



**Svalbard Barnacle Goose distribution around
the Solway Firth 2015-2016: 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 2015-2016 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 41,000 geese (the mean of four counts that were within 10% of the maximum of 42,017 recorded, rounded up to the nearest 100), an increase of 3,700 birds on last winter's adopted estimate of 37,300 geese. This apparent increase in the population was probably due in part to the reasonably good breeding season in 2015 compared to 2014, with count conditions being good in 2015-2016 and the geese making little use of areas outside their usual range and thus being well covered by the counter network. Mean brood size was 1.9 (range 1-4 goslings; 95 families sampled) goslings per family – which is not significantly less than the current ten year mean of 2.0 (S.E. \pm 0.1), with an average productivity of 7.8% - which is not significantly less than the current ten year mean of 9.0% (S.E. \pm 1.1; range 2.2-18.8% young; 16 flocks and 6,654 birds sampled). This compares to 1.7 goslings per family and 5.0% 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 Hurkledale 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 (greater than 9.5m as summarised from Laver's 'Liverpool and Irish Sea Tide Table 2015 & 2016') 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	10:38 26/09/15	13:19 30/09/15	9.5 – 10.4	n.a.	n.a.	n.a.
October	01:39 01/10/15	02:24 02/10/15	9.8 – 10.2	21:14 25/10/15	01:04 31/10/15	9.5 – 10.2
November	21:43 24/11/15	12:24 28/11/15	9.6 – 9.8	n.a.	n.a.	n.a.
December	11:29 26/12/15	12:11 27/12/15	9.5	n.a.	n.a.	n.a.
January	11:50 11/01/16	13:57 14/01/16	9.5 – 9.6	n.a.	n.a.	n.a.
February	11:33 09/02/16	14:26 13/02/16	9.6 – 10.0	n.a.	n.a.	n.a.
March	10:28 08/03/16	14:06 13/03/16	9.5 – 10.2	n.a.	n.a.	n.a.
April	11:02 06/04/16	14:48 11/04/16	9.5 – 10.2	n.a.	n.a.	n.a.



Figure 2. Mean goose use (total geese/number of goose count days) per hectare in winter 2015/16 (shaded symbols) compared to the previous five-year period from 2010/11 to 2014/15 (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 2015/16 (shaded symbols) compared to the previous five-year period from 2010/11 to 2014/15 (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. Other fields shown on the BING imagery are not part of the Barnacle Goose Scheme survey area.

Field use in winter 2015-2016 was fairly similar to that recorded in the previous five winters with core use areas being in 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 nearer the shore perhaps due to the upper fields being converted to cereals and this may have led to greater use of the Stanhope fields such as SC16, a reseeded pasture (**Figure 2**);
- Heavier use of fields in the Newmains (Caerlaverock) area such as C33, a reseed, and Midtown at stubble S67, little used in recent previous years (**Figure 3**);
- Greater use of the Flats of Cargen area at KM37 and KM43 to KM46 with lower use of the Netherwood Mains fields, perhaps because many of those have been converted from pasture to cereal (**Figure 4**);
- Heavier use of fields in the Newmains (Southernness) area and in particular field N15 and those surrounding it, probably due to the massive drainage and improvement effort invested in the pastures in that area over the last two years (**Figure 5**);
- Although traditionally quite high use fields, those at Cowcorse Farm including the cluster at M04b, P45d, P47 and P43b seemed particularly attractive to the geese this winter, with P09/12 at West Preston Farm to the north of the road also catering for some very large flocks (**Figure 5**);
- Only two flocks of approximately 500 birds were recorded on pastures in the Colvend area all winter with none seen in the Longbridgemuir area (**Figures 2 & 6**);
- Overall, as is usual at the peripheries of the core goose-use distribution considering the survey methodology, some lower use fields were recorded with increased usage and some with greater goose usage in the last five years had little or no goose use recorded in winter 2015/2016;
- 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.

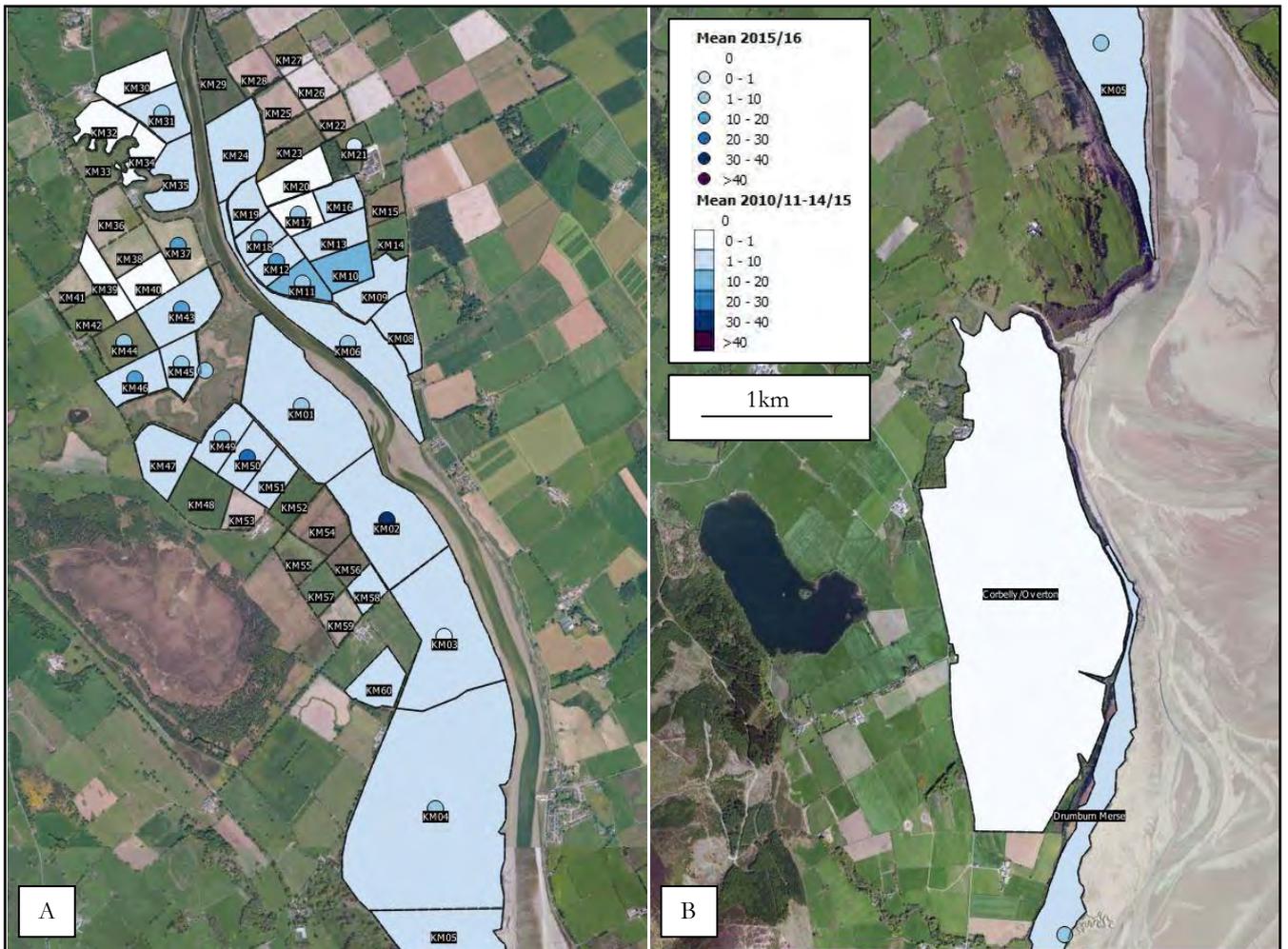


Figure 4. Mean goose use (total geese/number of goose count days) per hectare in winter 2015/16 (shaded symbols) compared to the previous five-year period from 2010/11 to 2014/15 (shaded fields plus SNH field codes) for the Kirkconnell and River Nith (A) south to the Corbilly/Overton and Drumburn Merse area (B).



Figure 5. Mean goose use (total geese/number of goose count days) per hectare in winter 2015/16 (shaded symbols) compared to the previous five-year period from 2010/11 to 2014/15 (shaded fields plus SNH field codes) for the Carsethorn to Southwick area.



Figure 6. Mean goose use (total geese/number of goose count days) per hectare in winter 2015/16 (shaded symbols) compared to the previous five-year period from 2010/11 to 2014/15 (shaded fields plus SNH field codes) for the Southwick to Colvend area.

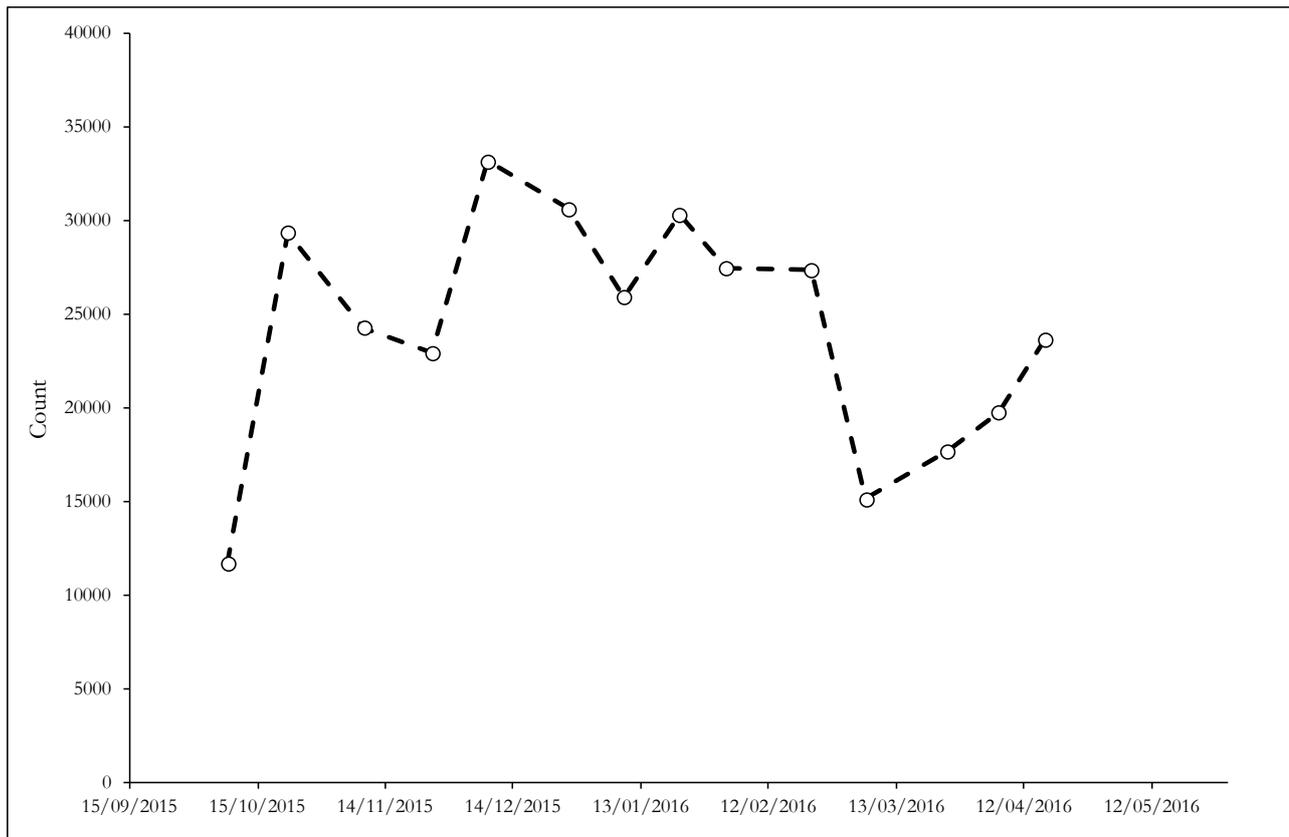


Figure 7. Svalbard Barnacle Goose route count totals within the SNH Solway Goose Management Scheme area.

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 24,252 for the period from the start of October (when the contract started) to the middle of April (22,165 in 2014-2015) ranging from a minimum of 11,700 on 8 October 2015 (8,350 in 2014-2015) up to a maximum of 33,173 on 8 December 2015 (31,229 in 2014-2015). On the final route count on 17 April 2016, 23,662 geese were still present within the Scheme area. During other census counts and monitoring the last three barnacle geese were recorded on the WWT Caerlaverock Wetland Reserve on 13 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 until mid-February which will have allowed for grass growth throughout the winter. Winter 2015-2016, as with the previous winter, was fairly benign with no periods of prolonged snow or ice cover and only 19 nights – the first being on 23 November – on which ground frosts were recorded (less than -1°C at the WWT Caerlaverock weather station).

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	08/10/15	22/10/15	09/11/15	25/11/15	08/12/15	27/12/15	09/01/16	22/01/16	02/02/16	22/02/16	06/03/16	25/03/16	06/04/16	17/04/16	Total
A18				2					170						172
A22					16										16
C01		1480		410		22	180	112	42	8					2254
C02				740	180			70	140						1130
C03				870	40	170	116		33			1			1230
C04/05	615		170	970	190			610	190						2745
C08	1550			170		290		12	320	35	2			220	2599
C09						820			6				330	1450	2606
C10/11					530	1790	170	530	11			700		410	4141
C12			140	260	490	35		40		2					967
C13					1260			990		1950				610	4810
C14			80	1280	2180			1300	860	280			2050		8030
C15								1310	60	12					1382
C16										23					23
C17						25		8	10	23					66
C19a		212	308		190				75	830					1615
C19b	270		60	100					260	610					1300
C19c	370					670	330								1370
C20			25	330	220				148	810					1533
C21/22			55	130			230	7							422
C23a			1460		360	2870				560					5250
C23b	110			840	1260										2210
C25/26										560					560
C27			11	1250		490			2						1753
C28				550	480				1240						2270
C29			280	760		7									1047
C30			1300		3430	580			18		1540	770		310	7948
C31		230		800	930	2380	160								4500
C33			440						2020						2460
C34		3910	1300		310				53						5573
C38			420										140		560
C40						95									95
C42										62					62
C44					380										380
C46					55										55
C47								1							1
C51/S71	280	2200	520		80	1440	1680		730	540	530	850	40		8890
C52	1750	2360	1490	160		770	1400	228	570		25	780	430	1270	11233
Drumburn Merse					45								1790		1835
JP06			430												430
JP18								540							540
JP42					21										21
JP44					380		9								389
JP48			310				1								311
JP52											390				390
KM01					60	270				3820	120		70	1230	5570
KM02		2550	520	920		960			2790	2610			1350	3570	15270
KM03												25	25		50
KM04							1770				2060	70	140	180	4220
KM05				940			50				1350				2340
KM06			380		440								810	930	2560
KM07					510										510
KM11											240				240
KM12											1180				1180
KM17			420												420
KM18								350							350
KM21												23			23
KM31													130		130
KM37								1710							1710
KM43			220		610			2380							3210
KM44					120										120
KM45					130			280							410
KM46					1420										1420
KM49			180										760		940
KM50										1960			870		2830
L12			280												280
L20/21						190							230		420
L24/29			45		970										1015
L25/28					136										136
L26/27								155							155
L30			290		7										297
L35									9						9
L37								2060							2060
L38														310	310

M04a									48					48
M04b							520						30	550
M06				110										110
M07b					230				6		610	190		1036
M07c						210		82			530			822
M12							103						190	293
M13a					470								220	690
M13b			18				55							73
M14			320											320
M15					35				34					69
M16										290			14	304
M18													2	2
M19								770				280	260	1310
M20			120	130				170					680	1100
M21								110			85		220	415
M22					450							265		715
M23												90		90
M25	830		15		48	42			80	1580	170	9	85	2859
M26		1830	270	240		75	440					330		3185
M27			150		65	28	24		55			1260		1582
M29			470		260	52	27	210	75		82	55	760	1991
M30		1150	7			36	2		36			23	190	1444
M31				1640	480	890	980	36			1060		640	5726
M32			720	190		120			340				25	1395
M33			460			550	690	820					640	3160
M36/37/38/39		45						17					62	124
M41				70							280			350
M43		1460												1460
M44		680		830										1510
M45a					310			990	800			2	570	2672
M45b			220		95			78	9					402
N08							580							580
N09							220							220
N11						680		130						810
N12												92	4	96
N14							550							550
N15							2540							2540
N17							115							115
N19							220							220
N24									760					760
N25									2500					2500
N28			260		16									276
N32							210							210
N34							340		140					480
N37				460										460
N44			480					1740						2220
N46			510					220						730
N47			320											320
N48			510											510
N52			950											950
N53			28	390	1020									1438
N55				1170										1170
P09/12					14	5640	2060							7714
P14							7							7
P15						1450								1450
P19		520	9		155			810	15					1509
P20					1120			115	960			1400		3595
P21/22				1480	2040	92								3612
P24		180			2300	410								2890
P25			32		22	17					1680		1960	3711
P31		2010												2010
P33							280	33		810			860	1983
P34		1160	260				35			1490				2945
P35			290	860	960							240		2350
P36					70								75	145
P37a												280		280
P39						220	16		150				1520	1906
P40				170	120				720		980		60	2050
P41a		1450			110		115	2		280		1150		3107
P41b	1450		120			320	80			1860	1780	3	2760	8373
P42a								310		75				385
P42b						510	8							518
P43a		1000							7				54	1061
P43b			180		55	1960		2230					2820	7245
P44								75						75
P45a							12		870			2	55	939
P45c							6		820	640				1466
P45d		2000	310			75			106	1780		710		4981
P46										250		2690		2940

P47			2900		6	8		3		1550		620		3	5090
PR03			60												60
PR06			5					17							22
PR07			550		1										551
PR08													120		120
PR22													130		130
PR24				180											180
PR30								510							510
PR35														17	17
PR44									12						12
PR45								17		125				17	159
PR51						1									1
PR54													145		145
PR55					120					690					810
PR56										410					410
PR57								12		120					132
PR58				360	230										590
PR68a								270		1890					2160
PR68b								45		1480					1525
PR75								135					65		200
PR76								2250							2268
R03									430						430
R11					540										540
S14									720						720
S15												190			190
S23				640					720						1360
S25			90					35		220					345
S26	1200				11				55	14		8			1288
S33b										42					42
S39										410		12			422
S40/42													530		530
S44/46												1050			1050
S45/47													1120		1120
S49										220					220
S50a										205					205
S53			230							250					480
S54/55										2060					2060
S56/57					480					2					482
S58											810				810
S59					340			195							535
S60/64	120	2													122
S61									190						190
S63									1130	80					1210
S65			160					620		910					1690
S66			26							64					90
S67			680						1130	230		920	1080		4040
S67a									380						380
S68	550	560	2	30								1			1143
S69								70							70
S70	550		800							360					1710
SC05										28					28
SC06					120	840	30			70					1060
SC10														210	210
SC15														480	480
SC16					1420					1270		220			2910
SC17										3					3
SC18								370							370
SC20										104					104
SC22/23					2480				1050		3				3533
SC27		1180													1180
SC28/29			640												640
SC30											1730				1730
SC34									15						15
SC35									960		740				1700
SC36											270				270
SC45	1755	1100		2060		2460	750				410	2350	1800	1850	14535
W40							1600								1600
W42							2600								2600
W53	420														420
Total	11700	29387	24308	22942	33173	30630	25942	30329	27483	27377	15122	17687	19780	23662	339522

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, and the last few days of September 2015 into the first few days of October 2015 witnessed unusually large numbers of more than 4,500 staging at WWT Caerlaverock, where they rested and fed on the pastures of the reserve before moving on. 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 area into early May. Pink-footed geese were seen in the usual wintering areas between Carsethorn and Powillimount, Priestside and Hurkledale, Kirkconnell Merse and in the Locharwoods area with occasional flocks elsewhere.

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

Field code	08/10/15	22/10/15	09/11/15	25/11/15	08/12/15	27/12/15	09/01/16	22/01/16	02/02/16	22/02/16	06/03/16	25/03/16	06/04/16	17/04/16	Total
C38													130		130
C40						220									220
C42										160		85			245
C44					440							110			550
C46					35										35
C47								350							350
D61									510						510
JP18								110							110
JP41								115							115
JP42					95										95
JP43					115										115
JP52												630			630
KM01											310				310
KM02						8									8
KM03													17		17
KM04												14		23	37
KM05										22	75				97
KM11											80	38			118
KM12											120				120
KM13												5			5
KM18								210							210
KM21												460			460
KM30						360									360
KM31													360		360
KM43					25										25
KM44					40										40
KM46					25										25
L09					25										25
N09							16								16
N11						520		240							760
N12								25			15		950	290	1280
N15							21								21
PR06												185			185
PR13													145		145
PR30							2	155							157
PR45													4		4
PR56													5		5
PR68a							60			330		750			1140
PR68b							6								6
PR69									180						180
PR75							17						230	1	248
PR76											920				920
PR78								37							37
S15											1020				1020
S33b									220						220
S39									30		80				110
S44/46											660				660
S49									70						70
S50a									190						190
S52									6						6
SC45														7	7
W40							500								500
W42							100								100
Total	0	0	0	0	800	1108	722	1242	1206	512	3910	1647	1841	321	13309

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 nearby (**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 the beginning of 2016 with numbers then dropping off rapidly to zero.

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

Field code	08/10/15	22/10/15	09/11/15	25/11/15	08/12/15	27/12/15	09/01/16	22/01/16	02/02/16	22/02/16	06/03/16	25/03/16	06/04/16	17/04/16	Total
C16								4							4
C17	22	3		79	7	45		1	7	2					166
C34			15												15
Total	22	3	15	79	7	45	0	5	7	2	0	0	0	0	185

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 or nearby (**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 birds coming to the swan feeds, alongside the Greylag Geese, at WWT Caerlaverock until early 2016 with numbers then dropping off rapidly to zero.

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

Field code	08/10/15	22/10/15	09/11/15	25/11/15	08/12/15	27/12/15	09/01/16	22/01/16	02/02/16	22/02/16	06/03/16	25/03/16	06/04/16	17/04/16	Total
C17			7	86	90	70	75	35	75	5					443
C34			5												5
M43						110									110
P43a			5						4						9
S60/64	250														250
Total	250	0	17	86	90	180	75	35	79	5	0	0	0	0	817

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	08/10/15	22/10/15	09/11/15	25/11/15	08/12/15	27/12/15	09/01/16	22/01/16	02/02/16	22/02/16	06/03/16	25/03/16	06/04/16	17/04/16	Total
A01/03			48	55	4			23	75	25			70		300
A04/05											34				34
A19							21								21
A22					95	41									136
C17	4	10	10	117	115	115	135	160	140	110	130	30			1076
C34			55												55
C37							8								8
KM19			80				35								115
KM23				110											110
KM51			40												40
LB14										45					45
LB16										35					35
P43a														1	1
PR06							7		4						11
PR07					24										24
PR70									11						11
PR72							4								4
S33b							26								26
SC16								1							1
SC40											5				5
Total	4	10	233	282	238	156	236	184	230	215	169	30	70	1	2058

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 counts.

Field code	08/10/15	22/10/15	09/11/15	25/11/15	08/12/15	27/12/15	09/01/16	22/01/16	02/02/16	22/02/16	06/03/16	25/03/16	06/04/16	17/04/16	Total
A01/03													4		4
A02														1	1
C08									1					1	2
C10/11										1	2				3
C16	4												2	2	8
C17	14	28	45	48	48	42	49	60	55	48	50	45	38	2	572
M16													1		1
M17											1			1	2
M25					2										2
S33a												2			2
Total	18	28	45	48	50	42	49	60	56	49	53	47	45	7	597

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 1 October to 29 October 2015, there was a regular grid of canes with red and white tape streamers on them (some of which were blown over from time to time but were maintained) deployed in a late reseed of Italian Ryegrass at WWT Caerlaverock field C12 which, with reference to the daily Farmhouse Tower counts carried out by WWT, seemed very effective at temporarily deterring geese from this field even though many thousands of pink-footed geese and barnacle geese used the fields around it. The geese did not start using this field until 17 October when 140 were recorded and only up to 330 birds were recorded in the days up to 29 October, over one month after the geese arrived on the Solway, with heavy use by up to ~1,600 geese immediately thereafter;
- From November 2015 April 2016, inclusive, there was an oil drum in field N40 in the Powillimount area, and also 3 plastic barrels appeared briefly in field JP03 during January, with two traffic cones recorded in field N57 near the golf course in January; whether these measures were aimed at scaring geese is not clear;
- In the Carsethorn area, a single piece of farm machinery was recorded in field JP44 from the start of December 2015 to the end of January 2016, it then being replaced by a scarecrow until the end of April; this scarecrow was never recorded as having its position altered. A scarecrow was also noted in field JP43 from the second half of January 2016 until mid-April 2016; again it was never recorded as having its position altered. A spinning disk on a post with a bag was added to field JP42 from mid-February 2016 until early April 2016 though it was broken and then laying on the ground from early March. A large bag on a post was recorded in field JP51 in early March 2016 but it had fallen later that month;
- Though not specifically directed towards scaring geese, a digger and Landrover were seen working on fields M18 and M26 at RSPB Mersehead during late January 2016 and late February 2016 and a plane disturbed a flock on field M29 on 17 April 2016;
- From 6 March 2016 small sections of red and white tape were noted hanging from ring feeders (for cattle) positioned in fields P31 and P32 at West Preston in the centre of the Southernness golf course, the cattle feeders had been present before this time but this was the first occasion on which it was noted that they were being used as a possible scaring device; some shots were heard on 6 April, possibly coming from this area;
- Steven Murray on a quad bike disturbed flocks on fields P25 and P33 on 17 April;
- Out with the Scheme count periods, rocket bangers were regularly used during April to disturb goose flocks on Newfield (Caerlaverock), with one disturbing a Eurasian Crane *Grus grus* at 18:00 on 20 April within five minutes of it having landed to feed on field C16 of the reserve such that it headed high to the southwest of

the NNR and out of sight. A pair of Pied Avocets *Recurvirostra avosetta*, showing signs of breeding activity, was disturbed from the main Folly Pond on field C08 of the reserve to a wet area on field C15 at 17:15 on 20 April by a rocket banger. This pair had been present for a few days but was not seen after this disturbance episode. Bangers were occasionally used at Newmains too.

3.8 Count section dates and times of coverage

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

	Thursday	Thursday	Monday	Wednesday	Tuesday	Sunday	Saturday	Friday	Tuesday	Monday	Sunday	Friday	Wednesday	Sunday
	08/10/15	22/10/15	09/11/15	25/11/15	08/12/15	27/12/15	09/01/16	22/01/16	02/02/16	22/02/16	06/03/16	25/03/16	06/04/16	17/04/16
Thwaite	08:00	10:30	12:00	10:15	15:00	15:15	13:00	16:15	09:00	13:30	15:30	09:15	14:00	12:30
Nith	10:00	08:30	09:15	08:45	13:30	14:00	09:00	14:45	13:00	14:30	13:15	07:00	11:45	08:00
Southernness	11:00	11:45	13:00	12:00	08:30	09:30	14:45	13:30	14:00	15:45	10:30	12:30	09:00	16:00
Colvend	12:00	12:30	14:00	11:30	11:15	12:15	16:00	11:00	15:00	16:30	11:15	13:30	07:30	17:15

There was an even spread of two counts on each day of the week except Saturday when there was one with three on Sunday 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.

22/10/15	Stephen Roan said there had been no geese at Colvend yet.
08/12/15	Jim Kirkland said the geese were in the usual places though the flood waters had pushed them off the lower lying areas.
09/01/16	Stephen Roan said he had not noticed any geese on his fields yet but had seen them flying over.
22/01/16	Stephen Roan's wife said they had just started using their southern fields in mid week, not in big numbers; fresh droppings found in field R08.
27/01/16	Jack Graham said counts represented what had been using his fields and he was glad that S67 had geese recorded on it as last year he felt the field had been well used yet no geese were counted.
	Alastair Wylie thought counts picked up well on the fields that had been used except perhaps for C25/26. Had been heavy use of C34 and wondered if that should be Feeding Zone.
	Stuart Brown thought the counts were fairly typical as was field use and he had no concerns. He said geese were often roosting on the flood pools in field S60/64 and possibly S61 puddling and eating the grass. These roosting flocks would not be detected by the counts.
	Alastair Martin thought the lack of any counts on most of his fields was fairly normal for the time of year. He felt that there had been some use of L43 and a field near the road.
	Doug Freeman felt that if geese were on his fields then we would count them. He did note some use of the flooded field at SC20 by small groups of geese at the edge of the water.
	James Worthington felt that fields out front of Lantonside had been used around New Year as had fields at Lands. Also use of fields above Glenhowan especially H05/06/31/32 at different times; felt that should be recognised more officially.
30/03/16	Andrew Marshall said he had some geese on SC11 at the weekend and also a few in front of house on SC04 some time back but not a lot, also he had some in SC15 a few days back with birds hopping over from SC16 Stanhope fields. But most fields quiet and feels wildfowler disturbance is having an impact on goose numbers but admits sheep numbers will also be suppressing goose numbers.
05/04/16	Sandy Forsyth noted he didn't know if it was a psychological thing that there seemed to be more geese than usual, but that a field opposite Mainsriddle of chicory and clover had been killed off by the geese through heavy use in December with geese using different fields to usual.
06/04/16	Jim Kirkland said that there had not been many geese about of late and was not sure where they were but said they had been on fields below, beside and above the farm with some use of fields north of the road which was unusual.
12/04/16	Roger Guy said he had four fields to the south of the road in buffer which are used by smaller numbers of geese when they do come, not large numbers. He has seen more geese north of the road, though mainly just 70-80 whooper swans using flooded stubble A22 by road with sprinkling of 20-30 barnacle geese. Swans also used triticale reseed in field A20b north of that.
12/04/16	Steven Murray felt counts represented the goose use fairly well, although some flocks on corner field P33 might be getting missed; golf course fields at P31 and P32 should maybe classed as buffer fields as have had increased use with improvement; license had been used, with shooting on a couple of mornings which had kept geese off for a couple of weeks; birds spread out in April, not so many big flocks about, some use north of the road of late but not much early on.

3.10 Coordinated Svalbard Barnacle Goose population count totals

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

Count section	01-Oct	22-Oct	29-Oct	25-Nov	15-Dec	10-Feb	16-Mar	13-Apr	20-Apr	27-Apr	04-May	10-May	11-May	18-May	25-May	27-May	31-May
Annan to Gretna	0	2420	n.c.	520	500	100	180	650	40	380	600	n.c.	170	0	0	0	0
Ruthwell to Cummertrees	0	1180	n.c.	540	0	330	40	1530	10	0	0	0	0	0	0	0	0
Longbridgemuir	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Caerlaverock	1210	11852	5600	9320	8900	11006	6150	11530	6600	5070	2	0	0	0	0	0	0
Kirkconnell & Ward Law	0	2550	5800	2500	4440	5730	2550	0	4550	4	0	0	0	0	0	0	0
Mersehead to Airds Pt	931	11485	4380	8190	7340	8972	6215	7394	7673	6873	2	0	0	0	0	0	0
Caulkerbush to Rascarrel	0	0	1400	80	220	20	0	n.c.	n.c.	n.c.	0	0	0	0	0	0	0
Dundrennan to Wigtown	0	0	0	0	500	25	380	1020	300	0	0	0	0	0	0	0	0
Rockcliffe Marsh	800	6200	1300	9700	5000	13140	7320	12320	9300	28720	27000	11880	8100	2050	224	440	30
Burgh Marsh	0	1520	1500	0	0	0	3000	600	0	0	0	n.c.	0	0	0	0	0
Bowness to Grune	0	2445	4912	4800	6900	1860	4655	5875	5680	970	0	0	0	0	0	0	0
Total	2941	39652	24892	35650	33800	41183	30490	40919	34153	42017	27604	11880	8270	2050	224	440	30

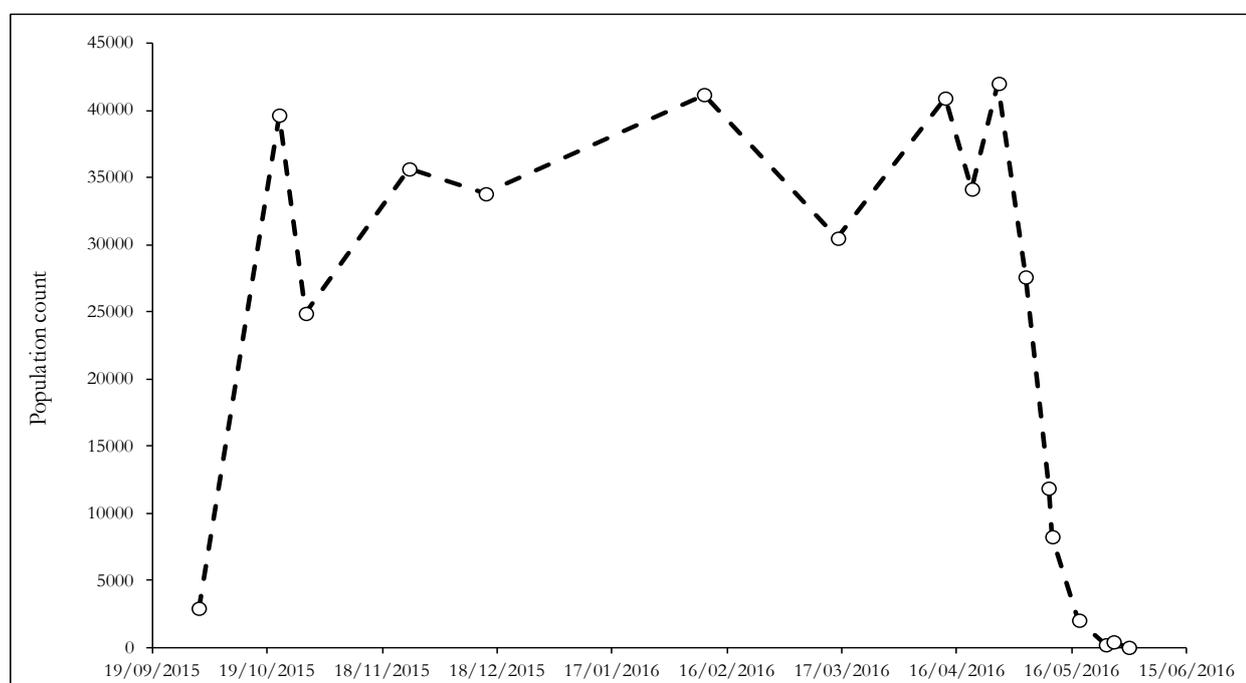


Figure 8. Total population of the Svalbard Barnacle Goose on the Inner Solway from October 2015 to May 2016.

Total population counts of Svalbard Barnacle Geese built up slowly on the Solway with only 3,000 present at the start of October (**Table 11; Figure 8**). The first arrival of Barnacle Geese thought to be genuine migrants was recorded at the WWT Caerlaverock reserve on 25 September 2015 and there were only 800 present by the end of that month. The numbers built fairly steadily throughout October with nearly 40,000 geese present on the Solway by 22 October only 2,000 less than the peak count of 42,017 recorded at the end of April. Over 35,000 birds were recorded quite regularly - five out of nine counts – between the end of October 2015 and the end of April 2016. 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 did not spread out across the Solway as much as in some of the previous years due to food resources being largely maintained. The first evidence of spring migration was seen by 27 April when over 29,000 geese had gathered on Rockcliffe Marsh, Cumbria (including Redkirk Marsh). By 12 May this had dropped to just 12,000 in the Rockcliffe area with zero geese recorded elsewhere on the Solway. By 18 May 2016, only about 2,000 Barnacle Geese remained on Rockcliffe Marsh, the remainder being in Norway or Svalbard.

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 2015-2016 the counts of 39,652 on 22 October 2015, 41,183 on 10 February, 40,919 on 13 April and 42,017 on 27 April 2016, fulfilled this criterion and were thus averaged to produce **an adopted population total of 41,000 Svalbard Barnacle Geese** (rounded up to the nearest 100; compared to 37,300 in 2014-2015).

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 2015 to January 2016 in the Thwaite, Caerlaverock, Kirkconnell, Carsethorn and Southernness areas varied between 2.2% to 18.8% (**Table 12**; 2.7% to 14.7% in 2014-2015) with a mean of 7.8% young from 16 flocks with 6,654 geese sampled (5.0%; n = 15 flocks; 13,104 geese sampled in 2014-2015). Across the same area, the total number of broods sampled was 95, with a mean family size of 1.9 young, range 1-4 young (1.7 young; n = 215 broods; range 1-4 young in 2014-2015).

Table 12. Brood size and juvenile (juv) productivity for Svalbard Barnacle Geese on the Solway in winter 2015-2016.

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
22/10/2015	3910	660	64	E10	stubble								9.7	LRG
27/10/2015	950	930	20	KM2/3	merse								2.2	LRG
03/11/2015	1550	913	29	O6	reseed	6	12		1				3.2	LRG
04/11/2015	38	38	2	A8	pasture		1						5.3	LRG
10/11/2015	2900	330	11	T5	pasture	7	2						3.3	LRG
10/11/2015	950	300	15	X79	pasture	6	3	1					5.0	LRG
10/11/2015	1120	450	49	O6	reseed	9	6	5	3				10.9	LRG
13/11/2015	2200	695	131	G12	stubble	5	7	5	3				18.8	LRG
13/11/2015	480	356	19	A8	pasture	4	3	3					5.3	LRG
25/11/2015	920	310	35	KM2/3	merse	1	1	1					11.3	LRG
25/11/2015	940	360	35	KM4b/5	merse								9.7	LRG
08/12/2015	2300	367	16	V9	pasture								4.4	LRG
08/12/2015	1440	255	10	T10/11	pasture								3.9	LRG
08/12/2015	2480	400	58	M1	pasture								14.5	LRG
08/01/2016	50	45	8	KM4b/5	merse								17.8	LRG
09/01/2016	2060	245	18	X2/3	pasture								7.3	LRG
Total		6654	520											
Overall juv%			7.81											
						Brood size totals:								
						38	35	15	7	0	0	Total broods 95		
						Number of juveniles per brood size category:					Max %juvs 18.8			
						38	70	45	28	0	0	Total juvs 181		
											Mean brood 1.91			

3.12 Leucistic Barnacle Geese

A minimum of four different leucistic Barnacle Geese was recorded in winter 2015-2016, often in the Newton Marsh to Rockcliffe Marsh area, Cumbria, as in previous winters or occasionally on Redkirk Marsh near Gretna or at Hurkledale, Caerlaverock, Kirkconnell or Mersehead. In the same flocks a Snow Goose *Chen caerulescens* was often recorded.

3.13 Other geese

One Light-bellied Brent Goose *Branta bernicla brota* was seen in a flock of Pink-footed Geese in the Bankend area in March 2016 with one also seen heading west across the saltmarsh of Eastpark in May 2016.

3.14 Acknowledgements

Thanks go to Mike Carrier and Bob Jones for conducting census counts in the Rockcliffe/Burgh Marsh area, Dave Blackledge 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 and Eric Neilson for covering the Southwick area to Drumburn.