



Animal &
Plant Health
Agency

Livestock
Demographic
Data Group:
Pig
population
report

Livestock
population
density maps
for GB 2019



*re-published with corrections



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Who are these reports for?

These reports are suitable for use in animal health and welfare policy work which requires an estimate of the distribution and size of the pig population at GB level. This type of population level information is often required to assess the economic or social impact of particular animal health policies, for contingency and resource planning, or to provide evidence to trading partners. There are important assumptions and uncertainties with these estimates, which the user must take into consideration; these can be found at [Annex 1](#).

Who did this work?

The Livestock Demographic Data Groups (LDDG) were formed in January 2014. These are made up of APHA representatives from data systems, epidemiology, species expert and GIS work groups. The LDDGs are grateful to Defra, Welsh Government, Scottish Government, the Agriculture and Horticulture Development Board (AHDB-Pork for their assistance in providing access to the pig movement eAML2 data), and APHA Weybridge Data System Group (DSG) staff who handled the Scottish EID Livestock Traceability Research (ScotEID) data through the ScotEID support team.

What do the data show about the population?

The maps in Figures 1 and 2 show the estimated pig density and pig holding density respectively, each with a small insert map to show how this compares with the estimated density of pig holdings or pigs respectively. A pig holding is defined here as any holding on which pigs are moved to and from during the period of interest. This definition includes markets, abattoir and other non pig-keeping premises, although these are estimated to be a small proportion compared to the pig-keeping holdings ([Pig Enhanced Demographics – summary for external report 2019](#)).

The pig and pig holding density maps are similar to previous reports. The highest densities in pig population (Figure 1) are in Yorkshire and Humber, the East of England and a small area within North-East Scotland, where the majority of large commercial farms are known to exist. The map outputs also correspond with high density pig areas of commercial farms identified by the [AHDB pig pocketbook](#), although the time period for this output was 2013 ([2017 AHDB pig pocketbook](#), page 5).

Figure 2 shows a higher density of pig holdings in several areas, particularly in South-West England and the Midlands. Interestingly, both Wales and South-East England are shown to have areas of higher holding density, whereas Figure 1 indicates lower pig density. This points to a lower number of pigs per holding, and may reflect a greater proportion of small-holder premises with pigs in these areas. Tables 2 and 3 summarise the estimated number of holdings by country within GB, and the estimated number of holdings by size category

for each country. The estimated total number of holdings has reduced from 31,663, in the 2014-2015 report, to 27,995 for 2016-17. This reduction in holdings may, in part, reflect data cleansing and improved accuracy in the eAML2 data extract provided by AHDB. This hypothesis was supported by fewer records requiring data cleaning within APHA. The number of movement records that were omitted due to having zero pigs recorded as being moved was reduced from 1,090 in 2014-2015 to 219 in 2016-2017, and the number of movements with missing County Parish Holding number (CPH) or postcode information, reduced from 1,237 to 28.

How accurate are the data?

Information for England and Wales on pig holding locations, and the data used to estimate pig density, was extracted from a dataset of pig movements reported to the electronic animal movements licencing scheme (eAML2) for England and Wales, from 2016-2017. Information on pig holdings and density in Scotland was accessed from the Scottish Electronic Identification (ScotEID) database from 2016-2017. These schemes record all movements reported by pig keepers in GB. The dataset is capable of identifying all holdings to or from which pigs have moved, regardless of the size or type of holding.

The dataset used may contain holdings which no longer have pigs, particularly due to the period of time the data spans (24 months). This issue is also relevant for other potential data sources, including the Agricultural Survey. Previous analysis identified a 24-month dataset as the most suitable, as this balanced maximizing the inclusion of smaller holdings with infrequent movements with the potential of including larger holdings which are no longer active.

These data sources are also considered most appropriate and most accurate for determining estimates for herd size for this population, despite not recording this information directly. Herd size (and hence pig density) was estimated using an algorithm, which assessed the number of pigs moved from or to holdings during the 24-month period. The estimates from the previous report were validated using a subset of accurately matched holdings (2,007) with herd size information held in the 2014 Agricultural Survey. Inferring herd size from movement data may have introduced inaccuracies. The supporting quality statement provides further detail on the limitations in the data ([Annex 1](#)).

What do the data not show?

There is uncertainty inherent in the information displayed. The limitations in the dataset are discussed in the supporting quality statement ([Annex 1](#)), and it is important that the users consider these in the context of their work and use of this data.

Previously, errors were identified where movements from some breeding herds had not been reported, due to a misinterpretation of PRIMO (Pigs (Records, Identification and Movement) Order) regulations. Therefore, there is potential for the size of some

commercial breeding herds to be underestimated. The use of a 24-month time period of movements may also introduce error. Some holdings may no longer have pigs present, and hence the total number of holdings may be an overestimate.

Population and holding density maps are classified using different scales and units. Due care must therefore be taken regarding their interpretation.

How were the maps produced?

Data providing summary information on pig movements for the 24-month period 2016-17 held in eAML2 and ScotEID were merged and rationalised to remove duplicates. A series of data cleaning steps were used to consolidate information on the CPH and postcode of sending and receiving holdings, departure date and the number of pigs moved. Further details of the cleaning process are available on request.

The cleaned movement data were used to compile a list of all holdings referenced in the dataset. A summary of the number of movements and numbers of pigs moved on and off during the specified 24-month period was created. The number of pigs moved off of a holding was used to estimate the number of pigs present on that departure holding. This was classed into five holding size categories, as indicated in the summary below (Table 1). If no 'off' movements were recorded in the 24-month period for a holding, then the same criteria for determining the size categories were applied to the 'on' movements.

In order to produce the maps of pig density, each size category of holding was designated a size weighting value. This value was previously determined based upon cross-reference to a subset of holdings present in the Agricultural Survey with a known herd size and extrapolated to the full dataset of holdings (Table 1).

Table 1: Description of the five categories of numbers of pigs moved (either incoming or outgoing movements) related to a holding in a 24 month period, which has been used to estimate relevant herd size categories and to provide weighted values for plotting pig density maps.

Size category of holding	Numbers of pigs moved in 24-month period	Size weighting	Comments
1	1-25	3	Size suggests pet pig owners or small holdings
2	26-300	20	Size suggests small holdings
3	301-2,000	110	Size suggests small commercial farms
4	2,001-8,000	550	Size suggests medium commercial farms
5	8000+	2800	Size suggests large commercial farms

The maps were created using the kernel density function in *ArcGIS* software. This tool distributes population information over a defined radius, creating a smooth density surface. Two key parameters that require adjustment are the *search radius distance* and the size of the *output surface grid*. Discussion at the LDDG meetings informed these criteria, and their

selection is recognised as a subjective process¹. A search radius of 15km was deemed sufficient to enable distinction between categories, and a 1km grid square was used for the density surfaces themselves. The classification bins were limited to six, to aide in cross referencing areas of the map to the key. Note that the ArcGIS Kernel Density tool does not take into account edge effects², and as such density estimates in and around coastal areas may be under estimated.

Comparison between the maps was optimised by assigning similar parameters between the species in this series of reports. However, further refinement of the parameters for each species could represent the information more accurately.

Determining the number of pig holdings per country was completed by assigning a country to each holding based on the holding's geographical map reference co-ordinates (Easting and Northing - British National Grid). The spatial coordinates were calculated using the postcode recorded in the dataset. If a holding's postcode was missing from the cleaned dataset, the CPH was used to try and identify a holding location from the APHA's operational database known as "Sam". The data shown in Tables 2 and 3 was produced using this method.

¹ Pfeiffer, D. Spatial Analysis in Epidemiology, 2008. p47.

² https://www.e-education.psu.edu/geog586/l5_p15.html

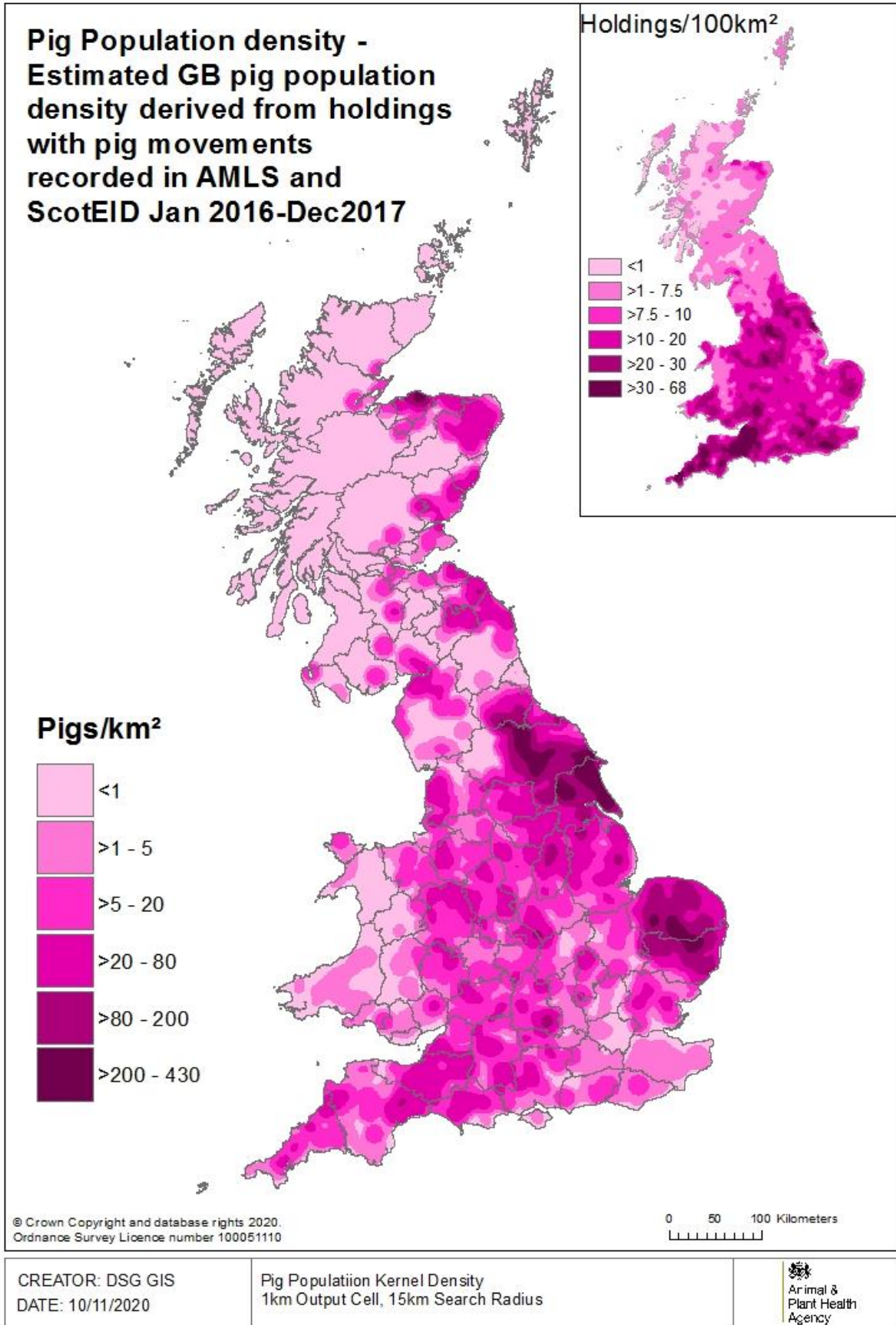


Figure 1: Pig population density in GB

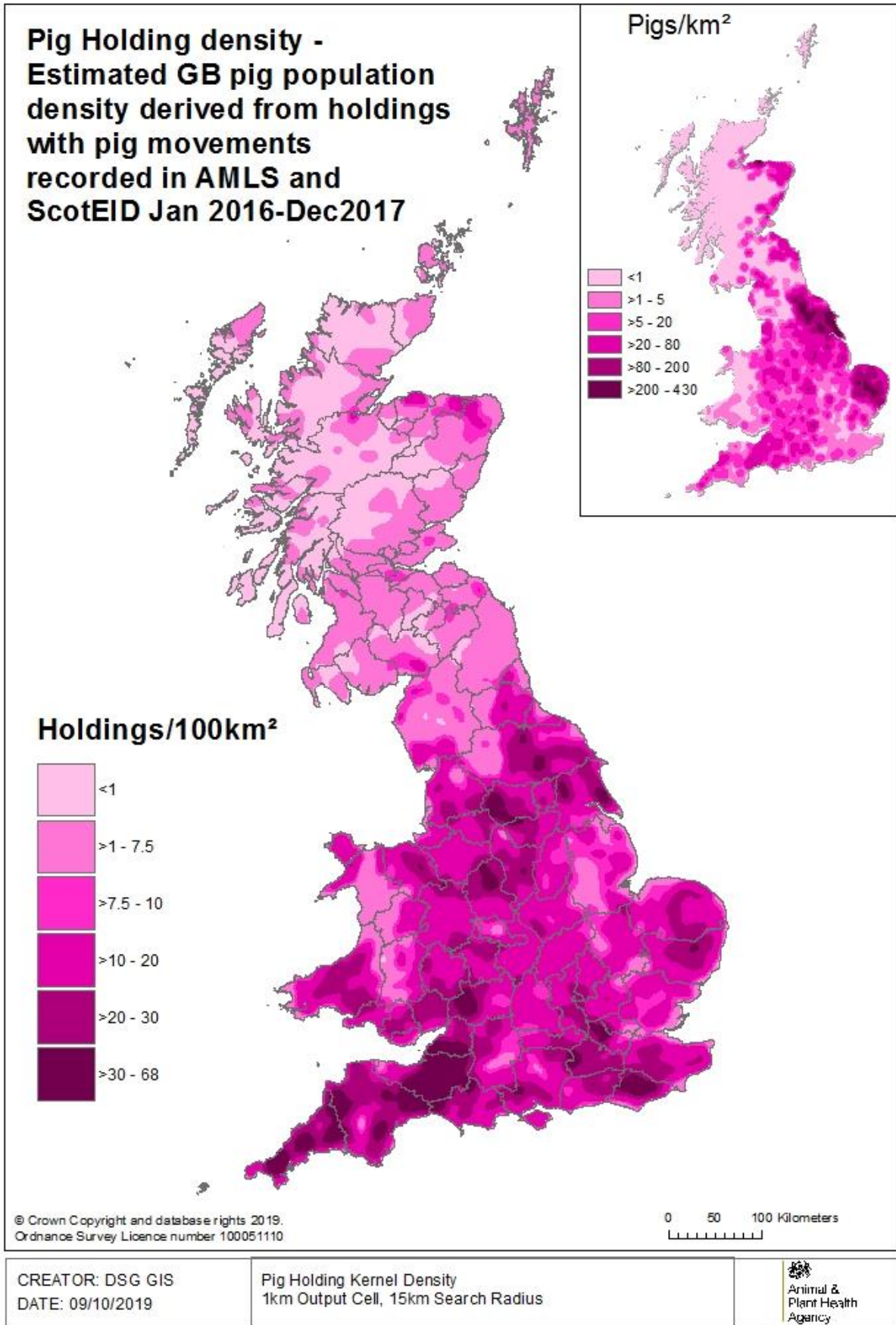


Figure 2: Pig holding density in GB

GB Pig Population and Holding Data tables 2016-17

A total of 27,995 holdings were identified in the dataset and 177 of these could not be related to farm location identifiers that would allow specific spatial coordinates to be generated. Of these, 138 provided information that allowed the county of origin to be determined and the centroid location of the country was used as a proxy for the location of the farm. The remaining 39 holdings were unable to be referenced to a county and were omitted for the reports tables and maps; these holdings had an estimated total of 3,636 pigs.

Table 2: Count of pig holdings, by country (2016-2017).

Country	Holdings
England total	22,769
Scotland total	2,204
Wales total	2,983
GB Total	27,956

The Pig Demographic Report published in November 2017 also used pig movement data from eAML2 and ScotEID. The dataset for this period derived from 2014-15 and included 31,663 holdings. The estimated total number of Scottish holdings recorded in the dataset increased from 1,817 to 2,104, while the total number of holdings in England and Wales reduced. This may in part be due to additional cleaning steps completed by AHDB to remove erroneous movements, or to improve the completion and accuracy of holding identifiers. Evidence for this comes from the reduction in the number of movement records omitted due to missing batch size and those with missing CPH and postcode information. In Scotland, the information supplied by ScotEID contained less identifying information for each holding and so there was greater risk of counting a unique holding as more than one holding location.

Table 3 shows a breakdown of holdings by estimated size category and country. The majority of holdings (73.3%) were within size category 1, and are likely pet pig owners and small holdings. There are 7,471 holdings in categories 2 to 5. The number of size category 4 farms had increased since the 2014-15 report from 1,016 to 1,109 in 2016-17. However, there were fewer size 1 and 2 holdings in the new dataset, reducing from 23,554 and 4,718 to 20,485 and 4,029 respectively. The number of size category 3 and 5 holdings were largely consistent with the previous report (+/-60 holdings). England continued to have the greatest number of holdings of each size category, with Wales having very few holdings of categories 3 to 5. There was an increase in the number of Scottish holdings of all sizes reported in 2016-2017 (from a total of 1,817 to 2,204), which concurs with anecdotal information from an expert at Scotland's Rural Colleges (SRUC) that there has been expansion of the pig industry within Scotland. Wales had a greater proportion of size 1 and 2 holdings compared to other countries, whereas Scotland had the greatest proportion of size category 3 to 5 holdings.

Table 3: The number of pig holdings in each country, by estimated herd size category (2016-2017).

Country	Size Category (No. of holdings)					Total	% of Country total				
	1	2	3	4	5		1	2	3	4	5
England	16,423	3,350	732	970	1,294	22,769	72.1%	14.7%	3.2%	4.3%	5.7%
Scotland	1,607	223	123	121	130	2,204	72.9%	10.1%	5.6%	5.5%	5.9%
Wales	2,455	456	46	18	8	2,983	82.3%	15.3%	1.5%	0.6%	0.3%
GB total	20,485	4,029	901	1,109	1,432	27,956	73.3%	14.4%	3.2%	4.0%	5.1%

Annex 1: Data quality statement for Pigs (November 2019)

Introduction

This statement provides an overview of the quality of the data used to underpin the kernel density holding and livestock maps, and the supporting data tables. This statement is written in the context of the data being used to provide an overview of the livestock demographics within Great Britain. The statement may not necessarily relate to data quality for other purposes.

Overview and purpose of the source data

Data from the eAML2 database was accessed through the AHDB PigHub. Movements of pigs between holdings in Scotland recorded by the ScotEID scheme were supplied by the ScotEID support team.

The eAML2/ScotEID datasets were chosen to represent GB pig population data, as this has the most inclusive coverage of holdings across GB. The Agricultural Survey was considered as a data source, however this survey only holds data on larger agricultural holdings and not smaller holdings or pet pigs.

Both the eAML2 and ScotEID datasets describe the movement of pigs between locations, and records the number and type of pigs moved, this information was used to estimate herd size.

Category <i>[definition]</i>	Quality description
Relevance of data <i>[degree to which data meets user needs in terms of currency, geographical coverage, content and detail]</i>	Spatial coverage: The data cover Great Britain. Temporal coverage: Data were extracted from both sources between March and April 2019 from movements recorded as occurring from January 2016 to December 2017. Key data items available: The main data items within the dataset are Date of Movement, Number of Animals Moved, CPH (county parish holding) and the postcode of the departing and destination locations; other fields are also available within the data.
Timeliness	How often are the data collected? The data are collected continuously throughout the year with users of the two systems

<p><i>[the degree to which data represent reality from the required time point]</i></p>	<p>registering a movement, which is then finalised after the receiving user confirms receipt of the animals.</p> <p>When do these data become available? The eAML2 and ScotEID databases are live with data continuously being added. Cancelled or incomplete movements were omitted for the analysis.</p> <p>Data reference period? These data reflect all holdings in GB that recorded sending or receiving pigs during 1st January 2016 and 31st December 2017.</p> <p>How often are the data updated? Once a movement record has been confirmed, this is not changed or updated after import, although holding location details may be updated due to cleaning exercises completed by AHDB.</p>
<p>Accuracy and precision</p> <p><i>[extent of data error and bias and how well data portrays reality]</i></p>	<p>How were the data collected? The data were collected via submissions by registered users via a web portal or a telephone bureau system. Separate movement forms are submitted as movements off and movements on; these are ‘paired’ by AHDB prior to being made available, i.e. the ‘from’ and ‘to’ herd forms are combined into a single record.</p> <p>Sample & collection size: There are approximately 30,000 unique CPHs listed in the dataset that had a pig movement.</p> <p>What steps have been taken to minimise processing errors? Data are cleansed by AHDB by comparing holding records with those held elsewhere on the AHDB PigHub. Further cleaning was completed by APHA to remove records with insufficient data to meet the LDDG project’s criteria to fully identify a holding, and to rationalise holdings that had been recorded with varying amounts of identifying information (e.g. movements for a CPH, which had been recorded with and without a postcode, were assigned to the same holding rather than as two separate holdings).</p> <p>What are the non-reporting or non-response rates? We have no information on pig owners who do not record pig movements, although it has been suggested that some farms within pig breeding companies do not record movements between sites due to a misunderstanding of the requirements.</p> <p>Are any parts of the population unaccounted for in the data collection? It is believed all parts of the population are accounted for. However, commercial breeding farms may have their herd size under-represented, due to the failure to record movements to other</p>

	units within the same pig production company.
<p>Comparability</p> <p><i>[how well these data can be compared with data taken from the same dataset and with similar data from other sources]</i></p>	<p>Within dataset comparability: Checks show that data extracted at different times are comparable.</p> <p>Other dataset comparability: A comparison of holdings present in eAML2, the Agricultural Survey, APHA’s operational database called Sam, the Red Tractor assurance scheme and the British Pig Association (BPA) membership indicated that eAML2 consistently matched the highest percentage of holdings in the other datasets. eAML2 was also the only dataset that included most of the BPA holdings (LDDG annual report 2014-2015).</p>
<p>Coherence</p> <p><i>[degree to which data can be or have been merged with other data sources]</i></p>	<p>How consistent are the data over time? If there are differences, what are they and what is their impact? Have there been changes to the underlying data collection? Analysis of the data has suggested that improvements to data cleansing processes and recording of holding identifiers in the eAML2 dataset by AHDB staff had occurred between the 2014-2015 report and the 2016-2017 report, but assume minimal bias has been caused.</p> <p>Have any real world events impacted on the data since the previous release? No</p> <p>How have these impacts on the data been managed? N/A</p> <p>What other data sources are this dataset comparable with? Other datasets with relevant pig location data available include the Agricultural Survey, Red Tractor and Sam. The Agricultural Survey collects demographical information from a proportion (~30%) of holdings each year, with the remaining population having answers imputed from previous historical records. Holdings included in the Agricultural Survey must meet criteria of a minimum threshold that lists various farmed livestock and crops, including criteria of 50 pigs or 10 breeding sows. Therefore, small holdings and hobby farms would be under-represented in these data.</p> <p>Red Tractor Quality Assurance scheme is an industry dataset that is regularly updated. This dataset includes the number of pigs present on a holding, but only covers commercial herds that use Quality Assured abattoirs. Therefore, holdings present are biased towards large commercial finisher or breeder-finisher farms.</p> <p>Sam is an APHA transactional database, which holds a dataset of information regularly collected from farms visited by APHA staff.</p>

	<p>The information collected would be suitable, but there is concern regarding whether the current quality of the data is of sufficient standard. Concerns include how up to date the records are, and how complete is the coverage of the pig industry. The British Pig Association has a register of pig holdings, although it is believed to be a register of typically smaller pig holdings, such as exotic or rare breeds farms.</p>
<p>Interpretability</p> <p><i>[how well the data is understood and utilised appropriately]</i></p>	<p>Is there a particular context that these data need to be considered within? This dataset can be used to obtain information regarding animal movements and animal population counts. Although pig numbers fluctuate on farms, it is not believed that a significant seasonal effect would be present that would affect the interpretation of the maps. The dataset was gathered to cover a 24-month period from 2016 to 2017. As registration of movements is a legal requirement, we expect the data to be a near complete representation of holdings moving pigs within GB.</p> <p>The definition of a unique “holding” is based on the combination of postcode and CPH (county parish holding) number. However, postcodes were not always present for every movement record. The categorisation of the number of pigs present was based on an algorithm applied to the number of pigs moved out of the holding during a two-year period. If none was moved out, it was based on pigs moved onto the holding. It should be noted that holdings in this context could be abattoirs, markets and other non-farm locations, and it is assumed that some of the holdings with a size category of 4 or 5 (due to their large number of pigs moved to them) are slaughterhouses.</p> <p>What other information is available to help users better understand this data source? Details of the eAML2 system and a guide on how movements are reported can be found here: https://www.eaml2.org.uk/ami/helpline.eb.</p> <p>Are there any ambiguous or technical terms that may need further explanation? No</p>
<p>Accessibility</p> <p><i>[availability of relevant information and access to the data in a convenient</i></p>	<p>What data are shared and with whom? Due to restrictions on sharing data provided by a confidentiality agreement between APHA and AHDB/ ScotEID, these data cannot be shared externally without AHDB/ ScotEID consent.</p> <p>Where approval for use of data has been provided, data must be aggregated to at least a county level before publishing, so individual farms cannot be identified (e.g. by CPH or postcode).</p>

<i>and suitable manner]</i>	<p>Estimates based on less than five holdings should not be used, as this would breach confidentiality.</p> <p>Contact details for data source queries</p> <p>AHDB-Pork: jennifer.newman@ahdb.org.uk</p> <p>ScotEID: help@scoteid.com</p>
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