



**Svalbard Barnacle Goose distribution around
the Solway Firth 2016-2017: Flock counts
from the Solway Goose Management Scheme
area**

WWT Conservation Programmes Report

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Executive Summary

A total of 14 route counts were carried out in winter 2016-2017 within the Solway Barnacle Goose Management Scheme area. Flock counts were made for all goose and swan species encountered, with flocks assigned to fields by code. The times of day, the days of the week and the starting points at which the counts were conducted were varied as much as possible to avoid bias in terms of when a section was surveyed. Instances of direct disturbance clearly aimed at the geese and of conversations with farmers were also noted. Data are also presented on the coordinated Solway population (JNCC) counts of the Svalbard Barnacle Goose *Branta leucopsis* and on brood size and productivity estimates for this population. The adopted total for this population wintering on the Solway Firth was 41,700 geese (the mean of two counts that were within 10% of the maximum of 43,425 recorded, rounded up to the nearest 100), an increase of 700 birds on last winter's adopted estimate of 41,000 geese. This continued increase in the population was due to high reproductive success in 2016. Count conditions were reasonably good in 2016-2017 and the geese made little use of areas outside their usual range and were thus well covered by the counter network. Mean brood size was 1.9 (range 1-4 goslings; 67 families sampled) goslings per family – which is not significantly different to the current ten year mean of 2.0 (S.E. \pm 0.1), with an average productivity of 16.0% - which is significantly higher than the current ten year mean of 9.2% (S.E. \pm 1.2; range 0.0-42.5% young; 15 flocks and 7,352 birds sampled). This compares to 1.9 goslings per family and 7.8% young for the previous winter.

1 Introduction

The Solway Firth is an internationally important site for a number of wetland bird species being a key site for the wintering Svalbard Barnacle Goose population. By mid-winter, 99% of this flyway population utilise five main sites around the Solway, with three of those being on the north side of the Firth, including Caerlaverock, Kirkconnell (Nith) and Southwick. This century with the growth of the population to over 40,000 birds, the distribution has spread west towards the Outer Solway with geese now visiting the areas around Colvend, Auchencairn and Rascarrel on a fairly regular basis in most winters, with significant flocks at Wigtown typically from late February to early April.

The Cumbrian saltmarshes west of Rockcliffe Marsh also accommodate a larger number of this increasing goose population for a longer duration. On Rockcliffe Marsh itself, gatherings of up to 30,000 barnacle geese have been recorded in late April/early May immediately prior to the spring departure north. Parts of this flock can utilise nearby fields and saltmarsh in the Gretna, Redkirk and Baurch area on the Scottish side of Solway.

During the winter, on the Scottish side of the Solway, the geese mainly feed within established nature reserves or within the Solway Barnacle Goose Management Scheme area, often choosing stubbles in early autumn and improved pastures and saltmarsh throughout the rest of the winter. SNH has run this management incentive scheme on the Solway since 1995 in order to integrate farming and goose grazing needs on areas of improved agricultural land. On land entered into the Scheme, tiered payments are made to help cover the extra costs of managing the land for Barnacle Geese. Fields are classified as 'Feeding', 'Buffer' (which receive a tiered payment) or 'Scaring' (non-payment) zones depending in large part on the typical level of winter goose use. Controlled scaring is encouraged in the non-payment zone during the winter to try to keep the geese within the feeding or buffer zones. Scaring is also permitted throughout April within the Scheme area, as due to budgetary constraints imposed since 2012 and then again in 2014, fields in the Scheme area no longer receive goose management payments for April.

1.1 Objective

The overall objective of the survey is to assess the distribution and abundance of the Svalbard Barnacle Goose and other goose and swan species on the fields and saltmarsh of the north side of the Solway Firth in relation to the Solway Barnacle Goose Management Scheme area.

2 Methods

2.1 Management Scheme route counts

Counts were carried out within a 14-day cycle and the starting points were varied to prevent counting any area at the same time of day, with count days spread evenly throughout the week including weekends. Geese and swans in larger flocks were counted in tens on a tally counter, while those in smaller flocks of <100 were counted individually. All flocks were mapped and coded according to the SNH convention on the field maps provided. Each day was broken down into four counting periods to cover the four main count areas (**Table 1**), starting at first light with allowance made for weather conditions, e.g. geese tend to be slow to move off the roost during periods of frost such as those geese flying off the Blackshaw Bank roost to utilise fields up the River Nith at Greenmerse and Kirkconnell. The time of observer arrival at each count section was recorded. Where significant numbers of geese moved during a count, the field the geese moved from and to was recorded with a “Comment” added within the Excel spreadsheet provided. Observations of leucistic geese and other goose species of note have also been added.

As agreed with SNH, in a modification to the previous methodology, only data from the official Scheme count days are included in this report as coded field counts. Summary census counts for the whole Solway and reproductive success estimates as provisioned under the Goose and Swan Monitoring (GSMP¹) contract are also provided in summary form for reference. The count route repeated every 14-days covered areas to the east as far as Hurlkedale and to the west as far as Colvend. Significant use of any fields outwith the intensive survey area was noted during the census counts.



Figure 1. The Inner Solway Firth showing the main areas surveyed during the SNH Solway Goose Management Scheme counts (black polygons). Site names are referred to in the text and also cover those areas surveyed during the coordinated JNCC census counts. For mapping clarity, Wigtown Bay and RSPB Crook of Baldoon are not shown as they are 20km to the west of Borgue.

¹ The GSMP is organised by the Wildfowl & Wetlands Trust (WWT) and funded in partnership with the Joint Nature Conservation Committee (on behalf of NRW, NE and DAERA Northern Ireland) and Scottish Natural Heritage.

Areas where there are difficulties observing the fields from the road are well known as are the high vantage points which can be utilised to count them from. Otherwise approach on foot was adopted with prior permission being sought for access. The presence and nature of any disturbance to the geese, intentional or otherwise, was noted using the SNH field code system provided. Impromptu discussion with any landowners during the surveys was welcomed and a record of each conversation regarding the geese along with those had during arranged visits or calls to a farmer was logged. Care was taken in relation to biosecurity and disease prevention, and where access to fields was required there was compliance with any precautions required by the landowners, with gates being left as they were found.

Table 1 – Count sections covered within the counting periods.

Count Period 1	Count Period 2	Count Period 3	Count Period 4
Thwaite	Nith	Southernness	Colvend
Nith	Thwaite	Colvend	Southernness
Southernness	Colvend	Nith	Thwaite
Colvend	Southernness	Thwaite	Nith

As with last winter it soon became clear that the Priestside/Hurkledale area was being used quite often by the Barnacle Geese whereas the section to the northeast of Ward Law covering the Quay Hill was rarely being used and was therefore not surveyed on a regular basis although it was covered during the co-ordinated counts. In previous years the Priestside/Hurkledale section has been dropped due to a lack of goose use but this winter it was again surveyed. During the co-ordinated counts of geese on the Solway, geese were rarely recorded in the Auchencairn/Rascarrel area in mid-winter and from February onwards small numbers of Barnacle Geese began using the Wigtown area with possible sporadic use of the Redkirk/Baurch/Gretna area too (especially Redkirk Merse) but this could not be economically covered via the SNH route count budget.

2.2 Coordinated Svalbard Barnacle Goose total population counts

Each winter WWT has conducted total population counts of the Svalbard Barnacle Geese present on the Solway from arrival to departure. This involves a network of staff and volunteers counting the geese in survey sections within a one- to two-hour time-period at the same time on the same day. There are weekly counts during the arrival period in October and during the departure period in April/May, with monthly counts from November to March depending on the weather.

2.3 Brood sizes and juvenile productivity of the Svalbard Barnacle Goose

Each winter WWT carefully assesses the brood sizes and juvenile productivity of a large proportion of the Barnacle Geese from as many sites as possible around the Solway. The dates, land use types, and flock sizes used for sampling are varied as much as possible to avoid any bias in the average estimate obtained, as are the sampling units within the flocks as families with young can tend to associate at the edges of a flock, particularly at the front. All observations were carried out by an experienced observer.

2.4 High tide heights, times and dates

Table 2. Dates and times of high tides ($\geq 9.5\text{m}$ as summarised from Laver's *'Liverpool and Irish Sea Tide Table 2016 & 2017'*) for the months during which geese were present in the Barnacle Goose Management Scheme area.

Month	Period 1: From date/time	Period 1: To date/time	Period 1: tidal height range (m)	Period 2: From date/time	Period 2: To date/time	Period 2: tidal height range (m)
September	23:48 16/09/16	02:39 21/09/16	9.6 – 10.2	n.a.	n.a.	n.a.
October	22:39 14/10/16	02:22 20/10/16	9.5 – 10.3	n.a.	n.a.	n.a.
November	09:39 13/11/16	13:29 18/11/16	9.5 – 10.1	n.a.	n.a.	n.a.
December	21:39 12/12/16	13:16 17/12/16	9.5 – 9.9	n.a.	n.a.	n.a.
January	10:45 12/01/17	13:00 15/01/17	9.5 – 9.8	12:36 30/01/17	13:14 31/01/17	9.5
February	11:21 11/02/17	12:40 13/02/17	9.5 – 9.7	11:38 27/02/17	12:15 28/02/17	9.6 – 9.8
March	00:36 01/03/17	13:34 02/03/17	9.5 – 9.8	12:12 28/03/17	13:16 31/03/17	9.6 – 10.0
April	11:45 26/04/17	02:21 30/04/17	9.6 – 10.0	n.a.	n.a.	n.a.



Figure 2. Mean goose use (total geese/number of goose count days) per hectare in winter 2016/17 (shaded symbols) compared to the previous five-year period from 2011/12 to 2015/16 (shaded fields plus SNH field codes) for the Priestsidge to Longbridgemuir area.



Figure 3. Mean goose use (total geese/number of goose count days) per hectare in winter 2016/17 (shaded symbols) compared to the previous five-year period from 2011/12 to 2015/16 (shaded fields plus SNH field codes) for the Glencaple to Ladyhall area.

3 Results

3.1 Barnacle Goose counts within the Management Scheme area

A field code system has been used by SNH to cover all of the fields within the Management Scheme area typically used by the geese (**Figures 2-6**). These are the codes also used in the results tables (**Tables 3 - 8**). Over the past decade, where geese were recorded in an uncoded field, the coding was extended in a logical and consecutive manner. The figures are ordered in a sequence from east (Priestside area; **Figure 2**) to west (Colvend area; **Figure 6**). The field and marsh compartments have been shaded from light to dark blue depending on the average number of geese encountered on the count days and the size of the field (as measured in the GIS). Those fields without shading but with an SNH code have never had Barnacle Geese observed in them during the Scheme counts carried out in the previous five year period. Other fields shown on the BING imagery are not part of the Barnacle Goose Scheme survey area.

Field use in winter 2016-2017 was fairly similar to that recorded in the previous five winters with core use being focussed on the Caerlaverock area at the WWT reserve, Newfield, Midtown and Newmains and in the Southernness area on the fields below West Preston and Cowcorse Farms; however some differences include:

- Heavier use of some of the Thwaite fields further east nearer the shore perhaps due to many of the upper fields north of the road and many of the lower fields south of the road being converted to cereals, perhaps also leading to greater use of the set of three Stanhope fields from SC16 to SC18 (**Figure 2**). Some of the Hukledale fields further east were also used more heavily;
- Continued near zero use of the Powhillon Farm holding probably due to continued grazing by high sheep densities over the winter, while many of the Nether Locharwood fields had greater goose use than typically recorded over the past five years (**Figure 2**);
- Heavier use of fields such as C02 at Newfield and C12 on the Eastpark holding of the WWT reserve was probably due to the 2nd year Italian ryegrass reseeds in those fields, though the Newfield holding south of the road had higher goose numbers more generally during the counts. Newmains field C36 at Northpark had a large flock on the stubble there during one of the counts; (**Figure 3**);
- Greater use of the Greenmerse Farm area at KM49 to KM52 with lower use of the Netherwood Mains fields except for KM11 and KM12, perhaps because many of the upper fields have been converted from pasture to cereal (**Figure 4**);
- Although traditionally quite high use fields, there was very heavy use of fields at West Preston and at Cowcorse with little use of fields north of the road this winter. Fields closer to Newmains Farm became more attractive later in the winter as large flocks of pink-footed geese gathered on the tall swards of improved grass in the that area (**Figure 5**);
- At Mersehead Farm, field M27 was well used by geese during the counts probably because this rush-dominated field had been reseeded. No goose flocks were recorded during the SNH counts further west at Colvend (**Figure 6**);
- Overall, the impression was of far fewer geese using feeding areas at the edge of the traditional distribution. It was thought that this was probably due to the very mild conditions allowing for grass growth throughout the winter and thus the geese could be accommodated on fewer pastures;
- The key pattern of 20 or so fields plus saltmarsh areas in each of the Southernness and Caerlaverock areas supporting the bulk of the goose use in those areas, attributable to about 10,000 birds each throughout the winter, remains consistent.

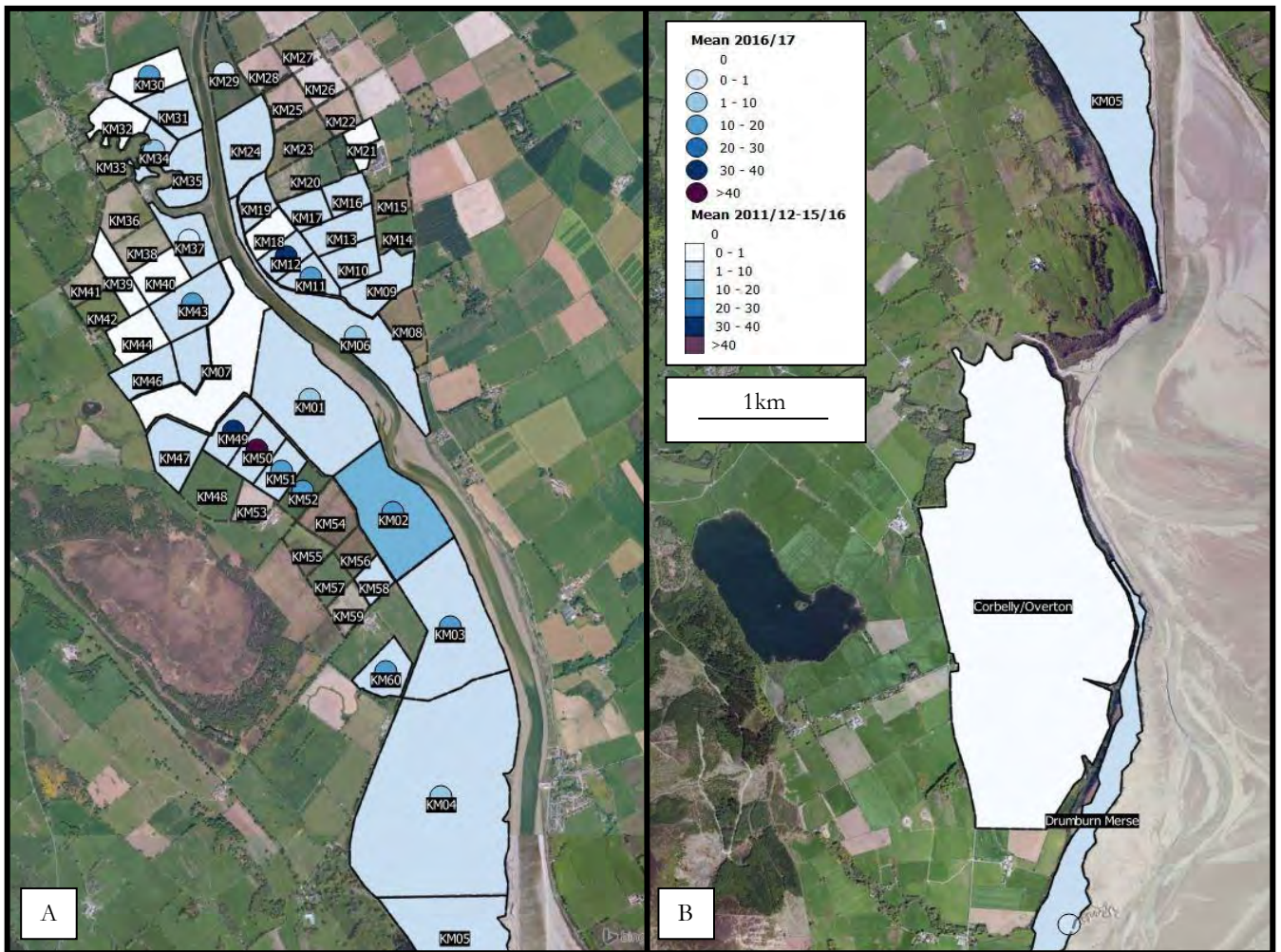


Figure 4. Mean goose use (total geese/number of goose count days) per hectare in winter 2016/17 (shaded symbols) compared to the previous five-year period from 2011/12 to 2015/16 (shaded fields plus SNH field codes) for the Kirkconnell and River Nith (A) south to the Corbely/Overton and Drumburn Merse area (B).

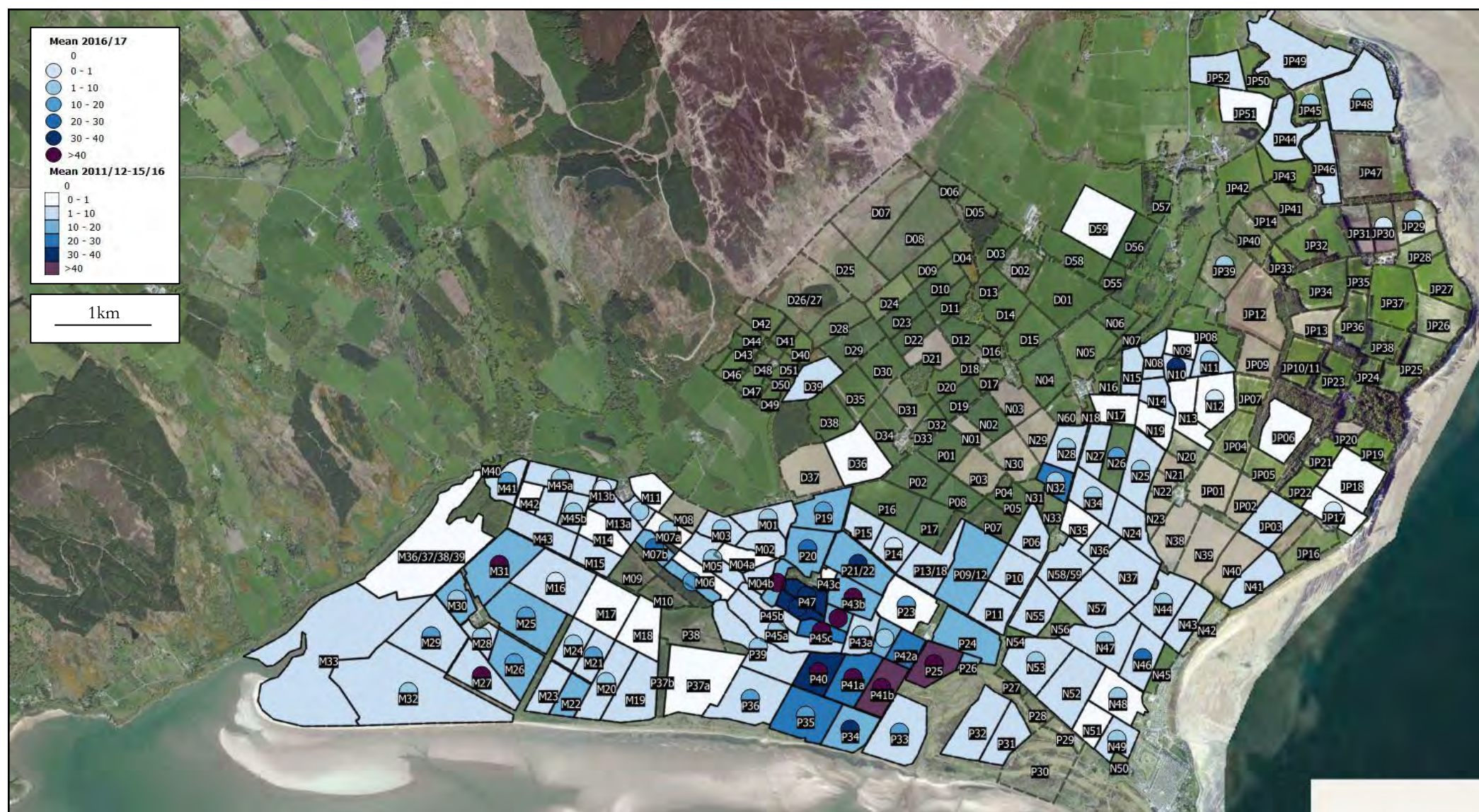


Figure 5. Mean goose use (total geese/number of goose count days) per hectare in winter 2016/17 (shaded symbols) compared to the previous five-year period from 2011/12 to 2015/16 (shaded fields plus SNH field codes) for the Carsethorn to Southwick area.

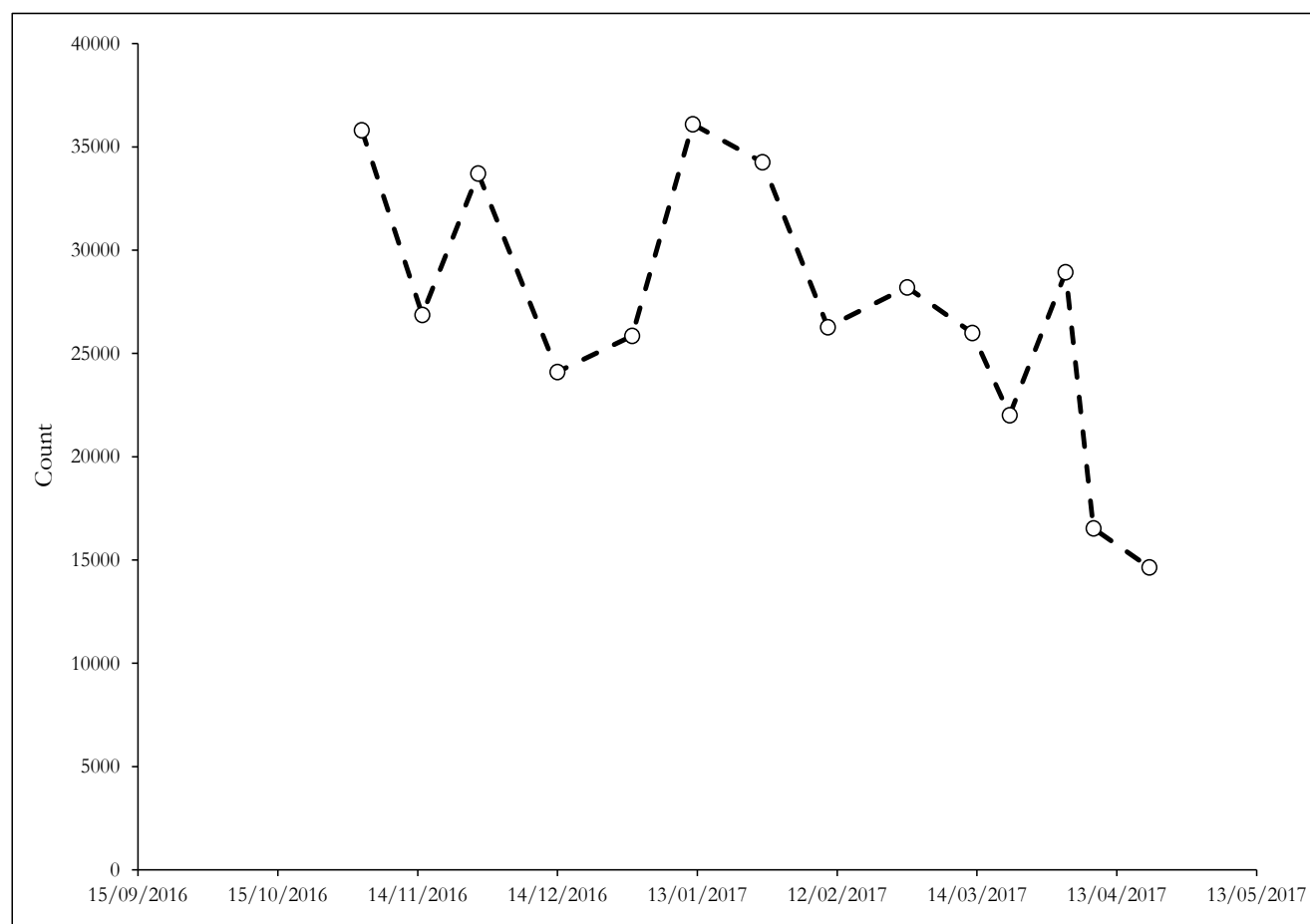


Figure 7. Svalbard Barnacle Goose route count totals within the SNH Solway Goose Management Scheme area.

Some goose count totals for the Scheme area are greater than others because double counting of flocks that move between fields often occurs over the course of a route count. The methodology does not seek to remove this bias as the aim is to record the numbers of geese using individual fields. Fluctuations in goose numbers within the Scheme area also occur due to the effect of high tides, coupled with weather conditions, pushing geese off low lying saltmarsh areas on the south side of the Solway and due to geese dispersing mid-winter, after peak arrival, to foraging areas outside the Scheme area (**Figure 7**).

The mean number of geese recorded during the route counts was 27,094 for the period from the start of November (when the contract started) to the middle of April (24,252 in 2015-2016) ranging from a minimum of 14,639 on 20 April 2017 (11,700 in 2015-2016) up to a maximum of 36,102 on 12 January 2017 (33,173 in 2015-2016). On the final route count on 20 April 2017, 14,639 geese were still present within the Scheme area. During other census counts and monitoring the last 90 barnacle geese were recorded on the WWT Caerlaverock Wetland Reserve on 9 May as the birds moved east to congregate on Rockcliffe Marsh, Cumbria, prior to spring departure. Overall within the Scheme area there tends to be a decline in goose use as food resources within the area are depleted by the end of January. As with last winter, this trend was again less apparent this winter probably because of the very mild conditions that persisted throughout the winter which will have allowed for grass growth. Winter 2016-2017, as with the previous winter, was fairly benign with no periods of prolonged snow or ice cover and only 19 nights on which ground frosts (minimum temperature less than -1°C recorded at the WWT Caerlaverock weather station) were likely; the first being on the 9 November.

Flock sizes and field distribution of Barnacle Geese within the Management Scheme area are given in **Table 3**. Coded fields with zero counts have not been shown although these data are provided in the accompanying Excel file.

Table 3. Svalbard Barnacle Goose flock sizes recorded during the Management Scheme route counts.

Field code	02/11/16	15/11/16	27/11/16	14/12/16	30/12/16	12/01/17	27/01/17	10/02/17	27/02/17	13/03/17	21/03/17	02/04/17	08/04/17	20/04/17	Total
A04/05						6									6
A18			3									62	24		89
A20b				95									16		111
C01	3	2110	580	12	390	8			330	470					3903
C02		3160	1140	630	950									2	5882
C03	1380			15	110	125			95						1725
C04/05		490	1840		1410	530	170	510	580				220	270	6020
C07								35	3				220		258
C08	260			230		310			25			130		46	1001
C09	430						10	700	5	1240	74		55		2514
C10/11			260	630	55	210			120	2080				550	3905
C12	580		2430			330		1900				530			5770
C13					1100						1530	8	170	340	3148
C14	630	3090		850	1750			1230			2700		50		10300
C15				3600	370				470	630		410			5480
C17							35								35
C19a	48		7	340	29				55	12		230			721
C19b				80											80
C20	245		1630	310		410				390					2985
C21/22	1060					92	62			21		370			1605
C23a	3240											370			3610
C23b												80			80
C27	270		1030									62			1362
C28				750		450						74			1274
C29	2140	1050		65		290				360					3905
C30	7					860				1410	1		22	8	2308
C31							1830				130				1960
C36	2140														2140
G44									3						3
C51/S71			35	1180		410		1120	910	1060	350	1230	270	530	7095
C52		810	795	1650	150	32	65	290	610	565		2170	520	275	7932
Drumburn Merse					23						410				433
G29							470								470
G35/38							11								11
JP17			86												86
JP29						620									620
JP30						26									26
JP39					650										650
JP45							490								490
JP48			170	910	9										1089
KM01								525		1140	1270				2935
KM02			3120					1250		820		1840			7030
KM03	3350									2500	1870	1910		65	9695
KM04								660			140	130	560	1070	2560
KM06			46							90	920				1056
KM11						350				163				410	923
KM12					114	2210							16		2340
KM29							55								55
KM30							1530					5			1535
KM34			670												670
KM37													48		48
KM43					2400				660				330		3390
KM49		1120					980	550			550				3200
KM50		1640		795				25			1860				4320
KM51		430						710							1140
KM52								760							760
KM60						1150									1150
L13								48							48
L23									3						3
L24/29						1860						280			2140
L25/28												360			360
L30						1860									1860
L37							3260								3260
L38									450			360			810
L43							120								120
M01			17		150	65									232
M03										45	87				132
M05		620				160	130								910
M07a														95	95
M07b			1060					240		3					1303

M07c										1010					1010
M12					160				28						188
M13b				6				2							8
M16						15		15						22	52
M20	280			610					5		35	360		32	1322
M21			650	350	22					47					1069
M24			330		28					140	12				510
M25	70		430	43	520	120	210	14		174		540	360	280	2761
M26		44	350	365	990			28		700	96				2573
M27		1030	62	250	460	510		75		104	230	1050	1420	970	6161
M28		12			310					120					442
M29		42	34	686	220	50			560	138		760		920	3410
M30		5	85		75			95	42		65	260	12	54	693
M31	2070	890	2200	720		1620	1380	1150	1520	30	1310	230			13120
M32							870	1570	430					510	3380
M41			1060												1060
M45a				1020				65							1085
M45b									85						85
N10					1740						96				1836
N11								630							630
N12								65			75				140
N19									1						1
N25						980									980
N26						980			860						1840
N28					230										230
N32				650											650
N34											320				320
N44			1380												1380
N46			2420												2420
N47			230												230
N48	230														230
N49			210												210
N53			480												480
P14							95								95
P15							2								2
P19			1030		1370						2	1			2403
P20					720				2600						3320
P21/22				650	630				2600		1080				4960
P23				45				1940			25				2010
P25	720	2180		560	1760		8600	3300	880		550				18550
P33		720			1820									280	2820
P34		460								2800			1280	340	4880
P35		70				1150							170	510	1900
P36									820			2200			3020
P39							18							640	658
P40	3000					140			530			230		750	4650
P41a	8000	95				1000			610			2060	860	2200	14825
P41b	3000	370	670			1700			1750	690			3700	2200	14080
P42b								320							320
P43a		7						460	120						587
P43b				840				540	720		2800	790			5690
P44		2550						2080	2						4632
P45a					1040							340			1380
P45c					350					1020		1070	510		2950
P45d													1950		1950
P46										2480					2480
P47						1440					130	810	74	15	2469
PR07			32												32
PR22													90		90
PR24				360											360
PR54		27				690									717
PR68a			5140			210				7			60		5417
PR68b				2200			3400								5600
PR69							1300								1300
PR70										4					4
PR75													910		910
PR78						7	440	8							455
S02/09/10/11				1140											1140
S17/18a					880										880
S26				250									80		330
S36							1710								1710
S37							220								220
S38								8							8
S39						4060	1670								5730
S44/46						4060									4060
S51												55			55
S53	1											420			421
S54/55					3	520						620			1143
S56/57					480	8						85			573

S59						270									270
S60/64						820									820
S61											50				50
S63							17								17
S65						380									380
S66		22		18					25						65
S67											760				760
S68		35			1410				485	92		340			2362
S69									4700				1200		5900
S70						350						560	660		1570
SC06		640		1200				160	770			510		95	3375
SC11									1530						1530
SC15						760									760
SC16						760	2280								3040
SC17							2280								2280
SC18						1120				1720					2840
SC22/23			14						13			11			38
SC27	2660														2660
SC30												640			640
SC35		1070			970							2220	530		4790
SC36		2080	1990												4070
SC45						18	550	3200	2200	1720	3300	1350	146	1160	13644
Total	35814	26869	33716	24105	25848	36102	34260	26278	28205	25995	22016	28934	16534	14639	379315

3.2 Pink-footed Goose counts for the Management Scheme area

Pink-footed Goose *Anser brachyrhynchus* counts are very variable as the extent to which geese remain in the area tends to be very weather and crop dependent. Typical peak times include the autumn as geese arrive back from Iceland into the UK, though the exceptional numbers of last winter were not repeated this winter. Peaks also tend to occur from February to April as birds from further south in the UK move north on migration. During the Scheme count period, the highest count totals were seen from early February (**Table 4**), and the geese remained in the Hurkledale, Kirkconnell and Carsethron area into early April, perhaps not lingering in great numbers as long as they did the previous spring. Pink-footed geese were seen in the usual wintering areas between Carsethron and Powillimount, Priestside and Hurkledale, and on Kirkconnell Merse with occasional flocks elsewhere at Lands, Shearington and Bankend and probably reduced use of the Locharwoods area.

Table 4. Pink-footed Goose flock sizes recorded during the Management Scheme route counts.

Field code	02/11/16	15/11/16	27/11/16	14/12/16	30/12/16	12/01/17	27/01/17	10/02/17	27/02/17	13/03/17	21/03/17	02/04/17	08/04/17	20/04/17	Total
A04/05						70									70
C42							27								27
C44									160						160
C45							71								71
C46			180												180
D59			230												230
H04/33											750				750
H05/06/31/32											470				470
JP07													240		240
JP17	260		12												272
JP18		38			16										54
JP39					170										170
JP42									3						3
JP44									1						1
JP45							95								95
JP46												520			520
JP49							23								23
KM01								30	440		90				560
KM02												70			70
KM03										65					65
KM04								90			20	60	280	60	510
KM11										54					54
KM12						8									8
KM18										230				30	260
KM30												870			870
KM33			85												85
KM34			1130												1130
KM39									210						210
KM43													30		30
L13								530							530
N06					260						230				490
N08							13			220					233
N10											880				880
N11								70							70
N12			13					130			440				583
N15										710					710

N19									720						720
N25						650									650
N26						650			1280						1930
N34											110				110
P14								3							3
PR04												9			9
PR07													7		7
PR14												11			11
PR18									620						620
PR25									470	220					690
PR30								270							270
PR33												240			240
PR53							4								4
PR64							11								11
PR68a						17				390			110		517
PR68b				25								1380			1405
PR69				490								70			560
PR70							45		60	145					250
PR75							31			340				260	631
PR76							4						2		6
PR78						140	90	180							410
S07			19												19
S38							22	105							127
S44/46						3	24								27
S51													46		46
S53	13												22		35
S54/55					310								16		326
SC06		6													6
SC22/23			2												2
SC26		2													2
SC33													6		6
Total	273	46	1671	515	756	1538	460	1408	3964	2374	4680	1624	935	90	20334

3.3 Greylag Goose counts for the Management Scheme area

Small numbers of Greylag Geese *Anser anser* were recorded within the Scheme area, most records occurring on the ponds and fields at WWT Caerlaverock or across the Lochar at Powhillon (**Table 5**). Post-moult flocks usually build up in this area during the late summer, with numbers declining from a few hundred to less than ten over the course of the winter. The pattern this winter was fairly typical with a small number of birds remaining at the WWT Caerlaverock swan feeds until early November with numbers then dropping off rapidly to ten or less.

Table 5. Greylag Goose flock sizes recorded during the Management Scheme route counts.

Field code	02/11/16	15/11/16	27/11/16	14/12/16	30/12/16	12/01/17	27/01/17	10/02/17	27/02/17	13/03/17	21/03/17	02/04/17	08/04/17	20/04/17	Total
A02													1		1
C16	42													1	43
C17	8							2							10
SC01							7			6					13
Total	50	0	0	0	0	0	7	2	0	6	0	0	1	1	67

3.4 Canada Goose counts for the Management Scheme area

Small numbers of Canada Geese *Branta canadensis* were recorded within the Scheme area, most records occurring on the ponds and fields at WWT Caerlaverock (**Table 6**). As with the Greylag Geese with which they often associate in mixed flocks, post-moult flocks usually build up in this area during the late summer, with numbers declining from a few hundred to less than ten over the course of the winter. The pattern of use was typical this winter with c.100 or more birds coming to the swan feeds at WWT Caerlaverock until early 2017 with numbers then dropping off to less than 20 by late February.

Table 6. Canada Goose flock sizes recorded during the Management Scheme route counts.

Field code	02/11/16	15/11/16	27/11/16	14/12/16	30/12/16	12/01/17	27/01/17	10/02/17	27/02/17	13/03/17	21/03/17	02/04/17	08/04/17	20/04/17	Total
C08					150			70					1		221
C17	35	95	3	70	10	125	35		3	15	6			2	399
M27					5										5
M29					7										7
P43a		12													12
Total	35	107	3	70	172	125	35	70	3	15	6	0	1	2	644

3.5 Whooper Swan counts for the Management Scheme area

The Scheme area and fields at its fringe especially around WWT Caerlaverock, Kelton and Thwaite generally hold up to 500 Whooper Swans *Cygnus cygnus* throughout the winter, with numbers increasing gradually up to mid-November as the swans arrive from Iceland and decreasing rapidly at the end of March as birds head north on migration. Some flocks occurring on fields outside the Scheme area are noted as comments on the Excel database but do not contribute to the totals given in **Table 7**. The swan numbers this winter followed the usual arrival and departure pattern, swans using the traditional feeding areas around Kelton, Caerlaverock, Thwaite and Ruthwell.

Table 7. Whooper Swan flock sizes recorded during the Management Scheme route counts.

Field code	02/11/16	15/11/16	27/11/16	14/12/16	30/12/16	12/01/17	27/01/17	10/02/17	27/02/17	13/03/17	21/03/17	02/04/17	08/04/17	20/04/17	Total
A01/03								4	26	23					53
A02				11							48		6		65
A22					70	45			58						173
C08					150			125	140						415
C17	160	95	22	110	25	115	120	15	10	155	96	5	2	1	931
C24						8			8	9					25
KM03						6									6
KM08		85													85
KM17	145														145
KM24			100												100
KM29					18		35								53
KM50						14		6							20
L13												10	10	13	33
L16			11							31					42
LB14							8								8
PR03						3									3
PR06									3	10	12				25
PR71								5							5
S33a					9										9
SC22/23			95												95
SC26			27												27
SC28/29										16					16
SC36			7												7
Total	305	180	262	121	272	191	163	155	245	244	156	15	18	14	2341

3.6 Mute Swan counts for the Management Scheme area

Mute Swans *Cygnus olor* mainly occur on the ponds at WWT Caerlaverock with scattered pairs elsewhere. This winter followed the usual pattern and after numbers built up at the Caerlaverock swan feeds to a peak in mid-winter, by March the birds were dispersing to breeding territories elsewhere (**Table 8**).

Table 8. Mute Swan flock sizes recorded during the Management Scheme route count

Field code	02/11/16	15/11/16	27/11/16	14/12/16	30/12/16	12/01/17	27/01/17	10/02/17	27/02/17	13/03/17	21/03/17	03/04/17	08/04/17	20/04/17	Total
A02											2		2		4
C08			2												2
C10/11						2									2
C16								2		6	2		2	2	14
C17	30	35	25	42	55	42	45	45	58	35	32	30	4	2	480
C25/26									2						2
C52			2												2
L13												2		2	4
M16														1	1
M17					2										2
Total	30	35	29	42	57	44	45	47	60	41	36	32	8	7	513

3.7 Deliberate disturbance to geese in the Management Scheme area

Records of disturbance activities specifically directed towards geese in the Scheme area were as follows (for further details see the Excel spreadsheet):

- From October 2016 to April 2017, there was a set of 7-9 canes with red and white tape streamers on them (some of which were blown over from time to time and they became less in April) deployed in a reseed of Italian Ryegrass at Newfield C02. Geese were using this field by the last week of October probably because the canes were not at a high enough density;
- At the end of December 2016, a single oil drum was recorded on a single count in JP03 in the Powillimount area, and a farm trailer – unmoved from then until late April - in JP44 in the Carsethorn area. Whether or not these were meant to deter geese was not clear;
- From January 2017 c. 25 stakes/canes with black and yellow tape or white and black bags and four stacks of pallets were noted at Ladyhall in PR06/07; the canes were gone by second week of April 2017 but the pallets remained. From early December an orange gas canister and a big blue bag had been seen in the field but were gone by late December;
- In December 2016 at Hurkledale two blue barrels were seen on PR68a and five blue barrels were put out at Newmains C28 in April 2017;
- Single unintentional disturbances of flocks on eight different fields by tractors/diggers, dog walkers, lorries or helicopters (or factors that might prevent flocks from settling in those areas) were noted during some of the counts - details are given in the accompanying Excel file provided;
- From the beginning of April to mid-April 2017, banger rockets were fired from Newfield Farm and these were observed to have mixed effects on any goose flocks feeding on that farm or those surrounding it, sometimes it cleared birds from the fields on that farm, but sometimes they returned or moved onto it having been disturbed from neighbouring farms or the WWT reserve.

3.8 Count section dates and times of coverage

Table 9. Survey dates and times for the Management Scheme route count sections.

	Wednesday	Tuesday	Sunday	Wednesday	Friday	Thursday	Friday	Friday	Monday	Monday	Tuesday	Sunday	Saturday	Thursday
	02/11/16	15/11/16	27/11/16	14/12/16	30/12/16	12/01/17	27/01/17	10/02/17	27/02/17	13/03/17	21/03/17	02/04/17	08/04/17	20/04/17
Thwaite	11:45	16:15	15:15	10:45	16:30	11:30	12:00	17:00	17:30	11:15	13:45	15:45	09:00	10:30
Nith	09:00	14:30	13:00	08:45	15:15	12:30	09:30	15:15	15:00	13:45	11:00	14:30	07:00	09:15
Southernness	15:00	10:00	09:00	11:45	11:15	15:30	15:00	13:45	10:30	15:45	07:00	14:30	14:00	14:15
Colvend	16:30	11:30	11:00	13:15	12:45	16:00	16:00	09:30	11:45	14:45	08:45	15:00	15:15	15:30

There was an even spread of two counts on each day of the week except Saturday when there was one with three on Friday giving 14 counts in total (Table 9).

3.9 Farmer liaisons regarding geese

As counts were conducted within the Scheme area, any significant conversations about goose numbers with the farmers were noted. Sometimes these were on days on which a count was not being conducted. Farmers were also contacted by phone during the January to April period to discuss goose issues once they had received the field count data from SNH. All conversations were about goose numbers and whether or not the counts being conducted gave a good representation of what the farmer's impression of field use was like; generally the farmers felt that the counts probably gave a reasonable representation of what was happening on their land although many also felt that the reduced frequency of counts did not give a good representation of goose use but understood the limitations of the methodology. Farmers engaging in conversations about geese were noted (Table 10).

Table 10. Records of conversations with farmers regarding goose activity in the Scheme area.

30/12/16	Walked fields R07, 08, 10, 11 & 13 at Colvend and no goose droppings seen.
12/01/17	Jim Kirkland said things were normal with a lot of use of the stubbles above the farm.
19/01/17	Alastair Martin said that things had been fairly normal but grass still growing, birds just starting to use the Locharwood fields with some use north of road; felt that birds must have been in L43 because pasture short.
20/01/17	Alastair Wylie said that field use had been fairly normal but noted some use of fields nearer Bankend though not his, birds just starting to use fields west of the road.
30/01/17	Stuart Brown said there was nothing out of the ordinary, geese have been spread out of late with recent use of the fields out the back of Hollands.
	James Worthington said he had seen them on winter barley on S08/12 and pasture W03/04 in period before New Year in 1000's rather than 100's; said that the barley still showed the signs of use.
	Doug Freeman suggested the three main pastures had indeed had good use and felt they should all be "Feeding Zone"; also there had been increasing use of the field between Stanhope and Shore Cottages.
	Steven Murray said there was nothing unusual although birds had just started using fields north of the road as no grass on the lower fields and that the birds seemed to be in bigger clumps this year. Three fields of kale rather than usual two though same acreage; geese don't use it unless there is a depth of snow covering the pastures.
10/02/17	Stephen Roan said geese had been about a bit on fields nearer shore and Glenhovan; droppings found on R07, R08, R10 & R11 but not R23; c.100 geese seen flying along coast in skeins from Rascarrel direction towards Mersehead.
27/02/17	Jim Kirkland said goose field use and numbers had been "same, same" but noticeable how grass had kept growing this winter and birds had not been under the powerlines so much and the grass was noticeably greener and lusher there.
03/03/17	Andrew Marshall reported there had been small numbers of probably less than 100 birds on the field in front of house at Dabin's end with bigger flocks on pastures in front of Willow Cottages and briefly on bigger fields to east of farmhouse, plus recent good use of the merse.
	Ben Oliphant had little to say and in a short call said there were no major problems with numbers of geese, nothing to report.
	Mr Thomas of Southwick Estates said roadside fields opposite gate to Southwick Estate and either side of the Mersehead turn-off had been well used (M41 & M45a), which agrees with the SNH counts; he thought the long field - M45a - alongside the road was not in the Scheme which seems surprising and I said I would query that with SNH as that was not my understanding. He agreed that M41 had not been used up until the last two winters and we agreed it might well in part be due to the pool of water in that field attracting the geese plus the good grass. I said that the field might well work its way into the Scheme if its use continues. He plans to drain the pool but suggested it would not be reseeded again as it was a lot of effort. Also the two fields in Mainsriddle to the south of the road had been well used and again SNH figures back this up for M01 in large part which he said had a chickory component which was gone and nettles had now been topped; this field will be ploughed and reseeded. He agreed that goose use had been less spread out this winter with no use of the hillside pastures or fields north of the road.
	Roger Guy said there had been flocks reported on stubbles north of the road, some by someone who had been staying with Graeme Dalby, I agreed that I had seen one flock on A20b during SNH counts and some barnacles on A22 in with whoopers on a flooded stubble during JNCC census counts. The stubble had been triticale and was likely to be going into oats in 2017 and then possibly pasture. Some buffer fields nearby he feels are not in a condition to hold geese or are places he has never seen geese so although he said he has made representations about this to SNH he wonders why they are presumably getting payments.
23/03/17	John Jamieson said he had two fields in Scheme that were in stubble last year and so had received no payment; some use of these fields, mainly by pink-feet but with barnacle geese in among them near the Lochar, some use of other fields by pink-feet but nothing too unusual.
02/04/17	John Jamieson said he had two fields in Scheme that were in stubble last year and so had received no payment; some use of these fields, mainly by pink-feet but with barnacle geese in among them near the Lochar, some use of other fields by pink-feet but nothing too unusual.
08/04/17	Jack Graham raised no concerns about the geese.

3.10 Coordinated Svalbard Barnacle Goose population count totals

Table 11. Coordinated Svalbard Barnacle Goose population count totals for the Solway.

Count section	05-Oct	12-Oct	19-Oct	26-Oct	16-Nov	14-Dec	15-Mar	19-Apr	26-Apr	03-May	09-May	10-May	17-May	28-May
Annan to Gretna	0	0	690	n.c.	50	1200	0	160	330	0	0	0	0	0
Ruthwell to Cummertrees	0	370	1920	3160	1050	2655	420	0	0	0	0	0	0	0
Longbridgemuir	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Caerlaverock	180	11680	12420	5665	7780	11560	7260	3550	0	0	90	0	0	0
Kirkconnell & Ward Law	0	240	1080	4000	4345	1815	4970	1680	290	0	0	0	0	0
Mersehead to Airds Pt	0	4840	10073	11600	6782	7705	6858	9818	830	0	0	0	0	0
Caulkerbush to Rascarrel	0	0	0	0	0	0	20	0	0	0	0	0	0	0
Dundrennan to Wigtown	0	0	1	0	n.c.	473	1700	19	0	0	0	0	0	0
Rockcliffe Marsh	0	4500	3840	1800	6600	11430	12700	24340	24140	17350	3370	800	1640	270
Burgh Marsh	0	3600	0	11700	9900	0	0	0	0	0	0	0	0	0
Bowness to Grune	0	476	3200	5500	5180	1500	4330	262	30	0	0	0	0	0
Total	180	25706	33224	43425	41687	38338	38258	39829	25620	17350	3460	800	1640	270

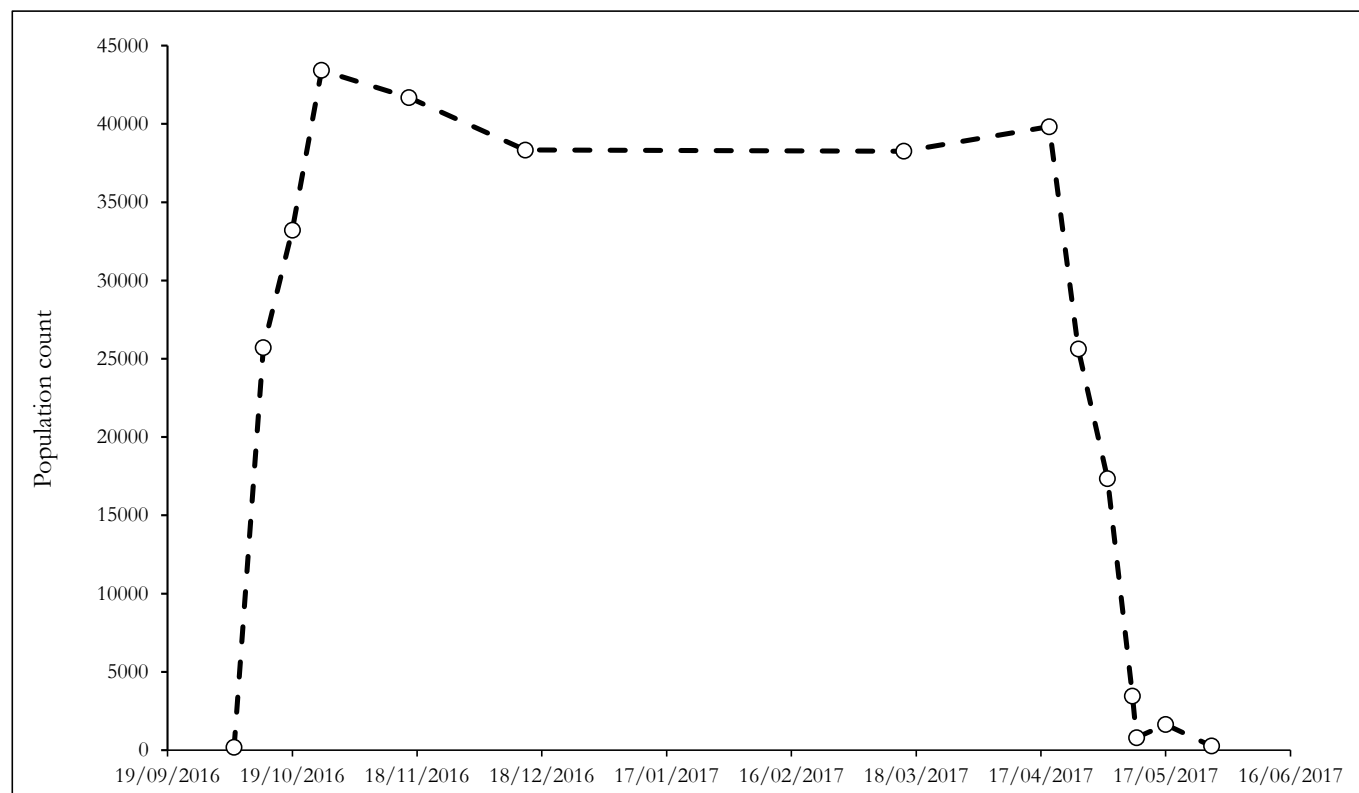


Figure 8. Total population of the Svalbard Barnacle Goose on the Inner Solway from October 2016 to May 2017.

The first arrival of Svalbard Barnacle Geese thought to be genuine migrants was a flock of 29 recorded on the saltmarsh at WWT Caerlaverock on 19 September 2016. Total population counts of Barnacle Geese built up incredibly slowly on the Solway as a whole with only 180 present by the morning of 5 October 2016 (**Table 11; Figure 8**). By late afternoon that day birds were arriving and on the afternoon of 7 October there were almost 16,000 at Caerlaverock. By 12 October there were nearly 26,000 on the Solway as a whole and by 26 October the highest census count of 43,425 for the 2016-2017 season was recorded. Over 38,000 geese were recorded quite regularly - five out of six census counts – between the end of October 2016 and the end of April 2017. This consistency in the counts was perhaps due to the constancy of the weather during the winter in that very few episodes of freezing conditions were recorded and so it was felt the geese, as with last winter, did not spread out across the Solway too much due to food resources being largely maintained. The first evidence of spring migration was noted by 19 April by which time over 24,000 geese had gathered on Rockcliffe Marsh, Cumbria (including Redkirk Marsh). By 26 April the Solway total had already dropped by about 15,000 birds, with a small flock lingering on Kirkconnell merse and less than 1,000 in the Mersehead area. By 3 May 2017, the only birds on the Solway remained at Rockcliffe, the remainder having migrated to Norway. The total on Rockcliffe had dropped to just over 3,000 by 9 May; a much lower total than usual for that time of the year.

Due to count variation, with possible inaccuracies and the chance of double-counting, an adopted count total for the population is usually derived by averaging those counts within 10% of the maximum recorded during the winter. In 2016-2017 the counts of 43,425 on 26 October 2016 and 39,829 on 19 April 2017 fulfilled this criterion and were thus averaged to produce **an adopted population total of 41,700 Svalbard Barnacle Geese** (rounded up to the nearest 100; compared to 41,000 in 2015-2016).

3.11 Brood size and juvenile productivity of the Svalbard Barnacle Goose

The juvenile productivity of the Svalbard Barnacle Goose observed in flocks sampled on the Inner Solway from October 2016 to December 2017 in the Caerlaverock, Kirkconnell, Carsethorn and Southernness areas varied between 0.0% to 42.5% (**Table 12**; 2.2% to 18.8% in 2015-2016) with a mean of 16.0% young from 15 flocks with 7,352 geese sampled (7.8%; n = 16 flocks; 6,654 geese sampled in 2015-2016). Across the same area, the total number of broods sampled was 67, with a mean family size of 1.9 young, range 1-4 young (1.9 young; n = 95 broods; range 1-4 young in 2015-2016).

Table 12. Brood size and juvenile (juv) productivity for Svalbard Barnacle Geese on the Solway in winter 2016-2017.

Date	Flock Size	Sample Size	Total Juvs	Field	Crop	Brood of 1	Brood of 2	Brood of 3	Brood of 4	Brood of 5	Brood of 6	Single Juvs	% juveniles	Observer
07/10/2016	1700	1470	202	O5	pasture								13.7	LRG
21/10/2016	180	170	14	A9/10	pasture	3	2	1					8.2	LRG
21/10/2016	1900	300	27	O5	pasture	7	6	4					9.0	LRG
01/11/2016	3000	497	61	KM2/3	merse	5	10	2	2				12.3	LRG
02/11/2016	2330	697	173	KM2/3	merse								24.8	LRG
02/11/2016	2140	410	124	F1	stubble								30.2	LRG
02/11/2016	2070	310	63	R4	pasture								20.3	LRG
04/11/2016	2100	1120	131	E6	pasture								11.7	LRG
16/11/2016	4500	47	10	Rockcliffe	merse								21.3	LRG
16/11/2016	69	69	0	O7	pasture								0.0	LRG
16/11/2016	2050	1060	75	O3	reseed	10	8	3	1				7.1	LRG
16/11/2016	1170	250	45	O5	pasture								18.0	LRG
28/11/2016	1060	707	150	S2	pasture								21.2	LRG
13/12/2016	228	228	97	H15	pasture								42.5	LRG
13/12/2016	17	17	7	O5	pasture		1	2					41.2	LRG
Total		7352	1179											
Overall juv%						16.04								
						Brood size totals:								
						25	27	12	3	0	0	Total broods 67		
						Number of juveniles per brood size category:						Max %juvs 42.5		
						25	54	36	12	0	0	Total juvs 127		
												Mean brood 1.90		

3.12 Leucistic Barnacle Geese

A minimum of seven leucistic Barnacle Geese was recorded on 16 November 2016, including four in the Newton Marsh/Anthorn area, two on Rockcliffe and one at Caerlaverock.

3.13 Other geese

A Snow Goose *Chen caerulescens* was recorded throughout winter 2016-2017, often in the Caerlaverock area. Mid-winter a possible Todd's Canada Goose *Branta canadensis interior* was seen in the Lantonside area in a flock of Barnacle Geese. In late April 2017 a Greenland White-fronted Goose *Anser albifrons flavirostris* was present in a small flock of Barnacle Geese at Eastpark. In mid-winter a European White-fronted Goose *Anser albifrons albifrons* was seen with Barnacle Geese and Pink-footed Geese at Eastpark.

3.14 Acknowledgements

Thanks go to Mike Carrier and Bob Jones for conducting census counts in the Rockcliffe/Burgh Marsh area, Dave Blackledge and Cara Bell for counts covering the Bowness to Grune route, Marian & Dave Rochester for covering the Borgue to Wigtown route, Paul Tarling for covering Crook of Baldoon, David Charnock for covering Rascarrel to Sandyhills and Rowena Flavelle, Eric Neilson, Mike Peacock, Sarah Livingstone and Lana Blakely for covering the Southwick area to Drumburn.