Animal & Plant Health Agency

Livestock Demographic Data Group:
Pig population report

Livestock population density maps for Great Britain, using 2022 to 2023 data

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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 Great Britain (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 which pigs are moved to or from during the 2-year period of interest (2022 to 2023). This definition includes markets, abattoirs and other non-farm 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 2020 to 2021 data indicated. The data was cleaned using the same method as the previous report. The regions with highest densities of pigs (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 in small pockets in Wales, Yorkshire, the Midlands and Eastern and South-East England. Interestingly, as before, both Wales and South-East England have areas of relatively high pig holding density (Figure 2), while the pig density is low in these areas (Figure 1). This points to fewer pigs per holding and thus 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 pig 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 4,826,086, which was a decrease from the estimate of 5,017,929 pigs from the previous report, which used 2020 to 2021 movement data. The estimated total number of holdings has reduced in each report from 31,663 in the 2014 to 2015 report to 20,856 in this current report for 2022 to 2023, and the reduction in the estimated number of pig holdings from 2020 to 2021 to the current reporting period was sizeable (2,574) (Table 2). The comparisons between the estimated numbers of pig holdings and pigs in 2020 to 2021 and 2022 to 2023 indicated that there was a decrease in all size categories of farms in all 3 countries, except for category 5 holdings in Wales where the number remained the same. The largest decrease was in size category 1 holdings (13.0% reduction for the whole of GB), expected to be pet pig owners and small holdings.

Although the collection of the datasets and cleaning processes had not changed for this report, this dataset covered a period in 2022 to 202023 of disruption in the pig industry. The year 2022 began with the cost of pig production exceeding pig prices at slaughter which was exacerbated by increased input costs relating to energy and pig feed prices and uncertainties about supply, associated with the war in Ukraine. These challenges may have contributed to the reduction in the pig holding population. Unfortunately, as the numbers of pigs present on holdings are only estimated based upon the size category of the holdings, this dataset may not fully reflect a reduction in the number of pigs present on these holdings.

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 2022 to 2023. Information on pig holdings and density in Scotland was accessed from the Scottish Electronic Identification (ScotEID) database from 2022 to 2023. 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 had pigs at some point during the 24-month period but may have stopped keeping pigs by the end of that period. This issue is also relevant for other potential data sources, including the Defra Agricultural Survey. Previous analysis identified a 24-month dataset derived from pig movement records as the most suitable, as this balanced maximizing the inclusion of smaller holdings with infrequent movements with the risk of including holdings which are no longer active.

These data sources are also considered most appropriate and most accurate for determining estimates for pig herd sizes, as this information is not directly recorded. 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 made for a previous report (LDDG Pig Demographics and Indicators Report 2016) 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 dataset.

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 2022 to 2023 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 5 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 5 categories of numbers of pigs moved (either incoming or outgoing movements) related to a holding in a 24-month period 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 to 25	3	Size suggests pet pig owners or small holdings
2	26 to 300	20	Size suggests small holdings
3	301 to 2,000	110	Size suggests small commercial farms
4	2,001 to 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 process[1]. 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 6, to aid in cross referencing areas of the map to the key. Note that the ArcGIS Kernel Density tool does not take into account edge effects[2], 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.

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[1] Pfieffer, D. Spatial Analysis in Epidemiology, 2008. p47.
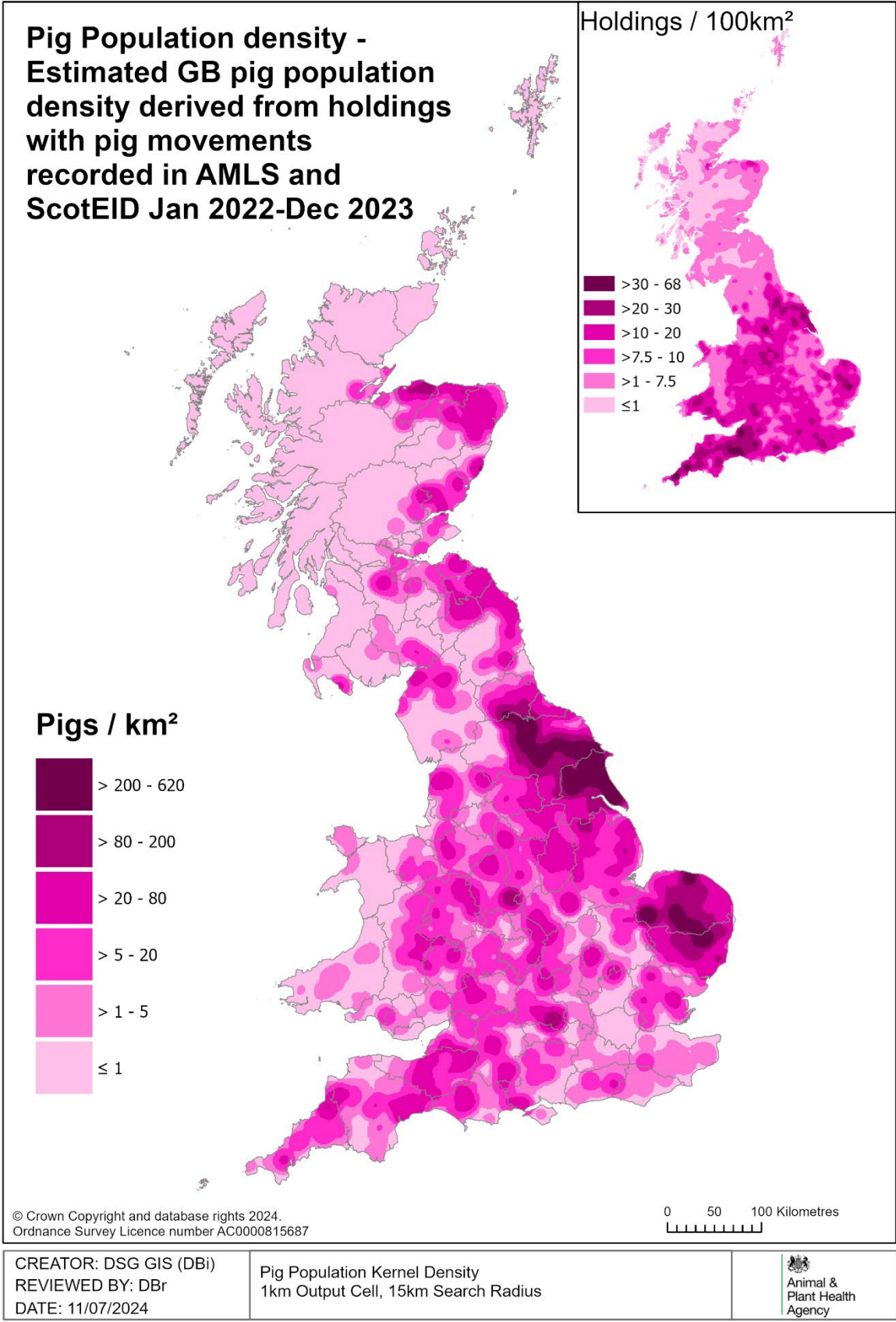[2] https://www.e-education.psu.edu/geog586/l5_p15.html

Figure 1: Pig population density in GB, estimated from pig movements recorded in eAML2 and ScotEID from January 2022 to December 2023.
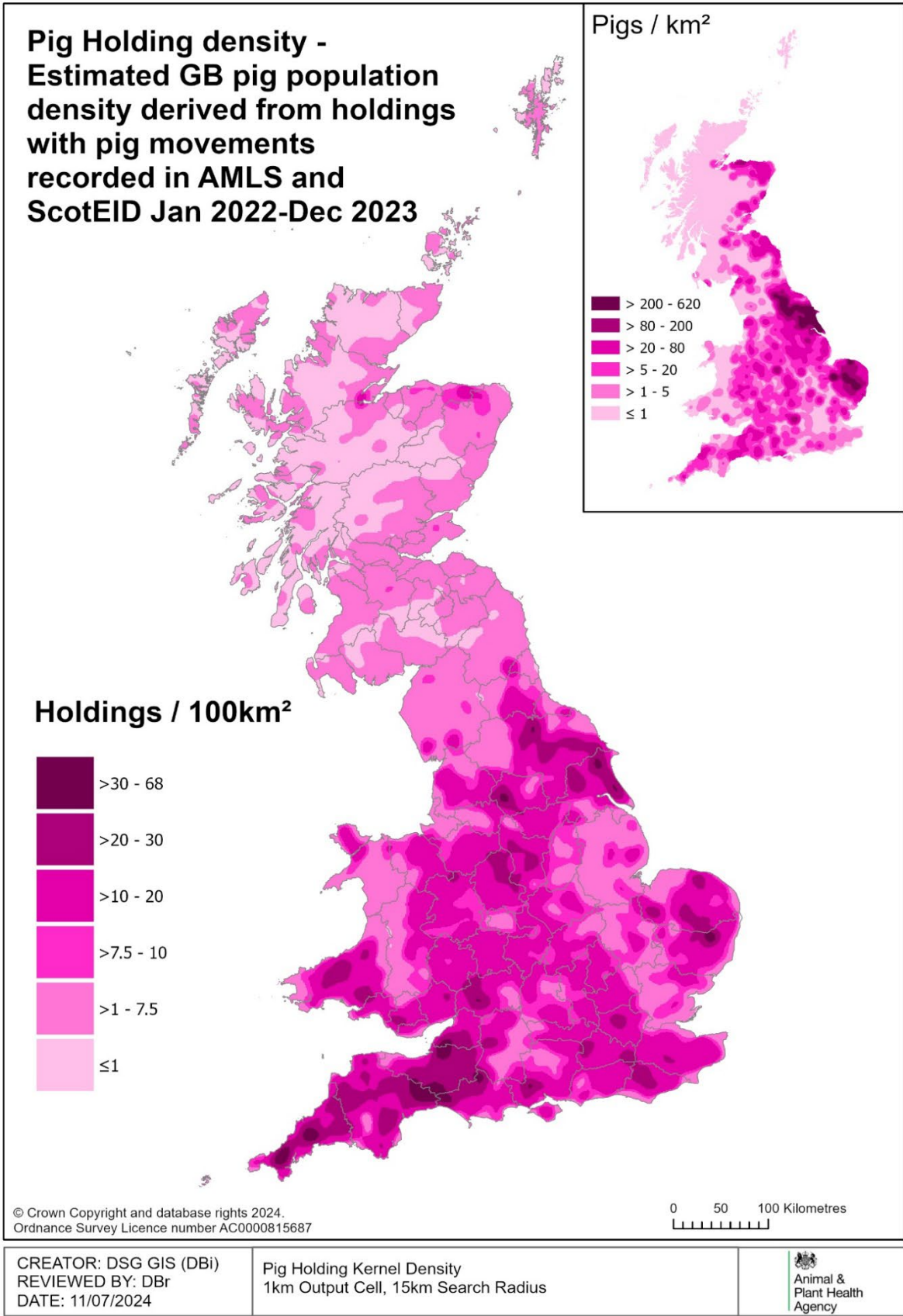
Figure 2: Pig holding density in GB, estimated from pig movements recorded in eAML2 and ScotEID from January 2022 to December 2023.

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GB Pig Population and Holding Data tables 2022 to 2023

A total of 20,856 holdings were identified in the dataset. Of these, 15 could not be related to farm location identifiers that would allow specific spatial coordinates to be generated, but information was provided that allowed the parish of origin to be determined and the centroid location of the parish was used as a proxy for the location of the holding. One holding was unable to provide data that would allow it to be geolocated or referenced to a country and it was omitted from the tables and maps in the report.

Table 2: Count of pig holdings and animals, by country, from pig movement time periods 2022 to 2023, 2020 to 2021, 2018 to 2019, and 2016 to 2017.

| Country	2022 to 2023 Holdings	2022 to 2023 Animals	2020 to 2021 Holdings	2020 to 2021 Animals	2018 to 2019 Holdings	2018 to 2019 Animals	2016 to 2017 Holdings	2016 to 2017 Animals
England	16,714	4,353,754	18,630	4,490,167	19,210	4,330,641	22,769	4,353,489
Scotland	1,820	410,863	2,109	461,231	1,952	368,054	2,204	453,361
Wales	2,321	61,469	2,690	66,531	2,560	54,772	2,983	53,845
GB Total	20,855	4,826,086	23,429	5,017,929	23,722	4,753,467	27,956	4,860,695
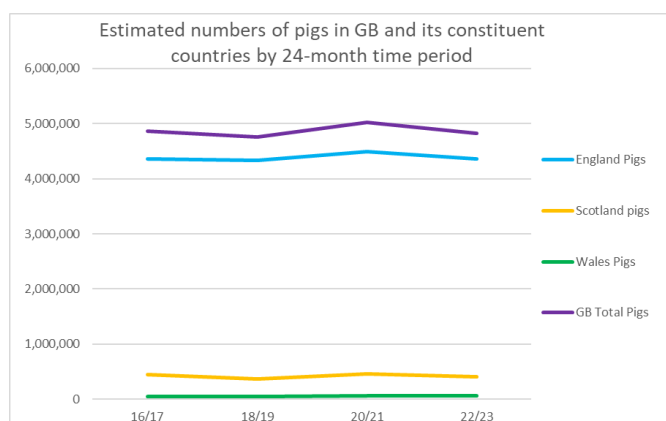
Figure 3: Estimated numbers of pigs present in Great Britain and its constituent countries, by time period, from which pig movement data were derived (2016 to 2017, 2018 to 2019, 2020 to 2021 and 2022 to 2023).
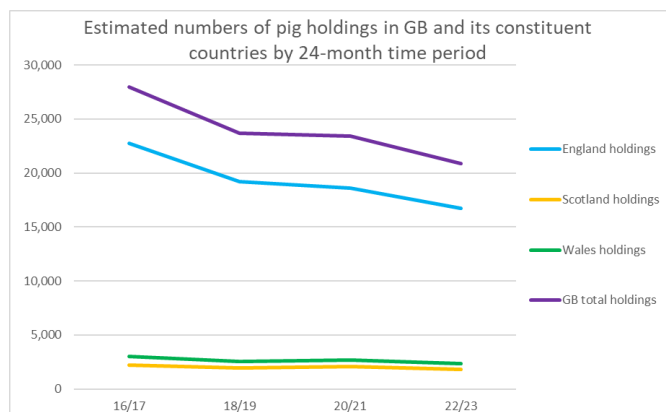

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Figure 4: Estimated numbers of pig holdings present in Great Britain and its constituent countries, by time period, from which pig movement data were derived (2016 to 2017, 2018 to 2019, 2020 to 2021 and 2022 to 2023).

The previous Pig Demographic Reports, published in February 2020, September 2021 and May 2024, also used pig movement data from eAML2 and ScotEID. The estimated total number of holdings in GB recorded in the dataset has decreased in every time period (Table 2, Figures 3 and 4). The largest reduction was between 2016 to 2017 and 2018 to 2019, during which period the largest decrease was in England (a drop of 15.6%) with smaller reductions in holdings in Wales and Scotland (14.2% and 11.4% respectively). The number of holdings recorded in 2022 to 2023 had reduced in all three countries of GB when compared to 2020 to 2021. The number of holdings decreased by 10.3% in England, 13.7% in Scotland and 13.7% in Wales.

The estimated total number of pigs in GB remained relatively constant from 2016 to 2017 to 2022 to 2023 and decreased between 2020 to 2021 and 2022 to 2023 by 3.8%. For all countries, the number of pigs estimated in 2022 to 2023 was lower when compared to 2020 to 2021, although this decrease was proportionally larger in Scotland (10.9%) and Wales (7.6%), than in England (3.0%). This may reflect the situation in 2022 where the cost of pig production exceeded pig prices at slaughter. This was exacerbated by increased input costs relating to energy and pig feed prices as well as uncertainties about supply, associated with the war in the Ukraine.

Table 3: The number of pig holdings in each country, by estimated herd size category (2022 to 2023).

Country	England	Scotland	Wales	GB Total
Size Category (No. of holdings): 1	11,788	1,331	1,923	15,042
Size Category (No. of holdings): 2	2,273	197	318	2,788
Size Category (No. of holdings): 3	488	68	39	595
Size Category (No. of holdings): 4	819	103	31	953
Size Category (No. of holdings): 5	1,346	121	10	1,477
Total	16,714	1,820	2,321	20,855
% of Country total: 1	70.50%	73.10%	82.90%	72.10%
% of Country total: 2	13.60%	10.80%	13.70%	13.40%
% of Country total: 3	2.90%	3.70%	1.70%	2.90%
% of Country total: 4	4.90%	5.70%	1.30%	4.60%
% of Country total: 5	8.10%	6.60%	0.40%	7.10%

Table 3 shows a breakdown of holdings by estimated size category and country. The majority of holdings (72.1%) were within size category 1, and these are likely to be pet pig owners and small holdings. There were 5,813 holdings in categories 2 to 5. The proportions of holdings in each GB size category remained relatively consistent between

2020 to 2021 and 2022 to 2023, with the percentage in each size category changing by less than 1% between the time periods. However, the number of holdings reduced. This was mainly in size category 1 (13.0% reduction in holdings at GB level), whereas the reduction in the other GB size categories were between 3.3 and 6.7%.

England continued to have the greatest number of holdings of each size category, with Wales having very few holdings of categories 3 to 5, which are considered to represent commercial pig herds. All size categories of farms within each country decreased in number between 2020 to 2021 and 2022 to 2023, the only exception being category 5 holdings in Wales for which the number remained the same. The largest decreases were seen in size category 1 (representing pet pig owners or small holdings) for all countries (ranging from 12.3% to 16.1%), size category 5 for Scotland (reduction of 12.3%) and size category 4 for Wales (reduction of 16.2%).

Annex 1: Data quality statement for Pigs (July 2024)

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 were 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 record the number and type of pigs moved. This information was used to estimate herd size.

Category [definition]	Quality description
Relevance of data [degree to which data meets user needs in terms of currency, geographical coverage, content and detail]	**Spatial coverage:** The data cover Great Britain. **Temporal coverage:** Data were extracted from the eAML2 data source between August 2023 and May 2024 and from ScotEID in December 2023. The datasets represented movements recorded as occurring from January 2022 to December 2023. **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 [the degree to which data	**How often are the data collected?** The data are collected continuously throughout the year with users of the 2 systems registering a movement, which is then finalised after the receiving user confirms receipt of the animals.

represent reality from the required time point]	**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. **Data reference period?** These data reflect all holdings in GB that recorded sending or receiving pigs between 1 January 2022 and 31December 2023. **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, occasionally 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).
Accuracy and precision [extent of data error and bias and how well data portrays reality]	**How were the data collected?** The data were collected through submissions by registered users on 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. That is, the 'from' and 'to' herd forms are combined into a single record. **Sample & collection size:** There are approximately 25,000 unique CPHs listed in the dataset that had a pig movement. **What steps have been taken to minimise processing errors?** Data were 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 (for example,movements for a CPH, which had been recorded with and without a postcode, were assigned to the same holding rather than as 2 separate holdings). **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. **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 underrepresented due to the failure to record movements to other units within the same pig production company.
Comparability [how well these data can be compared with data taken from the same dataset and with similar data from other sources]	**Within dataset comparability:** Checks show that data extracted at different times are comparable. **Other dataset comparability:** A previous 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 2014/15).
Coherence [degree to which data can be or have been merged with other data sources]	**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 to 2015 report and the 2016 to 2017 report. However, we assume that minimal bias has been caused. **Have any real world events impacted on the data since the previous release?** No **How have these impacts on the data been managed?** N/A **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 information imputed from previous records. Holdings included in the Agricultural Survey must meet minimum thresholds for various farmed livestock and crops, including criteria of 50 pigs or 10 breeding sows. Therefore, some small holdings and hobby farms are underrepresented in these data. 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.

	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. Due to the reason for collection of data (largely for statutory purposes) and frequency of APHA visits to herds, concerns include that data may not be up to date or that data may not offer complete coverage of the pig industry. The British Pig Association has a record of pig holdings registered with them, although these are typically smaller, heritage breed pig holdings.
Interpretability [how well the data is understood and utilised appropriately]	**Is there a particular context that these data need to be considered within?** In this report, the dataset has been used to obtain information regarding animal movements and animal population counts. Although pig numbers fluctuate on farms, large seasonal differences are not believed to occur that would affect the interpretation of the maps. The dataset analysed in this report covers a 24-month period from 2022 to 2023. 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. 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 herd size category assigned to each holding was based on an algorithm applied to the number of pigs moved off of the holding during a 2-year period. If no pigs were moved off, it was based on pigs moved onto the holding. It should be noted that a holding in this context includes abattoirs, markets and other non-farm locations. **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. **Are there any ambiguous or technical terms that may need further explanation?** No
Accessibility [availability of relevant	**What data are shared and with whom?** Due to restrictions on sharing data provided by a confidentiality agreement between APHA and AHDB, and APHA and ScotEID, these data cannot be shared externally without AHDB or ScotEID consent.

information and access to the data in a convenient and suitable manner]	Where approval for the use of data has been provided, data must be aggregated to at least a county level before publishing, so individual farms cannot be identified (for exampleby CPH or postcode). Estimates based on less than five holdings should not be used, as this could breach confidentiality. **Contact details for data source queries** AHDB-Pork: pig.health@ahdb.org.uk ScotEID: help@scoteid.com