



Animal &
Plant Health
Agency

Livestock Demographic Data Group:

Sheep and Goat Enhanced Demographics – Summary

2006-2016



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The Animal and Plant Health Agency (APHA) is an executive agency of the Department for Environment, Food & Rural Affairs, and also works on behalf of the Scottish Government and Welsh Government.

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LDDG Sheep and Goat Enhanced Demographics Summary 2017-19

A report of work done within APHA Contract G 2017-19.

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Introduction

The aim of the Livestock Demographic Data Groups (LDDGs) is to enhance knowledge of livestock demographics; including the development of a set of indicators, which can be used to monitor changes in risk of introduction or transmission of disease.

This report presents analysis of data from various sources, within and outside APHA, that were deemed to be of potential value to monitoring changes in the disease status or risk of disease introduction, transmission or detection in the GB sheep and goat population. Seven indicators were investigated for sheep and goat populations: (1) 'population of holdings and number of animals'; (2) 'distribution of flock sizes'; (3) 'Number of holdings that entered and exited the annual census'; (4) 'APHA field visits' (sheep only); (5) 'Number of fallen stock collections'; (6) 'Imports and Exports into/from GB'; (7) 'Distribution of sheep holdings in Less Favoured Areas'.

After the main indicators, an analysis on movement data of sheep in Britain between 2010 and 2014 has been included in the report.

Indicators

1. Population of holdings and number of animals

Rationale as indicator for disease entry/transmission

Population size provides a critical denominator needed to understand population at risk of disease and the potential impact of diseases. It can also influence risk of disease transmission between farms (e.g. increased farm density can increase risk of transmission) and to the human population. This is useful data to develop disease contingency plans. Furthermore, diseases can be a contributing factor to the sustainability of sheep and goat businesses. Important decreases in population size may be caused by disease impact on farm performance, among other factors.

Confounders and potential bias

Changes in population might also be an indicator of changes to the livestock inputs (feed costs, etc.), products prices, demand and social environment.

Important data collection gaps have been reported in the collection of the Sheep and Goat Inventory survey, with large number of farms potentially that have not been included. Hence, careful interpretation of these results is required.

Dataset source

Sheep and Goat Inventory.

Results

Table 1: Number of holdings and animal population of sheep and goats reported from the Sheep and Goat Inventory 2006-2016 in Great Britain (this includes breeding ewes and rams in December). The percentage change indicates changes in population of holdings or animals from the corresponding previous year.

Year	SHEEP				Year	GOAT			
	Number of holdings		Number of sheep			Number of holdings		Number of goat	
	No	% change	No	% change		No	% change	No	% change
2006	55,121	-	14,290,503	-	2006	6,092	-	84,868	-
2007	65,405	19%	16,764,411	17%	2007	5,984	-2%	75,575	-11%
2008	69,935	7%	17,630,806	5%	2008	5,442	-9%	72,060	-5%
2009	69,257	-1%	16,790,888	-5%	2009	6,932	27%	74,842	4%
2010	70,616	2%	16,533,177	-2%	2010	7,530	9%	85,213	14%
2011	72,218	2%	16,952,090	3%	2011	7,903	5%	93,627	10%
2012	73,393	2%	17,320,811	2%	2012	8,067	2%	95,425	2%
2013	72,317	-1%	17,859,007	3%	2013	7,907	-2%	89,211	-7%
2014	69,325	-4%	17,165,708	-4%	2014	7,868	0%	91,602	3%
2015	66,686	-4%	17,266,066	1%	2015	7,653	-3%	87,139	-5%
2016	65,878	-1%	17,008,309	-1%	2016	7,936	4%	92,977	7%

2. Distribution of flock sizes

Rationale as indicator for disease entry/transmission

Flock size has been identified as a risk factor for several diseases, such as scrapie (McIntyre et al., 2006), Contagious Ovine Digital Dermatitis (Dickins et al., 2016) or Q fever (Rizzo et al., 2016). Disease management might be very different in small and large farms and the disease impact can also vary greatly. Understanding which flock size categories are growing or decreasing in number might indicate potential changes in the risk of disease transmissions in GB.

Confounders and potential bias

Large farms are subject to economies of scale and are potentially able to better compete in the market. Flock size is also dependent on land availability.

Dataset source

Sheep and Goat Inventory.

Results

Table 2: Sheep flock sizes in Great Britain according to Sheep and Goat Inventory data, 2006-2016. Percentages in tables indicate the amount of population change compared to the previous year.

Year	Percentile flock size					Mean
	5th	25th	50th	75th	95th	
2006	4	26	104	329	1,000	259
2007	4	26	102	311	1,000	256
2008	4	24	98	300	1,000	252
2009	3	22	91	288	975	242
2010	3	20	87	278	944	234
2011	3	20	86	280	947	235
2012	3	20	88	281	945	236
2013	3	21	92	295	998	247
2014	6	19	84	290	1,027	247
2015	6	20	90	306	1,066	259
2016	6	20	87	297	1,075	258

Year	Number of sheep holdings per flock size category											
	<25		25-99		100-249		250-499		500-999		+1000	
	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%
2006	13,282		13,658		10,890		8,488		6,015		2,788	
2007	15,718	18%	16,300	19%	13,703	26%	9,595	13%	6,782	13%	3,307	19%
2008	17,518	11%	17,590	8%	14,532	6%	9,864	3%	6,924	2%	3,507	6%
2009	18,503	6%	17,273	-2%	13,986	-4%	9,542	-3%	6,653	-4%	3,300	-6%
2010	19,831	7%	17,265	0%	14,226	2%	9,557	0%	6,572	-1%	3,165	-4%
2011	20,425	3%	17,605	2%	14,381	1%	9,939	4%	6,647	1%	3,221	2%
2012	20,526	0%	17,879	2%	14,769	3%	9,988	0%	6,927	4%	3,304	3%
2013	19,727	-4%	17,454	-2%	14,432	-2%	10,100	1%	6,999	1%	3,605	9%
2014	19,974	1%	16,807	-4%	13,036	-10%	9,229	-9%	6,617	-5%	3,662	2%
2015	18,678	-6%	15,912	-5%	12,553	-4%	9,099	-1%	6,628	0%	3,816	4%
2016	18,596	0%	15,919	0%	12,561	0%	8,369	-5%	6,401	-3%	3,762	-1%

Year	Total number of sheep per flock size category											
	<25		25-99		100-249		250-499		500-999		+1000	
	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%
2006	143,695		736,635		1,790,190		3,024,680		4,139,415		4,455,888	
2007	166,872	16%	891,055	21%	2,236,266	25%	3,400,606	12%	4,684,250	13%	5,385,362	21%
2008	183,827	10%	960,848	8%	2,361,228	6%	3,497,166	3%	4,792,156	2%	5,835,581	8%
2009	187,659	2%	940,893	-2%	2,272,908	-4%	3,380,591	-3%	4,621,883	-4%	5,386,954	-8%
2010	199,547	6%	943,074	0%	2,319,220	2%	3,394,956	0%	4,548,720	-2%	5,127,660	-5%
2011	200,501	0%	966,830	3%	2,336,098	1%	3,531,415	4%	4,602,731	1%	5,314,515	4%
2012	202,512	1%	981,410	2%	2,409,811	3%	3,544,845	0%	4,787,855	4%	5,394,378	2%
2013	194,932	-4%	956,679	-3%	2,345,286	-3%	3,588,654	1%	4,860,444	2%	5,913,012	10%
2014	196,545	1%	914,957	-4%	2,115,160	-10%	3,277,574	-9%	4,607,594	-5%	6,053,878	2%
2015	183,179	-7%	871,578	-5%	2,040,475	-4%	3,239,485	-1%	4,621,088	0%	6,310,261	4%
2016	183,539	0%	866,856	0%	2,047,868	0%	3,077,852	-5%	4,474,040	-3%	6,358,154	1%

It appears that the total number of sheep and the number of larger flocks have increased over recent years but this increase is slight.

Table 3: Goat flock sizes in Great Britain according to Sheep and Goat Inventory data, 2006-2016. Percentages in tables indicate the amount of population change compared to the previous year.

Year	Percentile flock size					Mean
	5th	25th	50th	75th	95th	
2006	1	2	3	6	26	14
2007	1	2	3	5	22	13
2008	1	2	2	5	19	13
2009	1	2	2	5	18	11
2010	1	2	2	5	18	11
2011	1	2	2	5	18	12
2012	1	2	2	5	17	12
2013	1	2	2	5	17	11
2014	1	2	2	5	18	12
2015	1	2	3	5	18	11
2016	1	2	2	5	19	12

Year	Number of goat holdings per flock size category											
	<25		25-99		100-249		250-499		500-999		+1000	
	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%
2006	5775		210		47		22		22		16	
2007	5714	-1 %	181	-14 %	37	-21 %	20	-9 %	18	-18 %	14	-13 %
2008	5228	-9 %	143	-21 %	32	-14 %	8	-60 %	16	-11 %	15	7 %
2009	6687	28 %	170	19 %	31	-3 %	15	88 %	16	0 %	13	-13 %
2010	7273	9 %	175	3 %	38	23 %	13	-13 %	12	-25 %	19	46 %
2011	7625	5 %	189	8 %	40	5 %	14	8 5	14	17 %	21	11 %
2012	7800	2 %	182	-4 %	37	-8 %	7	-50 %	20	43 %	21	0 %
2013	7640	-2 %	191	5 %	32	-14 %	12	71 %	14	-30%	18	-14 %
2014	7592	-1 %	200	5 %	37	16 %	9	-25 %	10	-29 %	20	11 %
2015	7384	-3 %	193	-4 %	40	8 %	13	44 %	9	-10 %	14	-30 %
2016	7636	3 %	230	19 %	34	-15 %	8	-38 %	12	33 %	16	14 %

Year	Total number of goat per flock size category											
	<25		25-99		100-249		250-499		500-999		+1000	
	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%
2006	23516		9941		7307		7759		15283		21062	
2007	22674	-4 %	8170	-18 %	5821	-20 %	6782	-13 %	12273	-20 %	19855	-6 %
2008	20767	-8 %	6205	-24 %	4442	-24 %	2606	-62 %	10501	-14 %	27539	39 %
2009	25453	23 %	7438	20 %	4447	0 %	5335	105 %	11347	8 %	20822	-24 %
2010	27066	6 %	7892	6 %	5715	29 %	4686	-12 %	8694	-23 %	31160	50 %
2011	28134	4 %	8436	7 %	6160	8 %	4987	6 %	10126	16 %	35784	15 %
2012	29428	5 %	7883	-7 %	5513	-11 %	2382	-52 %	13686	35 %	36533	2 %
2013	29088	-1 %	8218	4 %	4847	-12 %	4329	82 %	9710	-29 %	33019	-10 %
2014	28822	-1 %	8796	7 %	5756	19 %	3181	-27 %	7209	-26 %	37838	15 %
2015	28305	-2 %	8341	-5 %	5936	3 %	4522	42 %	6995	-3 %	33040	-13 %
2016												11
	29477	4 %	10237	23 %	5126	-14 %	2783	-38 %	8649	24 %	36705	

3. Number of holdings that entered and exited the annual census

Rational as indicator for disease entry/transmission

Disease impact may be a relevant factor causing the opening and closing down of sheep holdings, but also may indicate the introduction of sheep with increased susceptibility to disease in the population.

Confounders and potential bias

Economic environment; national and local policies on sheep or goat production and land availability could also affect this indicator; survey response varies between years.

Dataset source

Sheep and Goat Inventory.

Results

Table 4: Number of sheep and goat holdings entering the survey in each year. Percentages presented are relative to the whole population in the respective year.

Number of new sheep holdings that entered the survey in GB					Number of new goat holdings that entered the survey in GB				
	First time in survey since 2006		New farms compared to previous year			First time in survey since 2006		New farms compared to previous year	
2007	22890	41%	22890	41%	2007	2126	35%	2126	35%
2008	12333	19%	18618	28%	2008	1347	23%	1939	32%
2009	8222	12%	13436	19%	2009	1627	30%	2813	52%
2010	7318	11%	13739	20%	2010	1627	23%	2170	31%
2011	7347	10%	14309	20%	2011	1678	22%	2148	29%
2012	6978	10%	13886	19%	2012	1553	20%	2033	26%
2013	5430	7%	12061	16%	2013	1228	15%	1787	22%
2014	5106	7%	12202	17%	2014	1219	15%	1860	24%
2015	4526	7%	10784	16%	2015	1039	13%	1638	21%
2016	4314	6%	11405	17%	2016	1408	18%	2019	26%

Table 5: Number of sheep and goat holdings exiting the survey in each year. Percentages presented are relative to the whole population in the respective year.

Number of sheep holdings that exited the survey in GB					Number of goat holdings that exited the survey in GB				
	Farm that exited and never returned to the survey		Farm exit from previous year			Farm that exited and never returned to the survey		Farm exit from previous year	
2007	3679	7%	12606	23%	2007	1274	21%	2234	37%
2008	6034	9%	14143	22%	2008	1187	20%	2481	41%
2009	6063	9%	14038	20%	2009	870	16%	1323	24%
2010	5792	8%	12666	18%	2010	1099	16%	1572	23%
2011	6594	9%	12743	18%	2011	1322	18%	1775	24%
2012	6643	9%	12652	18%	2012	1291	16%	1869	24%
2013	7208	10%	13168	18%	2013	1384	17%	1947	24%
2014	10414	14%	15031	21%	2014	1406	18%	1899	24%
2015	9067	13%	13291	19%	2015	1439	18%	1853	24%
2016	13360	20%	13360	20%	2016	1737	23%	1737	23%

4. APHA field visits (sheep only)

Rationale as indicator for disease entry/transmission

Changes in the number of APHA welfare farm visits may indicate a deterioration of animal health and an increased susceptibility to diseases. Some visits may be directly related to a

farm's disease status. Changes in the number of APHA farm visits for scrapie cases may indicate a change of scrapie status, but it may also suggest differences of farmers' awareness to disease reporting. Changes in the number of APHA field visits for the sheep and goat annual serosurvey may indicate effectiveness in accessing sheep farms. Overall figures provide an understanding of field contact by APHA to sheep and goat holdings, and on APHA capacity to control or detect diseases.

Confounders and potential bias

Number of field visits may respond to changes in policies in different countries or changes in the type of production systems. Changes in the size of the sheep population may also affect the number of visits conducted in a year. Many welfare visits may be due to non-disease related issues. Visits conducted for the serosurvey are predetermined based on an established study design and therefore are not expected to vary.

Some visits done by APHA, such as for suspicion of notifiable diseases, were not considered in this report.

Dataset source

Scrapie database, Sheep and goat annual serosurvey; Welfare visits; Sheep ID inspections.

Results

Table 6: Visits by APHA Field Services staff to sheep holdings for different purposes; with respective increase/decrease in the percentage of visits (%) compared to the previous financial year.

		Year 2013	Year 2014	Year 2015	Year 2016
Number of Visits	S&G survey	1272	666 (-52%)	648 (-3%)	704 (+8%)
	Welfare visits	592	687 (+16%)	1225 (+78%)	1259 (+3%)
	Scrapie surveillance	50	44 (-18%)	22 (-50%)	17 (-22%)
	RPA (Sheep ID inspections)	-	-	-	98
	Total*	1914	1397 (-27%)	1895 (+36%)	2078 (+9.7%)
Number of holdings visited	S&G survey	1272	660 (-52%)	648 (-2%)	704 (+9%)
	Welfare visits	380	425 (+12%)	978*** (+130%)	1002*** (+2%)
	Scrapie surveillance	24	21 (-13%)	4 (-81%)	12 (+200%)
	RPA (Sheep ID inspections)	-	-	-	98
	Total**	1670	1103 (-34%)	1623 (+47%)	1845 (+14%)

*Several holdings were visited for different surveys/purposes on the same date. This total represents the unique number of visits done to sheep holdings

**Several holdings were visited for different surveys/purpose. These totals represent the number of holdings that APHA visited.

***some visits did not have CPH records (2016 = 35 CPH missing, 2015=22 CPH missing)

5. Number of fallen stock collections

Rationale as indicator for disease entry/transmission

It is expected that the majority of sheep and goat die because of disease or health related issues, and thus the number of fallen stock may represent an important indicator of the health situation in farms.

This indicator provides some estimations on the limits to which number of fallen stock reported each month could be considered statistically normal, and could be used for monitoring of population health status. The number of fallen stock reported above those limits may indicate a deterioration of health status in the population.

Confounders and potential bias

Number of fallen stock is directly influenced by population size. In addition, fallen stock data depends on the number of collections point available from the National Fallen Stock company. Furthermore, there are some companies collecting fallen stock not represented in this study, other than the National fallen stock company.

Dataset source

National fallen stock company.

Results

Figure 1: Collection of sheep and lambs in GB, 2011-2016.

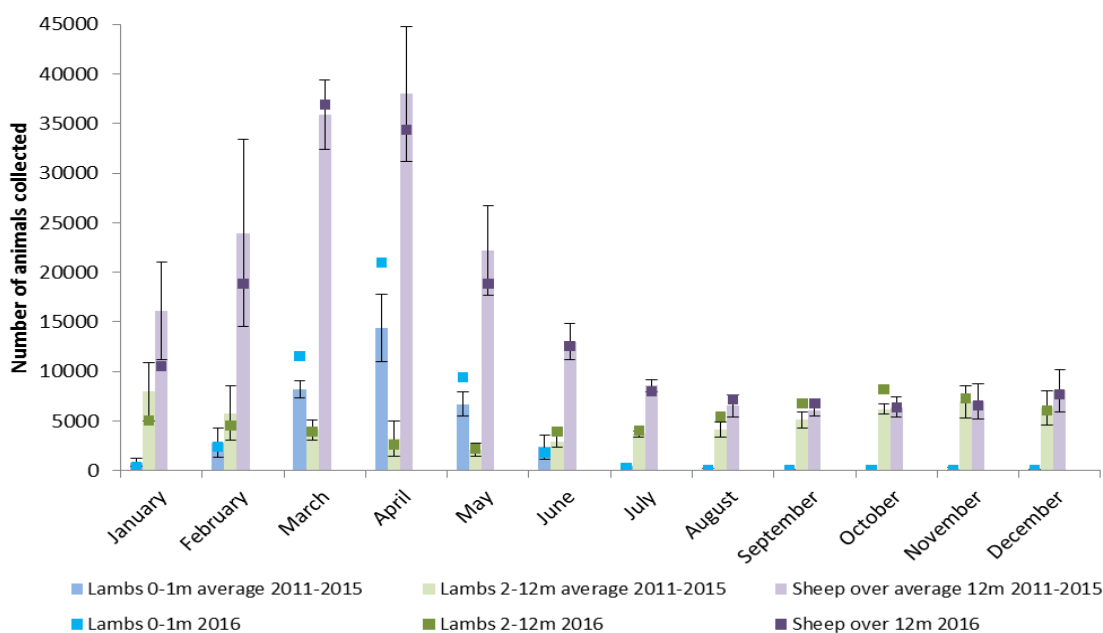
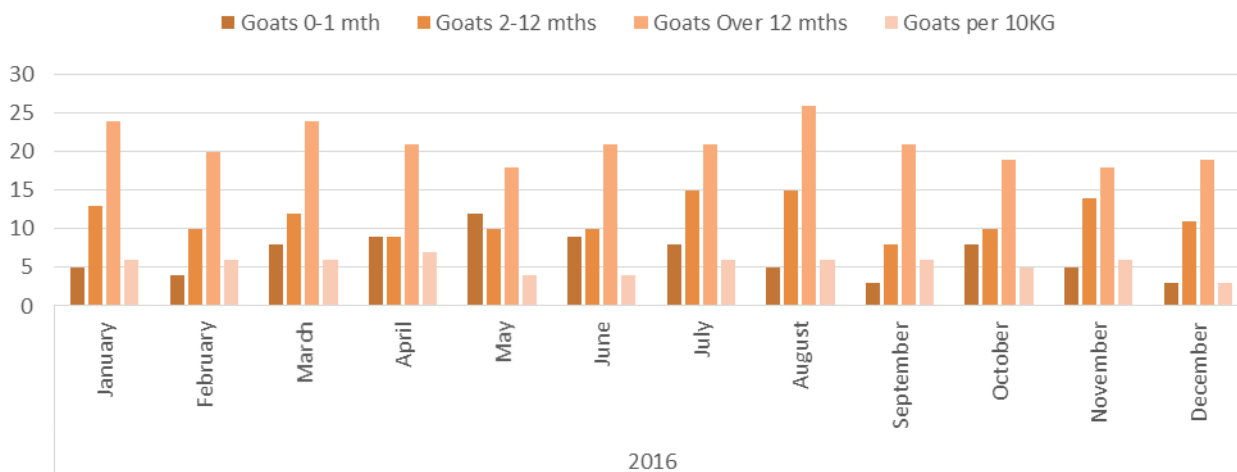


Figure 2: Total number of goats collected by month and age-group categories in GB, 2016.



6. Imports and Exports into/from GB

Rationale as indicator for disease entry/transmission

Imports may indicate potential exposure of the national sheep population to exotic pathogens from other countries. This also includes endemic diseases in imported animals which may not be present in the flock to which imported animals are introduced. It is critical information needed for risk assessment aiming to determine risk of introduction of diseases. It may also indicate the introduction of susceptible animals and breeds to national endemic diseases.

Similarly, to imports, exports data may indicate potential degree of indirect contact with other countries with different disease status. Changes in export may possibly also indicate changes in breeding, production systems and farm management systems in the UK which may affect susceptibility to disease.

Confounders and potential bias

Favourable international markets and domestic demand could affect the import patterns in particular periods.

Dataset source

TRAdE Control and Export System (TRACES).

Results

Table 7: Number of sheep and consignments imported to and exported from Britain within the EU, 2010-2016.

Year	Imported to GB				Exported from GB			
	Number of consignments		Number of animals		Number of consignments		Number of animals	
	No	% Change	No	%Change	No	%Change	No	%Change
2010	178	-	20,206	-	1771	-	394,103	-
2011	94	-47%	1,113	-94%	2114	19%	528,768	34%
2012	124	+32%	4,903	341%	1900	-10%	436,214	-12%
2013	66	-47%	2,096	-57%	2176	15%	499,274	14%
2014	126	+90%	3770	+80%	1782	-12%	402,158	-19%
2015	169	+33%	5639	+50%	1680	-6%	362,311	-10%
2016	131	--22%	3074	-46%	2242	33%	485,481	34%

Table 8: Number of goats and consignments imported to and exported from Britain within the EU, 2010-2016.

Year	Imported to GB		Exported from GB	
	Number of consignments	Number of animals	Number of consignments	Number of animals
2010	4	9	22	1279
2011	4	11	54	819
2012	14	454	62	706
2013	6	28	51	304
2014	7	275	34	464
2015	22	1972	57	637
2016	7	1701	No data	No data

7. Distribution of sheep holdings in Less Favoured Areas

Rationale as indicator for disease entry/transmission

Sheep production in Less Favoured Areas might have different susceptibility to diseases. They may also have a different contact rate with other sheep farms. Changes in the proportion of farms located in these areas might influence disease prevalence/incidence and the risk of disease transmission. There is a surveillance gap identified in these animals and the Centre of Expertise in Extensively Managed Livestock is tasked with developing better understanding of this population of animals.

Confounders and potential bias

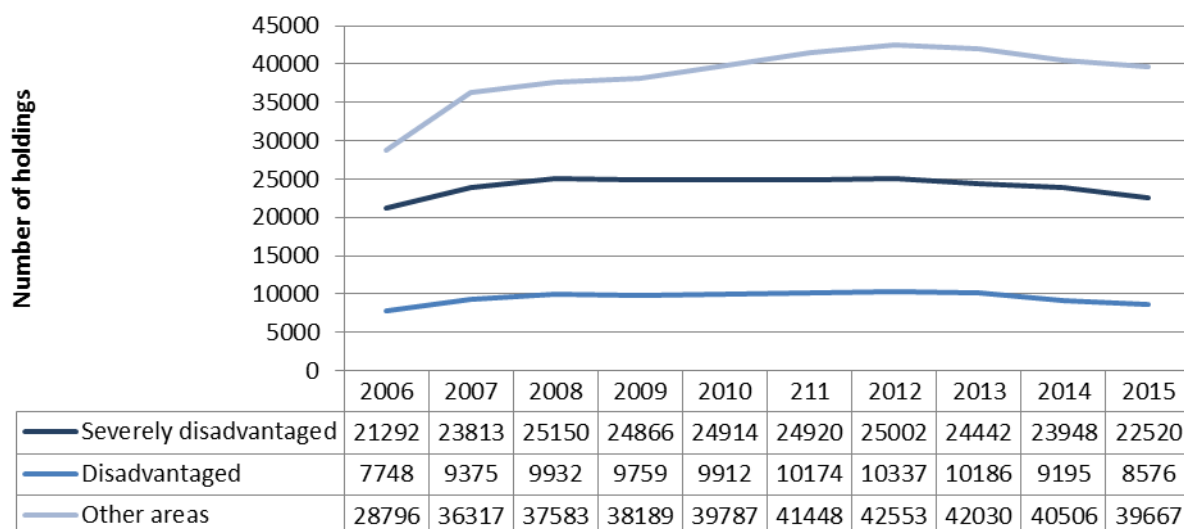
Less favoured areas are normally associated with specific breeds and production of pure breeds.

Dataset source

Spire.

Results

Figure 3: Number of sheep holdings in the different Less Favoured Areas in GB.



Movement of sheep in Britain between 2010-2014

Background

Unless otherwise specified, the analyses presented have been performed on sheep movement data from the Animal Movements Licensing System (AMLS) and Scottish Animal Movement System (SAMS) via the Rapid Analysis and Detection of Animal-related Risks (RADAR) data warehouse.

The GB Animal Movements Universe in RADAR contains movements throughout GB up until July 2014 where Scottish data stopped being included. The GB Universe contains only a limited number of fields from the two source databases and therefore is not suitable for more detailed analysis beyond summary movement statistics.

This report uses extracts from the GB Universe for all sheep movements 2010- 2014. Scottish data has been incorporated from July 2014 so as to complete movements for this

time period. Data extracts have been stored in a SQL Server database for analysis, alongside spatial information regarding county and APHA regions.

Results

Table 9: Total movements and number of sheep moved in GB, 2010-2014

Year	Total Animals moved	Total number of movements
2010	53439491	1316034
2011	52348010	1279071
2012	52303934	1284672
2013	54406134	1330462
2014 (AMLS to end Jun, then SAMS for Jul-Dec + AMLS for Eng/Wales only. Cross border movements from SAMS)	55963476	1499719 – Inflated due to processing of movements on a premises-market-premises basis.

Figure 4: Number of sheep moved within and between regions of England, Scotland and Wales, 2014.

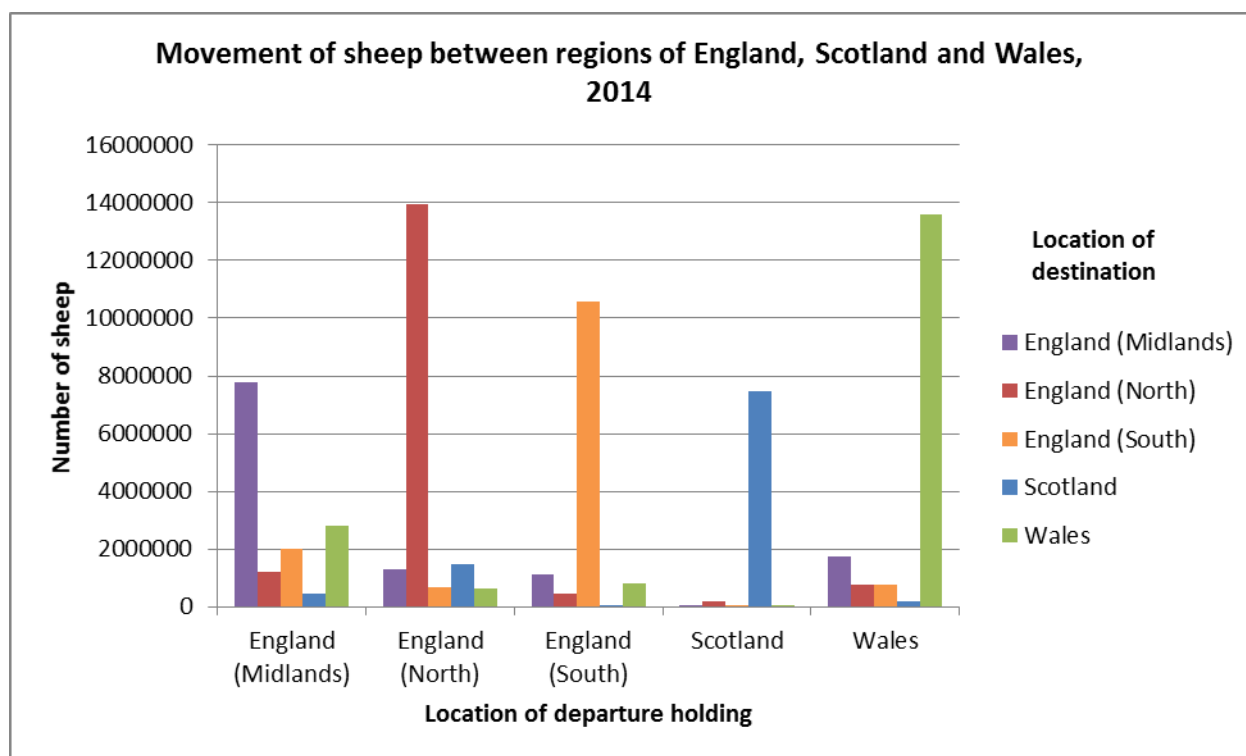


Figure 5: Movement of sheep in GB between Agricultural Holdings, Markets and Slaughter premises for the years 2010 to 2014.

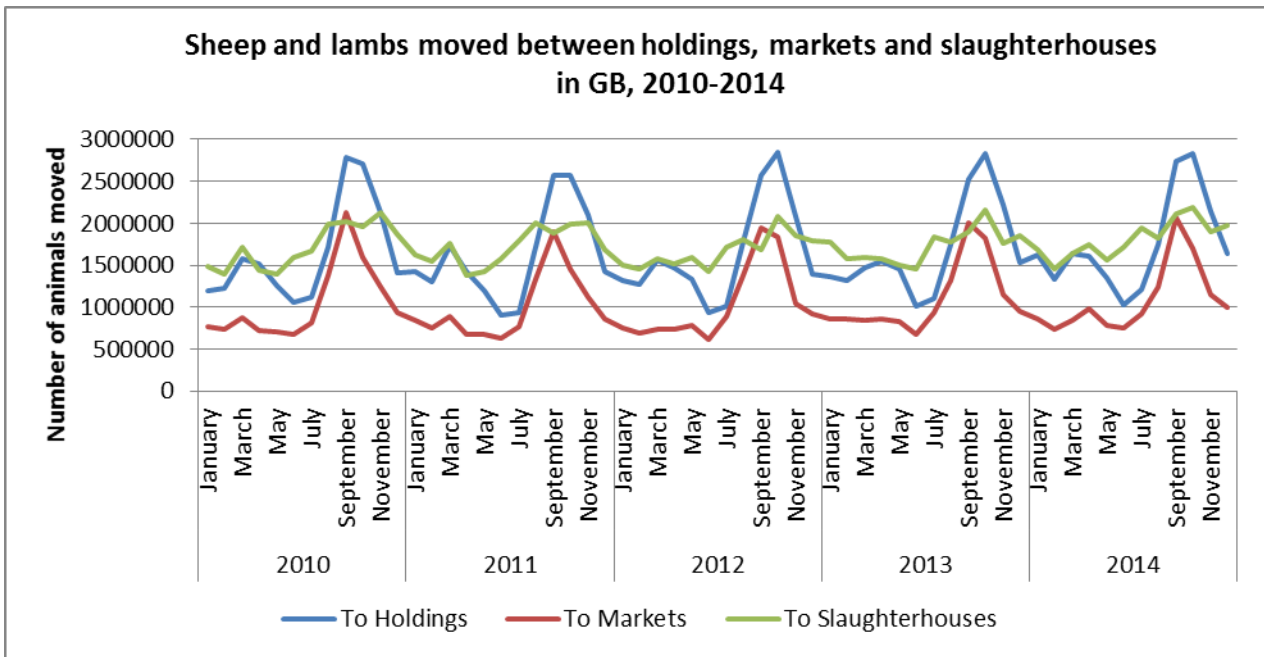


Figure 6: Average number of sheep moved per movement for different destination types by month.

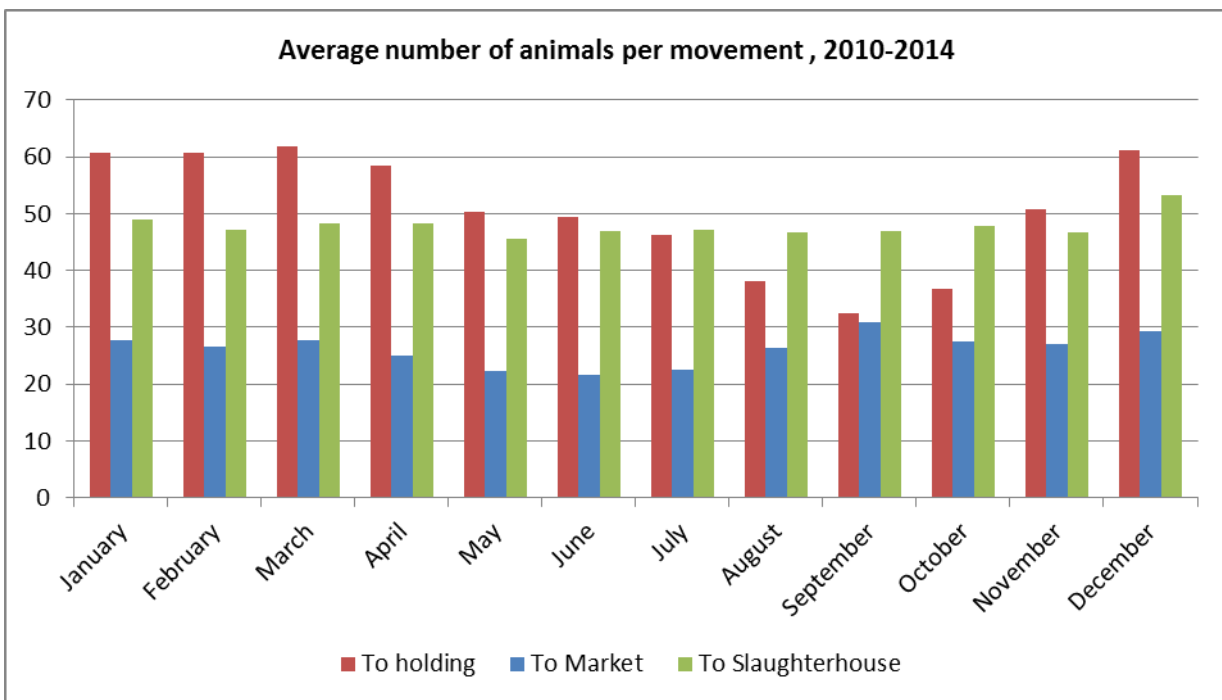


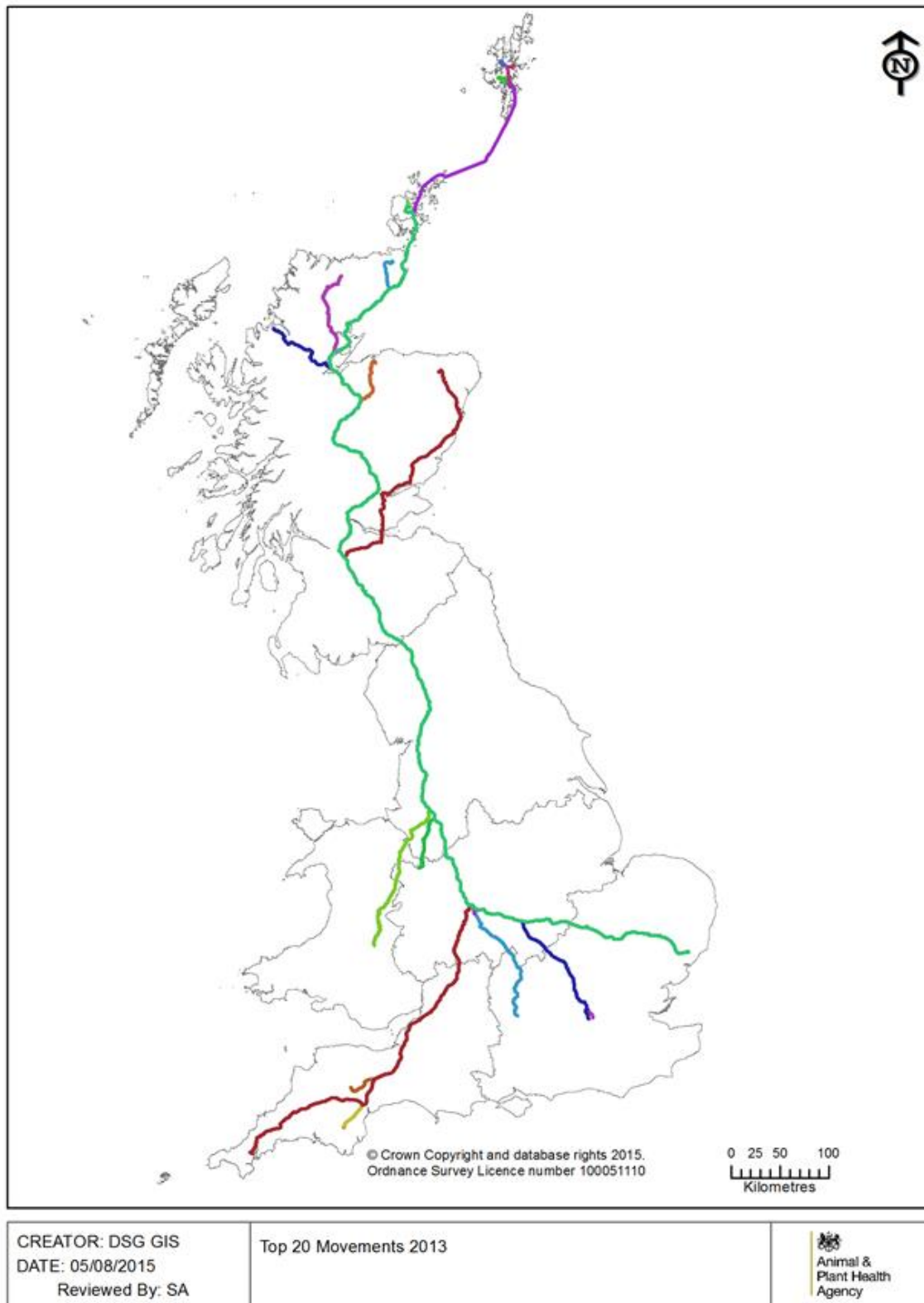
Table 10: Average distance moved by sheep and percentage of movements >250km by type of destination, 2011-2014.

	2011		2012		2013		2014	
	Ave distance (<250km)	% of moves >250km	Ave distance (<250km)	% of moves >250km	Ave distance (<250km)	% of moves >250km	Ave distance (<250km)	% of moves >250km
Holding	40.75	2.22	40.14	2.50	39.77	2.36	45.30	6.26
Common land	18.58	2.50	18.26	0.88	16.43	0.19	18.96	4.22
Market	27.93	0.50	28.22	0.53	28.26	0.56	32.02	1.09
Slaughter premises	27.63	3.85	56.71	3.93	59.16	4.31	60.57	11.32
All destinations	41.04	2.06	40.32	2.14	40.46	2.16	43.69	5.40

Table 11: Average distance moved by sheep (all purposes) and percentage of movements >250km by region of destination, 2011-2014.

	2011		2012		2013		2014	
	Ave distance (<250km)	% of moves >250km	Ave distance (<250km)	% of moves >250km	Ave distance (<250km)	% of moves >250km	Ave distance (<250km)	% of moves >250km
England Midlands	43.22	2.56	43.43	2.77	42.78	2.66	39.46	11.84
England North	40.62	1.61	39.55	1.63	40.12	1.96	44.92	5.40
England South	41.41	2.30	40.22	2.30	39.30	2.07	39.36	2.96
Scotland	50.49	2.09	48.87	2.36	50.03	2.36	54.51	3.22
Wales	33.70	1.91	33.97	1.98	34.72	2.00	34.71	5.66
GB	41.04	2.06	40.32	2.14	40.47	2.16	43.70	5.40

Figure 7: Most likely paths of the 20 longest movements of sheep recorded in 2013.



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