40
35
30
25
20
15
10
5
0
percent (%)
None
Little
some
widespread
Juncus presence


50
45
40
35
30
25
20
15
10
5
0
percent (%)
<20
21-40
41-60
61-80
81-100
Juncus presence (%)


80
70
60
50
40
30
20
10
0
percent (%)
No evidence
seasonal evidence
permanent pool
seasonal and permanent
flooding presence


100
90
80
70
60
50
40
30
20
10
0
percent (%)
<20
21-40
41-60
61-80
81-100
Water presence (%)


80
70
60
50
40
30
20
10
0
percent (%)
Sheep
Cattle
Sheep/Cattle
Horses
Sheep/Deer
livestock present

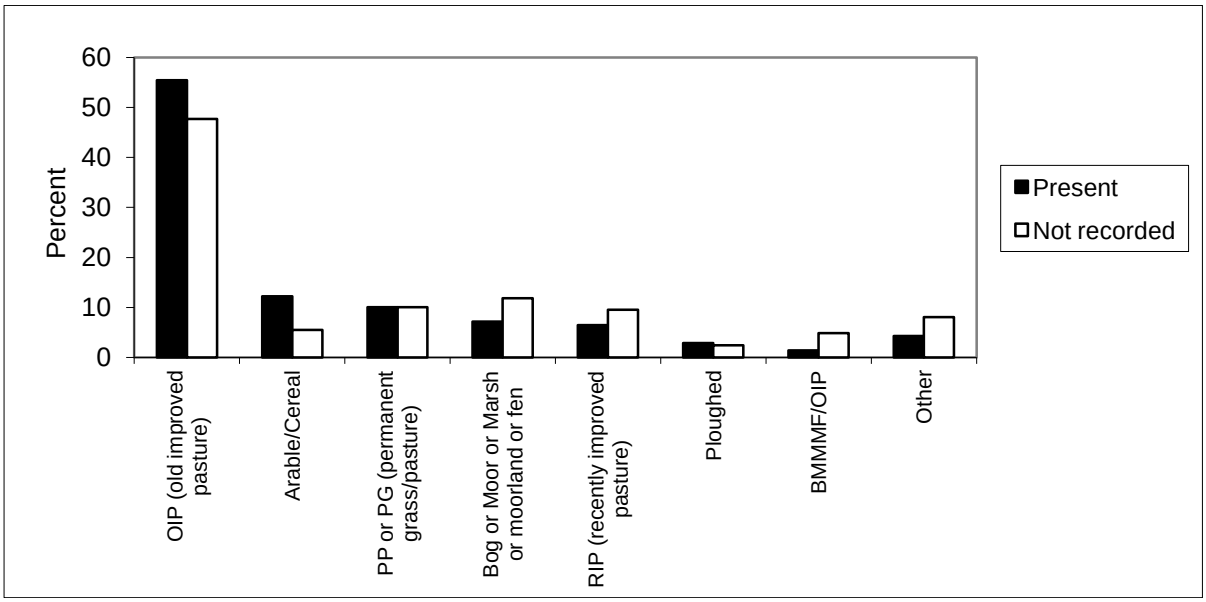

25
20
15
10
5
0
percent (%)
0-1
2
3
4
5
10
15
20
>20
Grazing intensity (LSU)

4.2.2.2. Differences between fields used and not used by the geese

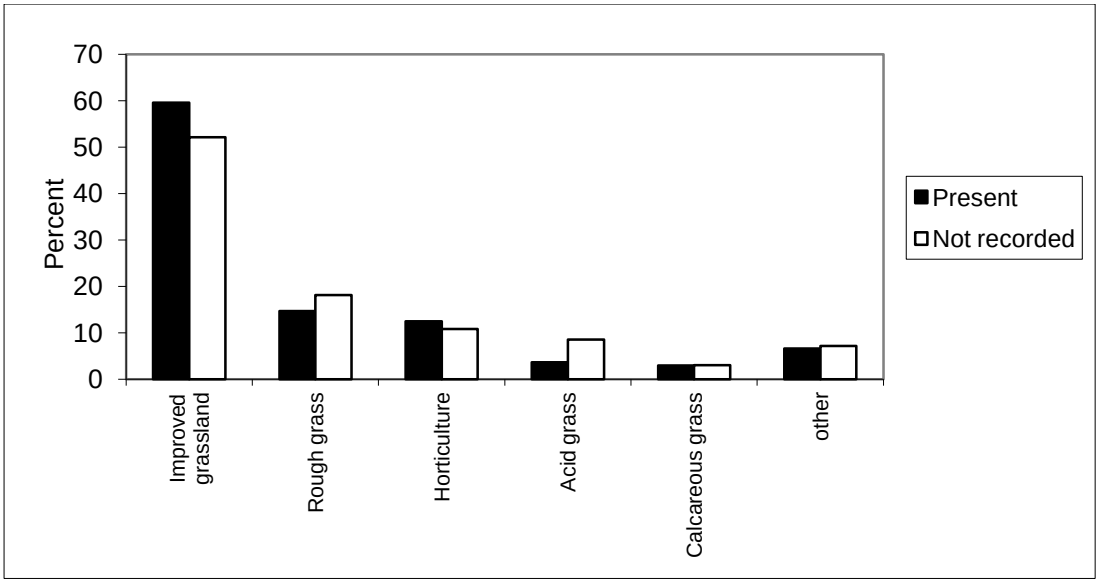
We examined the habitat characteristics of fields actually used by geese compared with those that were not. We should stress that the data underpinning field use by geese are not complete, as such information has not been gathered systematically and varies between sites. Many of the differences between fields used and not used are slight, suggesting that goose use reflects the general characteristics of the wintering sites, but some tendencies across all such sites are identified below. Generally the geese appear to select:

a) Improved land, classed as such by Land Cover classifications,
b) Older improved pastures within this category, according to our field classification, and also arable fields,
c) Greeny/yellow fields but seemingly not 'green' fields compared to those available,
d) Fields with shorter grass,
e) Fields with medium to high grazing intensities, rather than very low or very high,
f) Fields grazed by sheep, though data are sparse, and this preference may reflect greater prevalence of sheep in fields – this would require more detailed investigation,
g) Fields with no *Juncus* rushes, or if present, less than 40% cover; slightly less rushy than the fields available,
h) Fields with a little flooding, but reflecting the extent available; a slight preference for seasonal flooding rather than permanent,
i) Fields with a variety of boundary types (complex to interpret, so probably not clear cut).

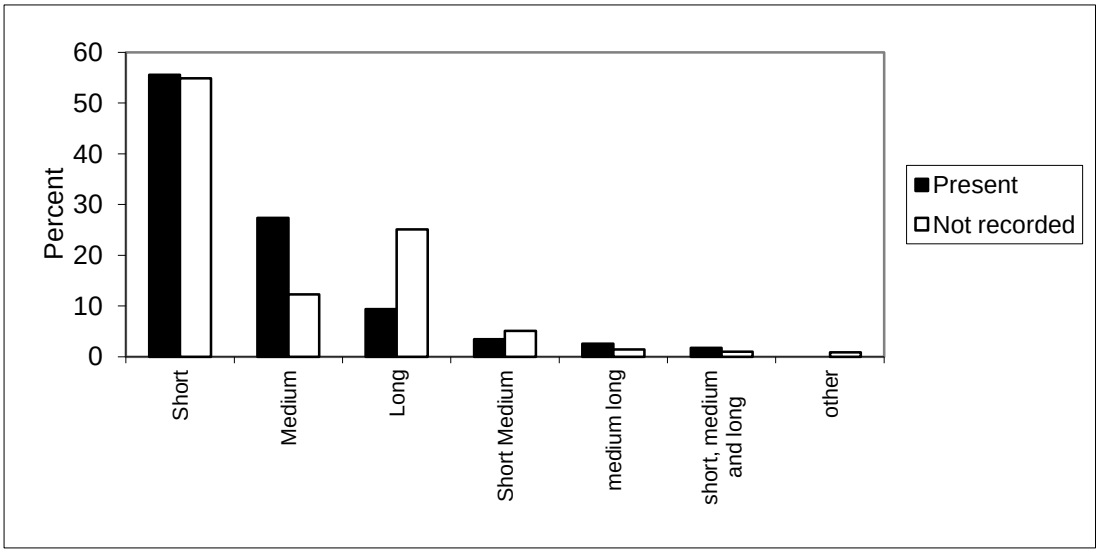
Some graphs illustrating these slight preferences are shown below, using 'present' to indicate fields used by geese and 'not recorded' to indicate those not used:



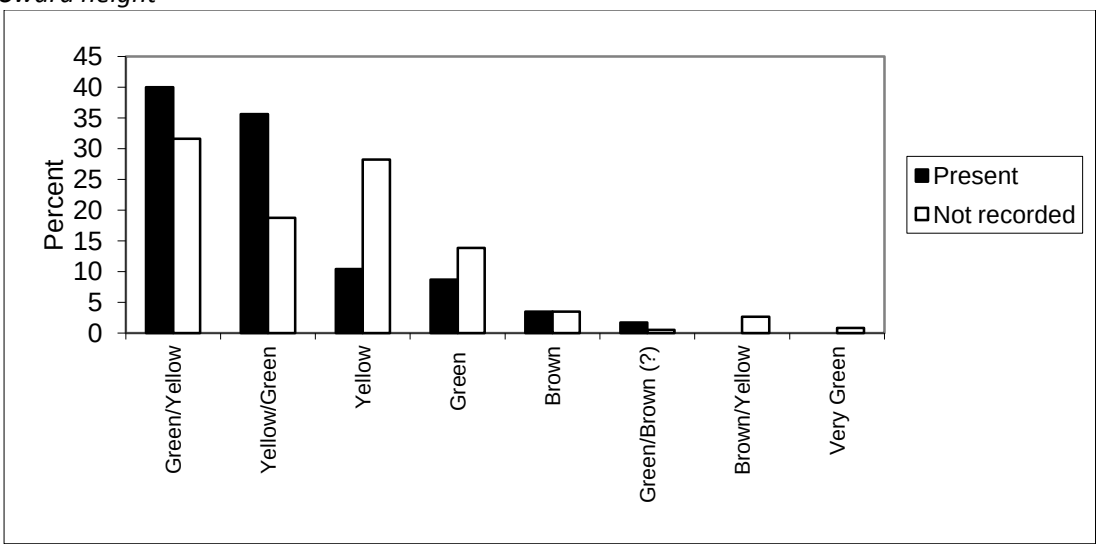
Habitat categories as classified in this project



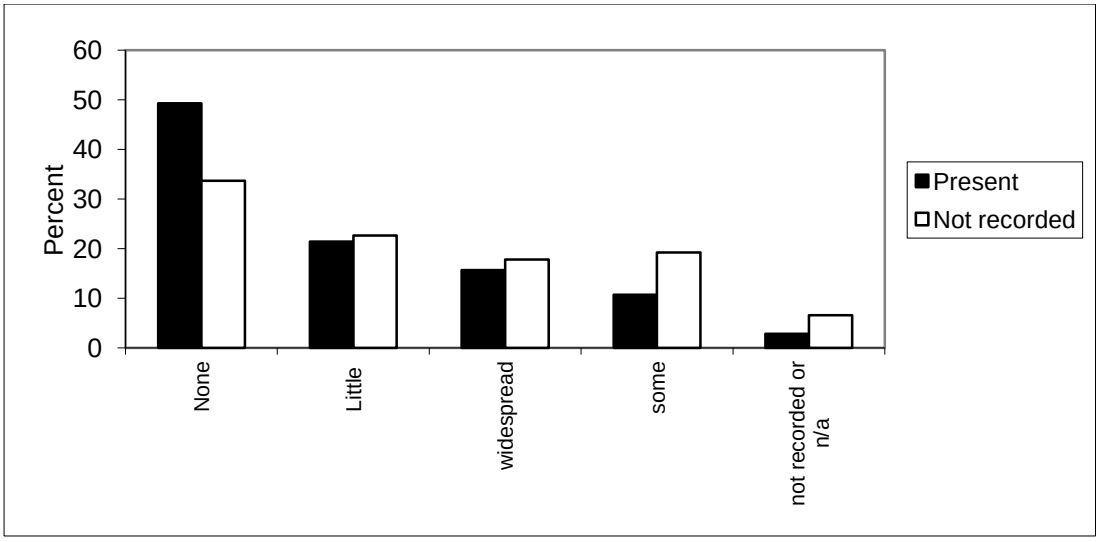
LCM2000 categories



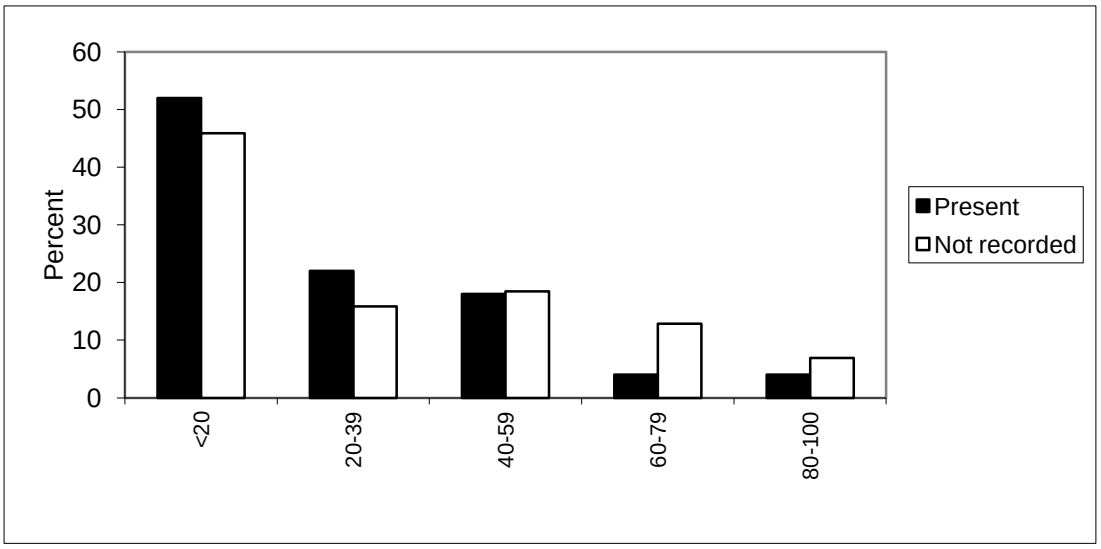
Sward height



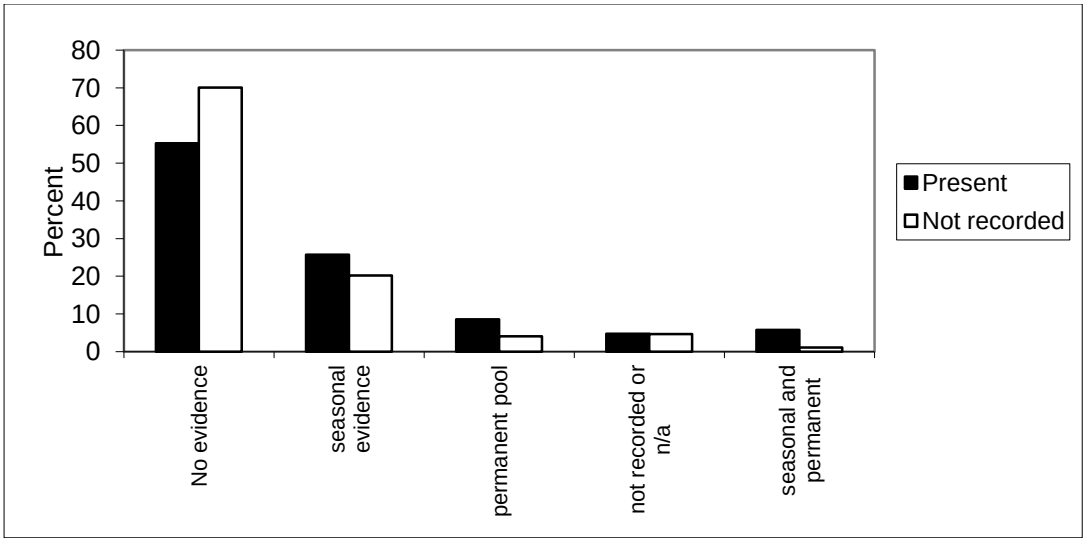
Sward colour



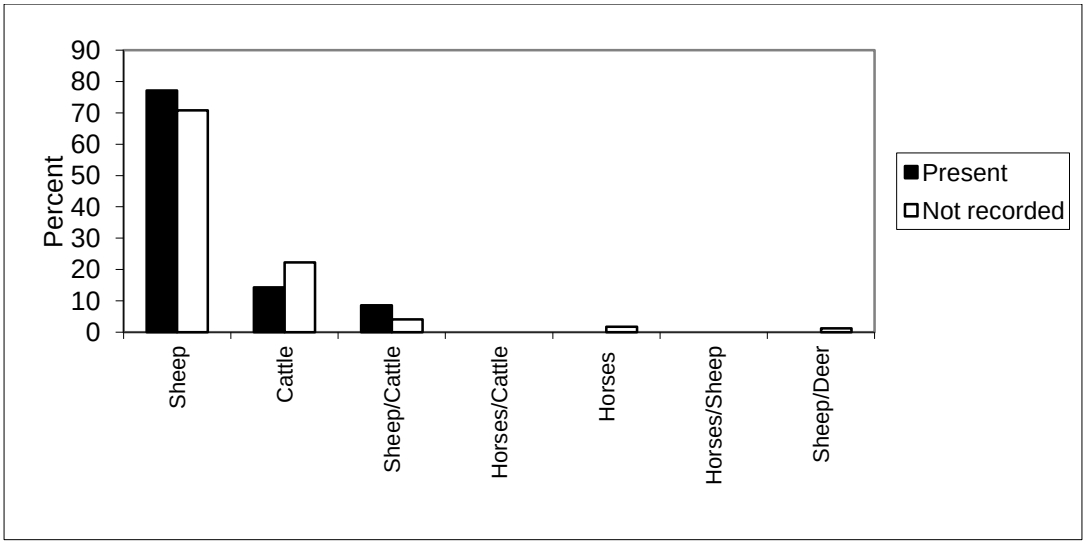
Juncus cover



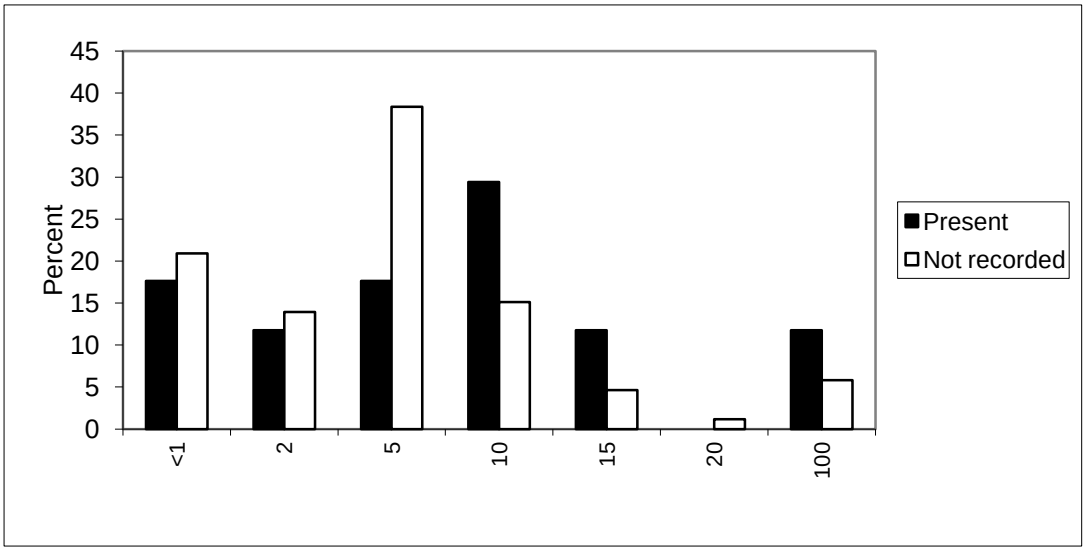
% Juncus cover



Extent of flooding



Livestock type



Grazing density (LSU)

These results appear to suggest that Greenland White-fronts are able to use a wide cross-section of the agricultural habitats that characterise the small sites, but within this, there seems to be a preference for slightly poorer quality improved grass fields, showing some seasonal inundation and with a short, livestock-grazed sward.

They appear not to prefer fields with very substantial cover of *Juncus effusus* rushes. We have tried to establish whether there is an optimal level of rush cover for the geese, but the information from our study, and the experimental results in Ridgill *et al*. (1994), do not allow confident statements to be made. It seems that intermediate levels of rush cover, perhaps 20-40%, appear to coincide with higher goose use, but this may be a surrogate for other factors associated with pasture improvement. We are sure though, that very high levels of rush cover are not preferred.

We suggest that reducing *Juncus* cover on some sites, together with permitting some degree of seasonal flooding in fields that are currently dry through much of the year, may open up more areas of preferred feeding habitat. Completely inundating sites, or relaxing grazing pressure, would appear not to be beneficial. These are not strong tendencies, however.

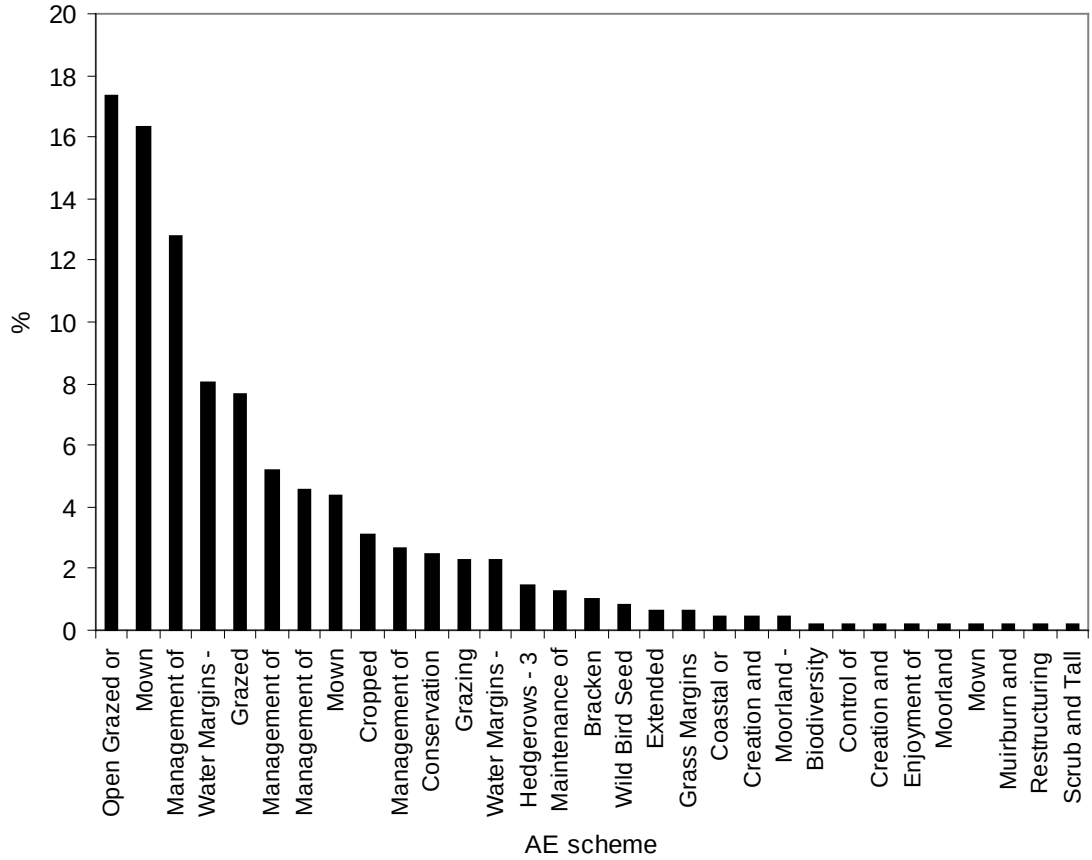
4.2.2.3. Agri-environment scheme options in place across all sites

Of the approximately 962 fields surveyed, approximately half (474 or 49%) were already under Rural Priorities measures to March 2010. The different schemes/prescriptions and % frequencies are shown in the following tables and graphs:

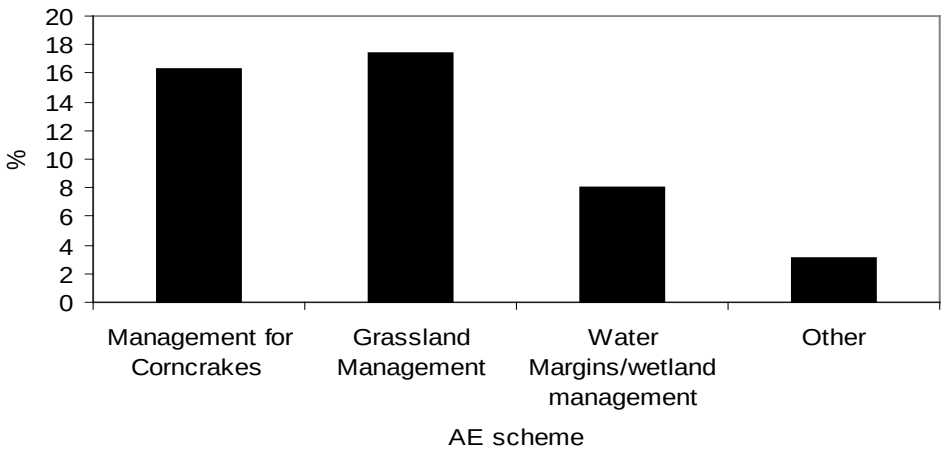
Agri-environment prescription	% frequency
Open Grazed or Wet Grassland for Wildlife	17.36
Mown Grassland for Corncrakes - 1 Aug	16.32
Management of Cover for Corncrakes	12.81
Water Margins - reduce diffuse pollution	8.06
Grazed Grassland for Corncrakes	7.64
Management of Wetland	5.17
Management of Species Rich Grassland	4.55
Mown Grassland for Wildlife	4.34
Cropped Machair - with FYM/seaweed	3.10
Management of Moorland Grazing	2.69
Conservation Management for Small Units - Individual	2.48
Grazing Management of Cattle - Retention	2.27
Water Margins - Enhance biodiversity	2.27
Hedgerows - 3 years for biodiversity benefits	1.45
Maintenance of organic farming - rough grazing	1.24
Bracken Management Programme for Habitat Enhancement	1.03
Wild Bird Seed Mix/Unharvested Crop	0.83
Extended hedges	0.62
Grass Margins and Beetlebanks - mixed arable	0.62
Coastal or Serpentine Heath	0.41
Creation and Management of Species Rich Grassland	0.41
Moorland - Stock Disposal	0.41
Biodiversity Cropping on In-Bye - basic management	0.21
Control of invasive non-native species - Rhododendron	0.21
Creation and Management of Cover for Corncrakes	0.21
Enjoyment of rural landscapes - restore built boundaries	0.21
Moorland Grazings on Uplands and Peatlands	0.21
Mown Grassland for Corn Buntings	0.21
Muirburn and Heather Swiping	0.21
Restructuring agricultural businesses	0.21
Scrub and Tall Herb Communities	0.21

although, the schemes can be lumped into some broadly similar categories:

Agri-environment prescription	% frequency
Management for Corncrakes	36.98
Grassland Management	30.17
Water Margins/wetland management	15.5
Other	17.35



Frequencies of various detailed agri-environment measures across Greenland White-front small sites (above) with broad categories (below). See Table, p.134, for full wording of AE scheme descriptions.



4.2.2.4. Implications of agri-environment measures for Greenland White-fronted Geese

Out of the 19 small sites, six of the smallest (Fidden, Moine Mhor, the two Jura sites, Broadford and Plockton) appear to have no current agri-environment measures in place. None of the measures at any site is aimed directly at Greenland White-fronts, which fall outwith the scope of SRDP priorities. Due to the multiple occurrence of measures in single fields, differing field boundaries, and some discrepancies in grid references, it is not possible to analyse the information according to the area of

each site covered. Establishing exactly how the measures adopted in the main prescriptions under SRDP summarised above affect Greenland White-fronts would be a major task which is beyond the scope of this project. Not only would it be necessary to know the extent of land involved and the overlap with areas used by geese (our knowledge is variable between sites), but each measure, with its set of prescriptions, would have to be examined in detail to assess the direct and indirect management implications for the geese. Such an exercise can only be done on a site by site basis, as part of an integrated management plan for the geese. It would also be necessary to take account of agri-environment measures aimed at other species and habitats when devising management for geese on the same areas.

4.2.2.5. Threats across all sites

We have relatively poor knowledge of current threats to the geese at these small sites. Certain common factors were certainly operative in the past, and have been identified in the site accounts as potentially influential. But much of that information dates from some years ago. Factors included disturbance from shooting, agricultural operations, scaring of other geese (and sometimes White-fronts), recreation, fishermen, low-flying aircraft and encroachment from development. Across the sites we covered, none of these was considered to clearly influence numbers or use of any of them, though they may have impacts at local levels within sites. The development of wind farms is an issue in Caithness and perhaps elsewhere, but their effects on the geese remain unknown. The impacts of longer term agricultural change are discussed in Section 5.

4.2.2.6. Conservation designations across all sites

Of the 19 sites, 10 are not covered by any formal nature conservation designation (one of these, at Plockton, is owned by the National Trust for Scotland). Designated sites (SSSIs, SPAs or SACs) overlap the other nine to varying degrees. In most cases, the areas designated are roosts, but some feeding areas are included, such as at Kentra and Claish Mosses at Loch Shiel. Most agricultural feeding areas are not included in designated sites.

5. Discussion

In most cases, we could find no obvious reason why goose numbers at any of the small sites should be low or declining. At all sites, there did not appear to be any clear habitat-related limit to suitable areas that the geese could feed or roost in. Often, very small numbers of White-fronts were found within an extensive landscape of apparently suitable or even apparently optimal habitat. There was a weak tendency for the geese to select certain characteristics of the fields available, and this may suggest some possible management options to investigate (see below). But there are probably certain inherent properties of small goose populations that could be important in attempting to understand the current situation, and stochastic events affecting a small proportion of birds are likely to be disproportionately influential in small flock dynamics.

5.1 Biological aspects of small flock dynamics

Greenland White-fronted Geese divide their annual cycle between the summering areas in west Greenland, staging areas in Iceland during spring and autumn and the winter quarters during the remainder of the non-breeding part of the annual cycle. For convenience and to support management actions on the winter quarters, we find it useful to define the global population in terms of wintering flocks, not least because our knowledge from individual marking shows that birds are highly faithful to their winter quarters. Studies of marked individuals show that approximately 85% of birds seen at a winter site in one year will also occur at the same site next winter (if they are reported in the second year) and many shift winter resort when they pair up (Warren *et al*. 1992, Marchi *et al*. 2010).

Different flocks have shown different trends over the years, with not all flocks changing in similar ways to the overall trends in the global population. The flocks associated with the most highly intensively managed farmland have tended to show the highest breeding success and the production of greatest numbers of young (Fox *et al*. 2005), so during the period of increase, these flocks tended to show more rapid rates of increases than stable flocks. Indeed, during the same time period, some flocks were showing declining trends despite increasing numbers overall (Fox *et al*. 2005).

The wintering population therefore represents a classic “meta-population” consisting of a series of relatively stable groups of birds using discrete areas, but which do not necessarily track the rates of change of the population as a whole. Each unit behaves slightly differently to others because of its environmental circumstances. Vital rates (i.e. birth rates and death rates) of the different flocks may be subject to different sources of regulation or limitation because of the geographical location of their members throughout the annual cycle or because of other prevalent conditions, with the result that flocks can show contrasting patterns during periods of boom or bust in the population as a whole.

Similarly, if wintering conditions at a site are less than suitable, geese may opt to shift to better sites, for example, where the food supply is better or disturbance at a site is less. Differences in annual immigration and emigration rates may also therefore play a role in annual rates of change in abundance of a flock, differences which may well be linked to site quality, but also the population as a whole. For instance, Marchi *et al*. (2010) showed that during years with high fecundity, i.e. large absolute numbers of young birds in the winter flocks at the most important wintering site at Wexford, young geese were more likely to disperse to sites elsewhere in the wintering range. Since Wexford is well known to be the largest single resort for the population and shows higher reproductive success than most flocks, this means that in many years, Wexford probably functioned as a “source” of young birds that were able to disperse and supplement other flocks. Although we

know something about emigration rates from Wexford, lack of marking at many of the other flocks has made it difficult to estimate the annual exchange rates of geese moving between flocks. For some of the smaller flocks, where reproductive rates are not high, it may be that in the past regular immigration from larger sites such as Wexford, has enabled survival amongst groups of birds where the mortality rate would otherwise have exceeded the recruitment of new young birds into the flocks.

What we do know (in the absence of extensive information about survival, immigration and emigration rates in all but the Wexford wintering group) is that in the 1990s, more southerly flocks in the wintering range with restricted feeding opportunities and higher levels of disturbance were showing the most serious declines, and that small flock size was also associated with a higher likelihood for dramatic declines (Fox *et al.* 1998). Seven wintering sites were abandoned between 1982 and 1995 in this otherwise highly site-faithful species, and several others have teetered on the edge of being abandoned since.

Historical evidence suggests that the very fact that a flock is small makes it more likely to abandon a site (although not necessarily always - see below), but the analysis presented here begins to suggest that some of the larger flocks are also exhibiting rapid declines and may be in equal jeopardy compared to the numerically smaller flocks. The analysis of productivity showed that flocks associated with low intensity agriculture and natural wetlands tended to return to the winter quarters with fewest young. Whether this is associated with the movement of successful breeders to better quality wintering sites, or the inability of individuals within these flocks to reproduce as often as those at better sites, we do not know. However, this difference is significant, because the flocks using these habitats are almost always smaller in size than those using the better quality farmland habitats. Hence, although the small flock size is not necessarily the *cause* of declines, the relative lack of young birds in these flocks compared to the large flocks means that they are more vulnerable. This is similar to, but not exactly the situation that creates the so-called Allée Effect, (Stephens *et al*. 1999) where reproduction (and in some cases survival) rates of individuals decreases with population density. It is typical to see small flocks returning from the breeding grounds with no young for a number of years in a row, then for the geese to return with one or two families in a single year. In a large aggregation, such as at Wexford, this makes little difference, but clearly such a pattern in a small flock can create large relative differences in year to year abundance. Typically a flock will show a long slow decline (as in the case of the Moine Mhor or Loch Shiel flocks), with small boosts in total number when the group returns with young, because a couple of broods in a small flock of geese makes a major difference to flock size.

The problems associated with the small flocks may have become even more acute in recent years, when there has been prolonged reduction in overall reproductive success in the population (thought linked to poor spring conditions on the breeding grounds - Boyd & Fox 2008). This has meant that not only are there even fewer goslings being brought back by these flocks, but there are far fewer birds emigrating from the larger groups than in former times when the population was larger and breeding success higher than in the last 15 years (Fox *et al*. 2006; Marchi *et al.* 2010). In addition, if their winter habitat means they are less fit and have accumulated fewer stores of energy and nutrients than those birds at better quality sites, then birds wintering in small flocks may be disadvantaged if they have to compete for resources on the spring staging areas in Iceland and later in west Greenland. Birds in poorer condition during migration may be less competitive and hence less able to displace stronger, fitter birds from better resources, which may have an adverse effect on the condition of the female and her ability to breed when she finally reaches her nesting area. If emigration rates are also higher amongst these flocks, it is clear they experience particular problems with surviving.

There are also compounding problems associated with such a situation, where a population is comprised of small sub-populations. If the sub-populations are subject to different environmental variations (i.e. separated enough that a disaster could occur at one sub-population site without affecting the other sub-populations) but still allow individuals to travel between sub-populations, then the individual sub-populations are more likely to go extinct than the total population. In the case of a catastrophic event decreasing numbers at a sub-population, individuals from another sub-population site may be able to repopulate the area, but this depends on a healthy supply of geese from large flocks supplementing those at the smaller groups. Hence, for example, a catastrophic die-off of 30 birds at Islay or Wexford (due for instance to a localised pollution event, outbreak of disease or natural disaster) would have little effect on the overall population there, but would be catastrophic to one of the smaller flocks. If the likelihood of Wexford geese emigrating to a very small or abandoned flock range was small, then the probability of survival would be very low indeed.

For these reasons, we have concentrated on the well-being of the small and indeed the smallest flocks, but as can be seen, some of the middle sized flocks are also showing rapid declines during the period of recent depression in reproductive success. It remains unclear why flocks that numbered 70-80 geese consistently in the past (as was the case at Loch Eye during the 1970s and 1980s) should abandon the wintering site in the following decade, especially when this flock fed with other goose species on intensively managed farmland. Nor is it clear why some flocks appeared to go extinct, only to appear again (as is the case of the group on Benbecula). Flocks have continued to abandon sites in southern Ireland where the potential causes have been difficult to identify, especially as some have formerly contained larger numbers than those considered here amongst Scottish small flocks. By comparison to the Irish flocks, the Scottish flocks have generally done better, and fewer have disappeared. Abandoned sites include Sullom Voe on Shetland (established since the 1980s and therefore potentially a new artificial site), Tankerness on Orkney, Lochs Meadie, Scarmclate and Winless in Caithness, and possibly Plockton (see above). Newly-colonised discrete sites on Kintyre have further spread the risk in that area, where the larger previous flocks have been expanding more than at other resorts during the last 20 years.

5.2 Habitat change, particularly in agricultural areas

It is likely that long-term habitat change has affected the suitability of the wintering habitat at all the small sites considered here, both in positive and negative ways. Some of these longer-term changes have been identified in the site accounts, but in others, such changes can only be surmised. Compared with say 50 years ago, it is likely that most sites have seen, for example, substantial amounts of agricultural improvement, drainage, reseeding, changes in stocking rates, the development of buildings and associated disturbance and increased tree planting nearby. While many fields have become more intensively used, others have been abandoned from periods of former intensive use and have often become dominated by *Juncus* rushes. In some crofting areas, there are now far fewer people using the land than would have been the case in the past, and Greenland White-fronts often use areas that show signs of former agricultural management but which are not used so now.

The White-fronts, like other goose species, have also responded to increases in fertiliser application rates in recent decades (though again, these may be decreasing again), as well as reseeding with newer grass varieties. At some of the small sites, peat bog habitats still form part of their winter feeding range, but at most locations, most geese feed for most of their time on agricultural land. We have insufficient information about how habitats have changed over the past few decades at any of the sites we visited. Therefore, we rarely make categorical statements on how any particular changes have affected geese at a given site. In the recommendations that follow in Section 6, we

have attempted to use the information gathered during the small sites study to list those actions which we consider may have beneficial consequences for the geese.

It is possible that factors operating elsewhere are the most important influences on White-front numbers in Scotland. However, conditions on these small wintering sites should have *some* impact on their use by the geese, and we hope that our recommendations will help improve these conditions. But in the absence of clear experimental evidence of winter management impacts on the geese, any actions will be based principally on anecdotal information.

6. Conclusions and recommendations

6.1 General recommendations

The most important issue is to keep 'small site' management options as wide as possible.

- There is a need for smaller scale, more flexible goose management arrangements in areas where Greenland White-fronted Geese occur in isolation, perhaps where other geese are absent or only present in small numbers. All such areas should have a management plan aimed at the specific requirements of a particular flock, drawn up using local knowledge.
- This could take the form of either a further dedicated goose scheme, or appropriate options under SRDP. Ideally these would be non-competitive when dealing with Annex 1 species. They should be offered as both LMOs and Rural Priorities, depending on option complexities, and the issue, in appropriate RPAC areas, should be listed as a regional priority.
- Ideally, specific SNH management agreements should still also be possible. This option has generally been removed due to 'integration' of such arrangements within SRDP. If possible, it should be reinstated. There is more flexibility and probably greater effectiveness and value for money in such targeted arrangements than there is in say 'unmonitored' LMO payments.

Actions at individual small sites are likely to depend on site-specific requirements, hence the idea of developing Greenland White-front management plans for each. Issues that may need to at least be considered include:

5. Integration of Greenland White-fronted Goose management on sites which are designated and managed for other natural heritage reasons. It is important to ensure that management aimed at the geese does not conflict with the conservation objectives for other species and habitats.
6. Consideration of agricultural land management, including issues such as reseeding and drainage and disturbance, as well as potential changes in stocking densities over the long term (e.g. reduction in numbers of grazing animals in the Western Isles to a point where insufficient grazing of favoured fields takes place).
7. Interactions with other goose species, either directly or indirectly through hunting disturbance of other species, as well as possible behavioural factors. Improving fields for Greenland White-fronts may have the additional effect of attracting increasing numbers of local or Icelandic Greylag Geese (and for example, at Moine Mhor, increasing numbers of Canada Geese). Thus, a farmer may be reluctant to continue goose grazing improvements for White-fronts if they also attract unwanted goose species.
8. Obtaining a better idea of field use at all the small sites. As shown above, our knowledge of this is often unsatisfactory, and local studies would help understand the situation much better, and lead to more accurate management recommendations.

6.2. Possible management actions at small sites

The list below includes a variety of potential issues that may be worth reviewing within site management plans at some or all sites holding small numbers of Greenland White-fronts. Some of these may already be covered by Rural Priorities options under SRDP, others possibly through direct agreements with SNH. In some cases, other mechanisms might be found.

General

18. Management plan preparation – management plans for each individual winter resort, including integrated species and habitat planning which takes into account other features such as Corncrakes in overlapping SPAs. These would include all factors below if necessary and would be sensitive to each site's requirements. In some cases, management planning would be at the scale of individual fields.
19. Production of a Greenland White-front management advice sheet, to be given to farmers with the birds on their land, explaining their status and requirements, and suggesting management good practice. This may help with more directly sympathetic land management, as well as raise the profile of the species amidst increasing numbers of other more problematic geese.
20. Monitoring of management and its effects at any site where this takes place should be undertaken.

Land management

21. *Juncus* rush topping and removal, especially when extensive or dense (perhaps >40% cover). This may need to be sustained over several years. May overlap into breeding wader prescriptions.
22. Reseeding and fertilising of selected plots, which may include seaweed spreading. This would need to be carefully applied and monitored, and the impacts on other aspects of the natural heritage assessed beforehand.
23. Control of slurry application management at certain sites. This can render fields unsuitable for a period if done at large scale.
24. Drain blocking/wetland expansion, pool creation, mixed with suitable feeding habitats.
25. Fence removal or re-spacing in areas where field divisions may make edges less attractive.
26. Hay cropping, silage cutting and aftermath grazing regime – individual site actions, if needed.
27. Changes to livestock grazing (stock type and intensity) – individual site actions, if needed.
28. Arable/grassland balance, including root crops as well as cereals. Ploughing up of grasslands and conversion to cereals/stubble may have adverse effects in places, so this needs to be planned in relation to goose use. Conversion to maize is also likely to be adverse and needs to be considered.
29. Rabbit control, if necessary.
30. Farm woodlands and scrub. Avoid planting so as to affect feeding areas or cause deterrence from preferred areas (this is relevant to the currently uncontrolled LMO woodland options). Manage scrub encroachment into feeding fields where relevant.

Disturbance reduction

31. Disturbance management – general disturbance including recreation, wildfowling and fishermen – disturbance reduction strategy, where relevant on site by site basis.
32. Undisturbed refuges and carefully channelled routes for footpaths.
33. Recreation signage and local leaflets.
34. Consideration of management of impacts of other geese on Greenland White-fronted Goose usage. This may be through competition or through association (i.e. White-fronts being considered as part of a wider goose 'issue' affecting farmers actually caused mainly by Canada Geese or Greylags). In most cases clear actions will not be apparent or feasible, but the issue needs to be considered at some sites, including in a public affairs sense.

6.3. Priority sites for management and conservation action

In Section 4.2.1 above, we suggested that some sites are more vulnerable than others, on current trends, to risk of extinction. In the table below, we develop this and suggest some possible management to consider on some of the sites, ranked in what seems the most sensible order of priority, taking into account population vulnerability as well as the feasibility of any actions. We stress though, that if any of these are pursued, more detailed investigative work should be carried out to improve baseline knowledge, especially of site use and management history.

A prioritised list of small sites for conservation action, with actions tabulated for each with timescale and estimated cost.

Site	Priority	Possible actions	Timescale and approximate cost
Stranraer	High	Crop planning, undersowing	2011-2012; <10K?
Colonsay and Oronsay	High	Reseeding; rush cutting	2011-2012; <10K?
South Uist (Kilpheder & Askernish)	High	Rush cutting, patch reseeding	2011-2012: <£5K
Loch Ken (Galloway)	High	Scrub clearance, undersowing, some fertilising	2011-2012; <£10K
Orkney (Loons)	High	None; management plan?	2011-2012; <£2K
Moine Mhor (Lochgilphead)	High	Rush cutting	2011-2012; <£1K
Skye (Loch Chaluim Chille, Skeabost – Loch Snizort)	Medium	Rush cutting, partial re-wetting	2011-2012; <£10K
Skye (Broadford)	Medium	Built development control	n/a
Jura (Lowlandman's Bay)	Medium	Rush cutting	2011-2012; <£1K
Caithness (Westfield, Broubster)	Medium	None; management plan?	2012-2013; <2K
Caithness (Loch of Mey)	Medium	None; management plan?	2012-2013; <2K
Loch Shiel (Lochaber)	Medium	None; management plan?	2012-2013; <2K
Mull (Fidden)	Medium	None; management plan?	2012-2013; <2K
Benbecula (Nunton)	Low	Rush cutting	2012-2013; <3K
Lewis (Loch Urrahag)	Low	None; management plan?	2012-2013; <2K
Mull (Loch Assapol)	Low	Rush cutting	2012-2013; <1K
Jura (Inver)	Low	None	n/a
Plockton (Kyle of Lochalsh)	Low, n/a?	None; prob. abandoned	n/a
Orkney (Tankerness)	n/a	None; abandoned	n/a

Acknowledgements

We thank Scottish Natural Heritage for funding and support for this study. Christine Urquhart provided guidance, information and comments on the report, and the SNH GIS team provided further site-based data.

We thank local counters and others who provided feedback on our assessments and suggestions – Pat Batty, George Christie, John Dye, Alison Graham, Tracey Johnston, Stan Laybourne, Alison MacLellan, Bob McMillan, Brian Neath, Bill Neill, Malcolm Ogilvie, Brian Rabbitts, Chris Rollie, Andrew Stevenson and Arthur Thirlwell.

Martin Scott, Mike Peacock, Paul Tarling (RSPB Scotland), as well as commenting on drafts, also provided field information for Greenland White-front sites on Lewis, Colonsay/Oronsay and at Stranraer. Baz Hughes kindly commented on the entire text.

References

Atkinson-Willes, G.L. (1963). *Wildfowl in Great Britain*. Nature Conservancy Monograph No.3. HMSO London.

Berry, J. (1939). *The status and distribution of wild geese and wild duck in Scotland*. University Press, Cambridge.

Boyd, H. & Fox, A.D. (2008). Effects of climate change on the breeding success of White-fronted Geese *Anser albifrons flavirostris* in West Greenland. *Wildfowl* 53: 55-70.

Clark, M. (1977). Canada Geese breeding and other geese wintering on the island of Colonsay. *Western Naturalist 1977: 103*.

Clarke, J. & Clarke, P. (1990). *Greenland White-fronted Geese on Colonsay and Oronsay*. pp.19-21 In: GWGS Research Report No.7. Greenland White-fronted Geese in Britain 1987/88-1989/90. GWGS, Aberystwyth.

Cunningham, W.A.J., Stroud, D.A. & Fox, A.D. (1990). Greenland White-fronted Geese in the Outer Hebrides. *Hebridean Naturalist 10: 64-68*.

Dickson, R.C. (1996). Greenland White-fronted Geese in Wigtownshire. *Dumfriesshire & Galloway Natural History & Antiquarian Society Transactions III 71: 5-10*.

Fox, A.D., Norriss, D.W., Stroud, D.A., Wilson, H.J. & Merne, O.J. (1998). The Greenland White-fronted Goose in Ireland and Britain 1982/83-1994/95: Population change under conservation legislation. *Wildlife Biology* 4: 1-12.

Fox, A.D., Madsen, J., Boyd, H., Kuijken, E., Norriss, D.W., Tombre, I.M. & Stroud, D.A. (2005). Effects of agricultural change on abundance, fitness components and distribution of two arctic-nesting goose populations. *Global Change Biology* 11: 881–893.

Fox, A.D., Stroud, D.A., Walsh, A.J., Wilson, H.J., Norriss, D.W., Francis, I.S. (2006). The rise and fall of the Greenland White-fronted Goose: a case study in international conservation. *British Birds* 99: 242-261.

Harding, N and Laybourne, S (1995). *Greenland White-fronted Geese and Whooper Swans in Caithness during the 1994/95 Winter*. Report to SNH.

Harvie-Brown & Buckley, T.E. (1887). *A Vertebrate Fauna of Sutherland, Caithness and West Cromarty.* David Douglas, Edinburgh.

Jardine, D.C., Clarke, P. & Clarke P.M. (1986). *The Birds of Colonsay and Oransay. Their History and Distribution.* Privately Published.

Laybourne, S. (1997). *Survey of winter wildfowl using Caithness Lochs proposed Special Protection Area and Ramsar Site*. Unpublished report to Scottish Natural Heritage.

Laybourne, S. & Fox, A.D. (1988). Greenland White-fronted Geese in Caithness. *Scottish Birds 15: 30-35*.

Laybourne, S and Legg, M.I.H. (1994). *Numbers and Behaviour of Greenland White-fronted Geese in Caithness with Special Reference to Daily Routines of Roosting and Feeding. Winter 1993/94*. Report to SNH.

Marchi, C., Sanz, I.F., Blot, E., Hansen, J., Walsh, A.J., Frederiksen, M. & Fox, A.D. (2010). Between-winter emigration rates linked to reproductive output in site-faithful Greenland White-fronted Geese. *Ibis* 152: 410–413.

Murray, I.M. (1954). Notes on the birds of Skye. *Glasgow and West of Scotland Bird Bulletin 3(1): 6-13.*

Ridgill, S.C., McKay, C.R. & Rees, E.C. (1994). *Greenland White-fronted Geese wintering on Islay*. Report to Scottish Natural Heritage from Wildfowl & Wetlands Trust, Slimbridge. 167pp.

Ruttledge, R.F. & Ogilvie, M.A. (1979). The Past and Current Status of the Greenland. White-Fronted Goose in Ireland and Britain, *Irish Birds*, 1:293-363.

Stephens, P.A., Sutherland, W.J. & Freckleton, R.P. (1999). What is the Allée effect? *Oikos* 87: 185-90.

Thompson, K. & Harding, N.J. (1994). *Winter bird surveys on proposed Special Protection Areas in Scotland*. Report 3: Winter Goose Surveys in Kintyre, Wigtownshire and Flanders Moss. Report by RSPB to Scottish Natural Heritage

Warren, S.M., Fox, A.,D., Walsh, A. Merne, O.J. & Wilson, H.J. (1992). Wintering site interchange amongst Greenland White-fronted Geese *Anser albifrons flavirostris* captured at Wexford Slobs, Ireland. *Bird Study* 39: 186-194.