



Animal &
Plant Health
Agency

**Livestock Demographic Data
Group:
Pig population report
Livestock population density maps
for GB, using 2018/19 data**

January 2022



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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 does 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 two-year 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 2018 \(defra.gov.uk\)](#)).

The pig and pig holding density maps are similar to previous reports, although with a lower number of holdings than the 2016/17 data indicated, which was cleaned using the same method as the previous report. The regions with highest densities of pig population (Figure 1) remain the same and 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. Figure 2 shows a high density of pig holdings in several areas, particularly in South-West England and the Midlands. Interestingly, as before, both Wales and South-East England have areas of relatively high holding density, while the pig density is low in these areas (Figure 1). This points to fewer pigs per holding, and is likely to reflect a greater proportion of premises with small pig herds in these areas. Tables 2 and 3

summarise the estimated number of holdings and pigs by country within GB, and the estimated number of holdings by size category for each country.

The estimated total number of pigs in GB was 4,753,467, which was similar to the estimate of 4,860,695 pigs from 2016/17 movement data in the previous report. The estimated total number of holdings has reduced in each report from 31,663 in the 2014/15 report to 23,722 in this current report for 2018/19 (Table 2). The largest reduction in pig holdings between 2016/17 and 2018/19 was seen in England, although the reductions were relatively similar for all three countries (Figure 3). In contrast, the reduction in estimated pig numbers in Scotland was proportionally much greater than England and Wales. Although the collection of the datasets and cleaning processes had not changed for this report, improved Scottish holding details were provided by ScotEID for this report. This may have led to a greater number of duplicate movements held in eAML2, and also in ScotEID, being able to be removed. This would not have affected the number of holdings but would have removed the overestimation of the size of these holdings and the estimated number of pigs present. The effect of improvements to the identifying information was also highlighted by fewer holdings failing to be linked to spatial coordinates (47 for 2018/19 and 177 for 2106/17 respectively). This suggests that the proportionally greater reduction of estimated pig numbers in Scotland may have been related to this improved cleaning of the dataset.

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 2018-2019. Information on pig holdings and density in Scotland was accessed from the Scottish Electronic Identification (ScotEID) database from 2018-2019. 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 a 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 does 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, under-representation in the source data was identified where movements from some breeding herds had not been reported due to a misinterpretation of the regulations that underpin movement reporting (PRIMO; Pigs (Records, Identification and Movement) Orders). 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 2018/19 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 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, and 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 underestimated.

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 pigs and 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

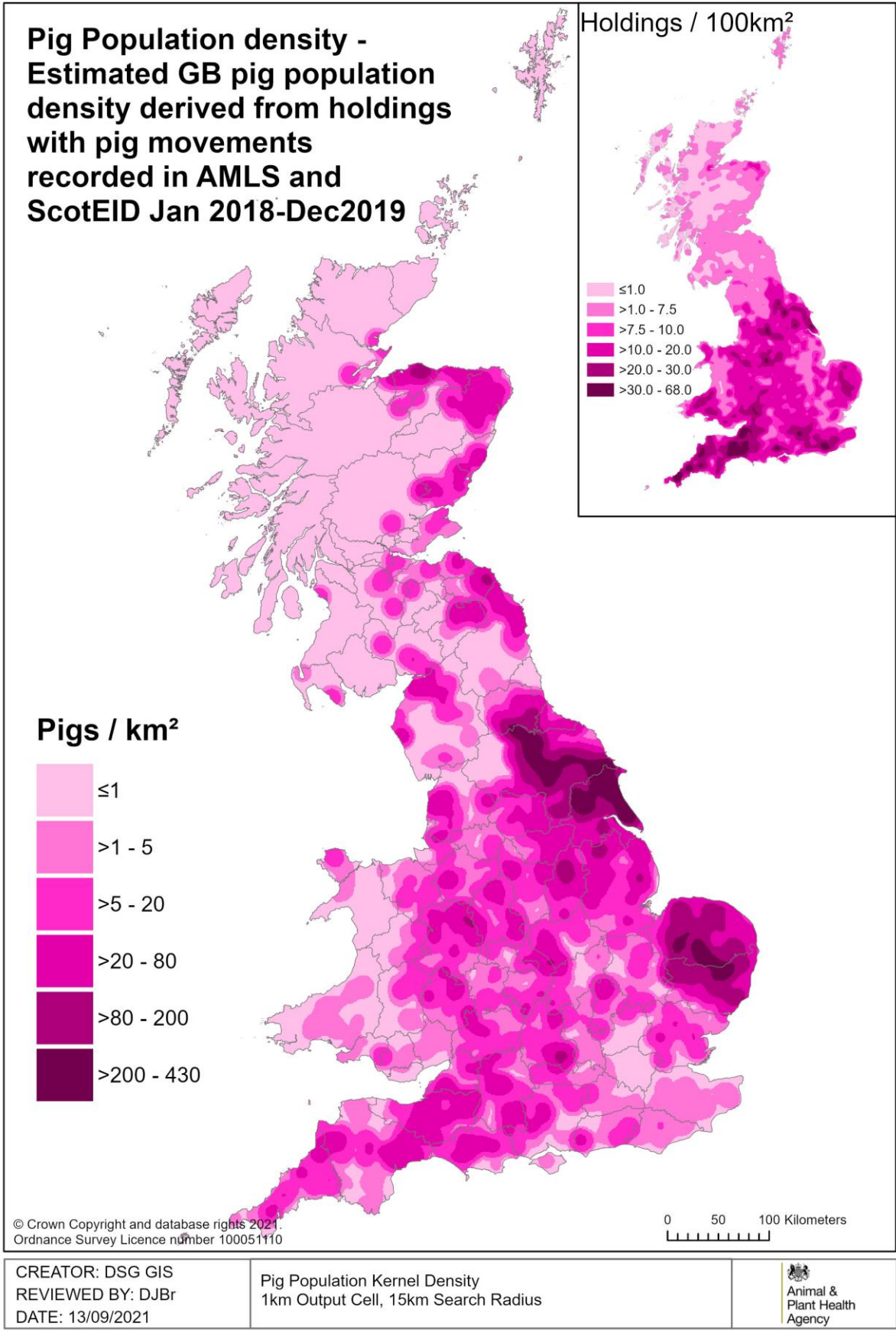


Figure 1: Pig population density in GB.

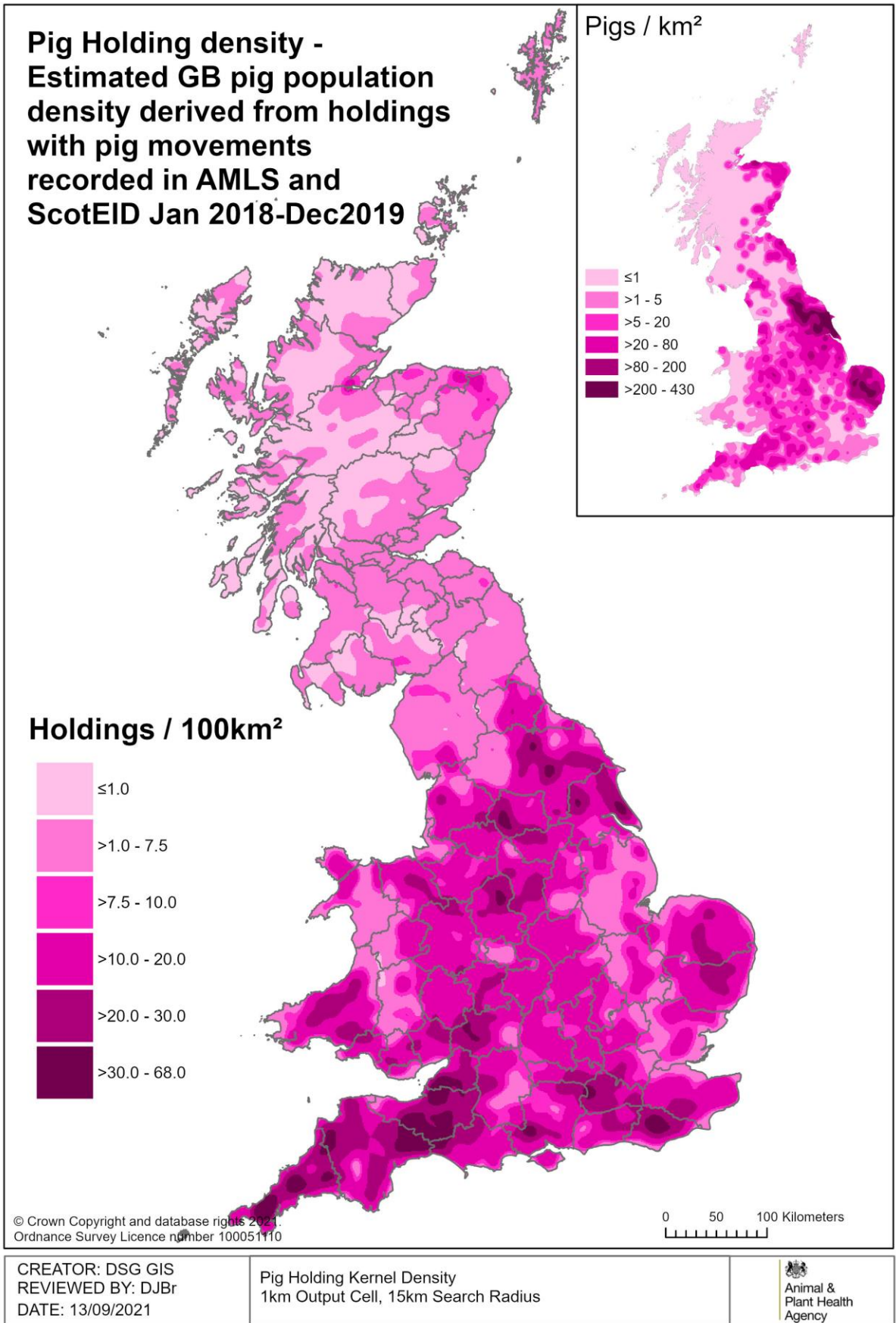


Figure 2: Pig holding density in GB.

GB Pig Population and Holding Data tables 2018/19

A total of 23,750 holdings were identified in the dataset, 47 of which could not be related to holding location identifiers that would allow specific spatial coordinates to be generated. Of these, 19 provided information that allowed the county of origin to be determined and the centroid location of the county was used as a proxy for the location of the holding. The remaining 28 holdings were unable to be referenced to a country and were omitted for the reports tables and maps; these holdings had an estimated total of 1,037 pigs.

Table 2: Count of pig holdings and animals, by country from pig movement time periods 2018/19, 2016/17 and 2014/15.

| Country | 2018/19 Holdings | 2018/19 Animals | 2016/17 Holdings | 2016/17 Animals | 2014/15 Holdings | 2014/15 Animals |
|----------------|------------------|-----------------|------------------|-----------------|------------------|-----------------|
| England total | 19,210 | 4,330,641 | 22,769 | 4,353,489 | 26,542 | 4,553,806 |
| Scotland total | 1,952 | 368,054 | 2,204 | 453,361 | 1,817 | 365,119 |
| Wales total | 2,560 | 54,772 | 2,983 | 53,845 | 3,304 | 58,107 |
| GB Total | 23,722 | 4,753,467 | 27,956 | 4,860,695 | 31,663 | 4,977,032 |



Figure 3: Estimated numbers of pigs and number of pig holdings present in Great Britain and its constituent countries by time period from which pig movement data was derived (2014/15, 2016/17 and 2018/19).

The previous Pig Demographic Reports, published in November 2019 and February 2020, also used pig movement data from eAML2 and ScotEID. The estimated number of holdings recorded in the dataset has decreased in every time period (Table 2, Figure 3). The largest reduction between 2016/17 and 2018/19 was in England (a drop of 15.6%)

with smaller reductions in holdings in Wales and Scotland (14.2% and 11.4% respectively). In contrast, the estimated number of pigs in GB has remained relatively constant, with just a 2.2% reduction in total pig numbers from 2016/17 to 2018/19. In Scotland, the reduction in pig numbers was proportionally higher (18.8% reduction), whereas Wales saw a small (1.7%) increase in the number of pigs estimated. This may have been related to improved holding details being provided by ScotEID, which allowed for more duplicate movements to be removed from Scottish holdings than in the previous reports.

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 6,323 holdings in categories 2 to 5. The number of holdings of each size category reduced from the 2016/17 period to the 2018/19 period. However, the number of the largest holdings (categories 4 and 5) were generally consistent with the previous report (+/-90 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 although these increased from 72 to 88 since 2016/17. There was a decrease in the number of Scottish holdings of all sizes reported in 2018/19 (from a total of 2,204 to 1,952), and the proportion of categories 3-5 holdings were reduced in contrast to 2016/17, which may be related to the improved holding identifying information supplied by ScotEID. Wales had a greater proportion of size 1 and 2 holdings compared to other countries, whereas England 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 (2018/19).

| Country | Size Category (No. of holdings) | | | | | Total |
|----------|---------------------------------|-------|-----|-------|-------|--------|
| | 1 | 2 | 3 | 4 | 5 | |
| England | 13,787 | 2,588 | 617 | 907 | 1,311 | 19,210 |
| Scotland | 1,498 | 204 | 58 | 82 | 110 | 1,952 |
| Wales | 2,114 | 358 | 52 | 29 | 7 | 2,560 |
| GB Total | 17,399 | 3,150 | 727 | 1,018 | 1,428 | 23,722 |

| Country | % of Country's total | | | | |
|---------|----------------------|-------|------|------|------|
| | 1 | 2 | 3 | 4 | 5 |
| England | 71.8% | 13.5% | 3.2% | 4.7% | 6.8% |

| | | | | | |
|----------|-------|-------|------|------|------|
| Scotland | 76.7% | 10.5% | 3.0% | 4.2% | 5.6% |
| Wales | 82.6% | 14.0% | 2.0% | 1.1% | 0.3% |
| GB Total | 73.3% | 13.3% | 3.1% | 4.3% | 6.0% |

Annex 1: Data quality statement for Pigs (September 2021)

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 (not held by eAML2) recorded by the ScotEID scheme were supplied by the ScotEID support team.

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 (definition) | 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 the eAML2 data source between June and October 2020 and from ScotEID in July 2021. The datasets represented movements recorded as occurring from January 2018 to December 2019. 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 <i>(the degree to which data represent reality from the required time point)</i> | How often are the data collected? The data are collected continuously throughout the year with users of the two systems registering a movement, which is then finalised after the receiving user confirms receipt of the animals. When do these data become available? The eAML2 and ScotEID databases are live with data continuously being added. Cancelled or |

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| | <p>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 2018 and 31st December 2019.</p> <p>How often are the data updated? Once a movement record has been confirmed, this is not changed or updated after import by the client entering the data. However, holding location details may be updated due to cleaning exercises completed by AHDB. Additionally, occasional movements are uploaded some time after the movement occurred due to missing movements being flagged by internal or external audits. This is believed to affect abattoirs (AHDB personal communication).</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 25,000 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 or improve 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 either do not register their holding or do not record pig movements, although it has been suggested that some farms within pig breeding companies do not record some 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 units within the same pig production company.</p> |
| <p>Comparability</p> <p><i>(how well these data can be compared with</i></p> | <p>Within dataset comparability: Checks show that data extracted at different times are comparable.</p> <p>Other dataset comparability: A previous comparison of holdings</p> |

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| <p><i>data taken from the same dataset and with similar data from other sources)</i></p> | <p>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 2014/15).</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 2014/15 report and the 2016/17 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 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. 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, due to the nature (largely for statutory purposes) and frequency of APHA visits to herds.</p> <p>The British Pig Association has a register of pig holdings, although it is a register of typically smaller pig holdings, such as exotic or rare breeds farms.</p> |
| <p>Interpretability</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</p> |

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| <p><i>(how well the data is understood and utilised appropriately)</i></p> | <p>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 2018 to 2019. As registration of holdings and 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.</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 and suitable manner)</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). 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> |