Quarterly Hogs and Pigs Methodology and Quality Measures

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Quarterly Hogs and Pigs Survey Methodology

Scope and Purpose: The Hogs and Pigs Survey is conducted quarterly in December, March, June, and September. The survey targets hog and pig producers in the United States. The survey collects data for total hog inventory and other components including breeding herd, market hog inventory, market hogs by weight group, farrowings, pig crop, and litter rate. Additional data is collected for death loss, on-farm and custom slaughter, inventory values, and hogs raised under contract. Data is published for 16 major states every quarter except December when every state is published.

Survey Timeline: The reference date for the Hogs and Pigs Survey is the first day of the quarterly month with a data collection period of 15 days. Regional Field Offices (RFO) may begin data collection one day prior to the reference date. Data collection continues until a scheduled ending date, and RFO have about four or five business days to complete editing and analysis, execute the summary, and interpret the survey results. The Agricultural Statistics Board (ASB) must perform the National review, reconcile State estimates to the National estimates, and prepare the official estimates for release in five or six business days. The estimates are usually released to the public by the last week in the quarterly month. The publication date may change due to the timing of federal holidays.

Sampling: The target population for the Hogs and Pigs Survey is all agricultural establishments with one or more hogs or pigs owned by the operation. NASS uses a dual frame approach, consisting of list frame and area frame components, to provide complete coverage of this target population. The Hogs and Pigs Survey is conducted for every state.

The list frame includes all known agricultural establishments. Livestock inventory of each establishment is maintained on the list frame to allow NASS to define list frame sampling populations for specific surveys and to employ efficient sampling designs. Only list frame records with recent positive hog inventory data are included in the list frame population. In December, a base sample is selected for all states in the survey. During the follow-on quarters, the list sample is split into five replicates and only a partial number of replicates are contacted. This is done to reduce the burden of multiple survey contacts on the respondents in one calendar year. The list frame hog population covers approximately 99 percent of hog inventory in the United States.

The area frame contains all land in the state and, as such, is complete. The land is stratified according to intensity of agriculture using satellite imagery. The land in each stratum is divided into segments of roughly one square mile. Segments are optimally allocated and sampled to effectively measure crops and livestock. The sampled segments are fully enumerated in June. All farms and ranches found operating tracts in these segments are checked to see if they are included in the list frame hog population. The farms and ranches that are not included in the list frame hog population, called nonoverlap tracts, are sampled for the December Hogs and Pigs Survey so that the target population is completely represented. The area frame component of the December Hogs and Pigs Survey covers approximately one percent of the December hog inventory in the United States. The area frame component is modeled for the other three quarters to reduce respondent burden.

The Hogs and Pigs Survey list frame sample is selected using a hierarchical stratified sampling design with strata defined by total hogs and pigs. The sample is a panel sample and is designed to achieve a standard error of one percent of the point estimate for total hogs and pigs at a National level. The Hogs and Pigs Survey nonoverlap sample uses a stratified sample design based on data collected in the June Area Frame Survey. Each list frame and area frame sampling unit are assigned a sampling weight which is used to create the survey estimates.

Data Collection and Editing: For consistency across modes, the paper version is considered the master questionnaire and the Computer Assisted Telephone Interview (CATI), Computed Assisted Self Interview (CASI), and Mobile Computer Assisted Personal Interview (mCAPI) instruments are built to model the paper instrument. Questionnaire content and format are evaluated annually through a specifications process where requests for changes are evaluated and approved or disapproved. Input may vary from question wording or formatting to a program change involving the deletion or modification of current questions or addition of new ones. If there are significant changes to either the content or format proposed, a NASS survey methodologist will pre-test the changes for usability. Prior to the start of data collection, all modes of instruments are reviewed and the paper, mCAPI, CASI and CATI instruments are thoroughly tested.

All federal data collections require approval by the Office of Management and Budget (OMB). NASS must document the public need for the data, apply sound statistical practice, prove the data does not already exist elsewhere, and ensure the public is not excessively burdened. The questionnaire must display an active OMB number that gives NASS the authority to conduct the survey, a statement of the purpose of the survey and the use of the data being collected, a response burden statement that gives an estimate of the time required to complete the form, a confidentiality statement that the respondent's information will only be used for statistical purposes in combination with other producers, and a statement saying that response to the survey is voluntary and not required by law.

In addition to asking the specific hog inventory items, all instruments collect information to verify the sampled unit, determine any changes in the name or address, identify any partners to detect possible duplication, verify the farm still qualifies for the target population, and identify any additional operations operated by the sampled operator.

Sampled farms and ranches receive a pre-survey letter explaining the survey and informing them that they will be contacted for survey purposes only. The letter provides the questions to be asked to allow respondents to prepare in advance and also provides a pass code they can use to complete the survey on the internet. All modes of data collection are utilized for hog surveys. RFO are given the option of conducting a mail out/mail back phase. While mail is the least costly mode of collection, the short data collection period and the uncertainty of postal delivery times limit its effectiveness. Most of the data are collected by computer-assisted telephone interviews (CATI) by RFO and Data Collection Centers. A program is run to determine if any sampled farms are in multiple on-going surveys, so data collection can be coordinated.

Survey Edit: As survey data are collected and captured, they are edited for consistency and reasonableness using automated systems. The edit logic ensures the coding of administrative data follows the methodological rules associated with the survey design. Relationships between data items on the current survey are verified and in certain situations those items may be compared to data from earlier surveys to make sure certain relationships are logical. The edit will determine the status of each record to be either "dirty" or "clean". Dirty records must be updated and reedited or certified by an analyst to be clean. If updates are needed, they are reedited interactively. Only clean records are eligible for analysis and summary.

Analysis Tools: Edited data are processed through an interactive analysis tool which displays data for all reports by item. The tool provides scatter plots, tables, charts, and special tabulations that allow the analyst to compare an individual record to other similar records within their state. Outliers and unusual data relationships become evident and RFO staff will review them to determine if they are correct. The tool also allows comparison to previously reported data to detect large changes in the operation. Suspect data found to be in error are corrected, while data found to be correct are kept.

Nonsampling Errors: Nonsampling errors are present in any survey process. These errors include reporting, recording, editing, and imputation errors. Steps are taken to minimize the impact of these errors, such as questionnaire testing, comprehensive interviewer training, validation and verification of processing systems, detailed computer edits, and the analysis tool.

Estimators: Each farm and ranch in the sample has an initial sampling weight. This is the inverse of the sampling fraction. For example, if a stratum has 1,000 farms in the population and 200 are sampled for this survey, each sampled farm has a weight of 5. In other words, each sampled farm represents 5 farms. The nonoverlap tracts sampled to measure the hogs and pigs not accounted for by the list have a weight determined by adjusting their original area frame weight by any second stage sampling weight.

Response to the Hogs and Pigs Survey is voluntary. Some producers refuse to participate in the survey. Others cannot be located during the data collection period and some submit incomplete reports. These nonrespondents must be accounted for if accurate estimates of hogs are to be made. For the Hogs and Pigs Survey, most nonrespondents are accounted for by adjusting the weights of the respondents. The adjustment occurs by stratum as the bounded strata represent homogeneous groupings of similar sized farms. Also, the adjustment is performed for each individual item (total hogs, market hogs, pig crop) because sometimes only a partial report is obtained. The largest stratum is unbounded and is made up of large and, often unique, farms. Nonrespondents in this stratum and the nonoverlap tracts must be manually imputed by RFO statisticians and their weights are not adjusted.

Two estimators are used to compute direct measures of the hog inventory items. The "reweighted" estimator and the "adjusted" estimator are computationally identical except in how the nonresponse adjustments are made. The reweighted estimator uses a global weight adjustment across all reported and estimated reports. Using the previous example, if 180 of the original 200 respond, the weights of the 180 will be adjusted to 1,000 divided by 180, or 5.56. The nonresponse weight adjustment for the adjusted estimator uses an additional piece of information. When a sampled farm refuses to cooperate, interviewers will probe to determine the presence of hogs even though the number is not known. This presence/absence indicator is used in the weight adjustment.

Point estimates, also called direct expansions, for both estimators are calculated by multiplying the reported value by the nonresponse weight and summing to a stratum total. A variance estimate is also computed at the stratum level. The nonoverlap tracts are treated as an additional stratum. Totals and variances are additive across strata to form a State estimate and states are additive to a National estimate.

Ratio estimates are also computed for many items. For example, market hogs can be estimated as a percent of total inventory. A matched record ratio of current quarter data to previous quarter data is used to indicate change. Ratio indications use the reweighted estimator described above for the numerator and denominator. Both the numerator and denominator must be complete for that record to be included in the ratio estimator.

Estimation: When all samples are accounted for, all responses fully edited, and the analysis material is reviewed, each RFO executes summaries for their states. When all states have been summarized, Headquarters executes the National summary. Since all states conduct identical surveys, the samples can be pooled, and National survey results computed. The summary results provide multiple point estimates and their standard errors for each data series being estimated. It also provides information used to assess the performance of the current survey and evaluate the quality of the survey estimates, such as strata level expansions, response rates, and percent of the expansion from usable reports.

RFO are responsible for performing a detailed review of their survey results. Any irregularities revealed by the summary must be investigated and, if necessary, resolved. Using the historical relationship of the survey estimates to the official estimate, RFO must interpret the survey results and submit a recommended estimate to Headquarters for all data series for which they are in the NASS program. The data are viewed in tabular and graphical form and a consensus estimate is established. RFO see their survey results only and do not have access to other Regions' results. For some data series, information from other sources is also utilized in the process of establishing estimates. This includes commercial slaughter data, imports, and exports.

For the National estimates, NASS assembles a panel of statisticians to serve as the ASB which reviews the National results and establishes the National estimates. Since larger sample sizes yield more precise results, NASS employs the "top-down" approach by determining the National estimates first and reconciling the state estimates to the National number for hog inventory, pig crop, and farrowings. The ASB has the advantage of being able to examine results across states, compare the state recommendations, and utilize administrative data available only at the United States level. The same estimators used in the state summaries are produced by the National summary. The ASB follows the same approach the states do in determining the National estimate. The historical relationship of the survey estimates to the official estimate is evaluated over time to determine accuracy and bias using tables and graphs. Every five years NASS conducts the Census of Agriculture, which is an exhaustive data collection effort for all known farm operations across the United States. The information gathered from the Census of Agriculture is used to establish "benchmark" levels by which the survey estimators can be compared, and bias determined. Survey based estimators can also be impacted by outliers –

individual reports that have excessive influence on the results due to either improper classification or extremely unusual data for a given operation (i.e. the operation is not representative of other operations). NASS thoroughly reviews the survey data to identify these situations and considers their impact on the survey results when establishing the official estimates.

External information (administrative data) is also utilized in the process of setting estimates. In order to be considered fit for use, these data must be deemed to be reliable and come from unbiased sources. The most common administrative data is commercial slaughter. NASS employs a balance sheet approach whenever possible to ensure that estimates are as accurate as possible. This approach typically is limited to National-level estimates. A balance sheet and its components are reviewed when the inventory numbers are established. Commercial slaughter is an important element of the balance sheet at the National level since its high degree of reliability is based on a near-actual count of animals slaughtered. Live United States imports and exports to other countries are also considered.

Subtracting the disposition components of the balance sheet from supply components should, theoretically, give the current inventory. However, each component of the balance sheet has varying degrees of possible estimation error. To be most useful as an indication of inventory, therefore, each component should be estimated based on all available information. The supply components of the United States balance sheet are the beginning inventory, births, and imports (inshipments for State balance sheets). From this supply, the disposition components – commercial slaughter (marketings at State level), farm slaughter, deaths, and exports – are subtracted. The result is the indicated number on hand at the end of the period or year.

Quality Metrics for Hogs and Pigs

Purpose and Definitions: Under the guidance of the Statistical Policy Office of the Office of Management and Budget (OMB), the United States Department of Agriculture's National Agricultural Statistics Service (NASS) provides data users with quality metrics for its published data series. The metrics tables below describe the performance data for all surveys contributing to the publication. The accuracy of data products may be evaluated through sampling and non-sampling error. The measurement of error due to sampling in the current period is irrelevant for a fully enumerated data series. Non-sampling error is evaluated by response rates and the weighted item response rates.

Sample size is the number of observations selected from the population to represent a characteristic of the population. Operations that did not have the item of interest or were out of business at the time of data collection have been excluded.

Response rate is the proportion of the above sample size that completed the survey.

Weighted item response rate is a ratio of reported survey data expanded by the original sampling weight compared to final nonresponse adjusted summary totals.

Coefficient of variation provides a measure of the size for the standard error relative to the point estimate and is used to measure the precision of the results of a survey estimator.

Hogs and Pigs Survey Sample Size and Response Rates: To assist in evaluating the performance of the estimates in the hogs and pigs report, the sample size and response rates are displayed. Response rates overall for 2020 and 2021 are displayed.

Hogs and Pigs Survey Sample Size and Response Rates - United States: December 1, 2020-2021

	Sample size		Response rates	
	2020	2021	2020	2021
	(number)	(number)	(percent)	(percent)
United States	5,589	5,770	58.7	48.4

Quality Metrics for December 1 Hogs and Pigs – United States: 2020 and 2021

	Weighted item response rate		Coefficient of variation	
	2020	2021	2020	2021
	(percent)	(percent)	(percent)	(percent)
All hogs and pigs	77.3	73.8	0.4	0.6
Kept for breeding	79.6	76.8	0.5	0.6
Market	77.0	73.5	0.5	0.6
Sows farrowed	79.2	78.1	0.6	0.7
Pig crop	80.6	79.3	0.6	0.7

Hogs and Pigs Survey Sample Size and Response Rates – United States: 2020 and 2021

	Sample size		Response rate		Weighted item response rate		Coefficient of variation	
	2020	2021	2020	2021	2020	2021	2020	2021
	(number)	(number)	(percent)	(percent)	(percent)	(percent)	(percent)	(percent)
Alabama	41	(D)	61.0	(D)	53.5	(D)	8.3	(D)
Alaska	19	21	52.6	57.1	60.4	45.6	5.9	38.8
Arizona	25	29	60.0	55.2	99.2	99.4	0.5	0.3
Arkansas	38	57	94.7	61.4	87.3	83.7	1.2	1.0
California	61	67	52.5	32.8	84.9	62.6	4.1	1.1
Colorado	37	46	70.3	54.3	89.1	79.8	0.4	1.7
Connecticut	34	33	52.9	48.5	64.9	15.3	29.8	38.8
Delaware	26	26	11.5	15.4	(Z)	46.6	1.3	(Z)
Florida	68	(D)	35.3	(D)	41.6	(D)	14.0	(D)
Georgia	48	36	52.1	58.3	49.5	31.9	8.8	12.9
Hawaii	36	39	66.7	33.3	68.4	30.1	10.9	15.9
Idaho	41	60	53.7	36.7	72.6	76.0	4.4	3.6
Illinois	475	445	57.9	43.6	64.5	61.9	1.0	0.9
Indiana	412	427	68.0	62.3	79.7	51.5	0.6	0.8
Iowa	876	892	54.6	44.5	71.9	69.3	0.7	1.4
Kansas	117	128	42.7	31.3	74.9	70.6	0.7	0.7
Kentucky	66	60	72.7	63.3	85.4	75.3	2.4	1.5
Louisiana	51	37	70.6	48.6	19.9	36.3	33.4	31.5
Maine	51	51	52.9	39.2	53.7	34.1	31.7	20.8
Maryland	39	39	48.7	17.9	6.3	10.2	3.7	18.6
Massachusetts	53	46	58.5	52.2	54.6	27.6	4.9	39.1
Michigan	99	106	74.7	71.7	78.0	74.3	1.7	0.8
Minnesota	560	582	61.4	45.2	74.2	66.1	3.2	2.7
Mississippi	36	37	75.0	48.6	98.4	98.7	0.4	0.3
Missouri	215	225	54.0	36.4	83.3	81.8	0.6	0.9
Montana	63	79	82.5	77.2	89.5	89.0	1.5	0.3
Nebraska	392	406	58.2	48.5	77.7	84.1	0.6	0.8
Nevada	16	19	75.0	36.8	95.8	3.2	2.3	3.6
New Hampshire	44	45	47.7	62.2	48.6	42.3	14.2	25.6
New Jersey	32	31	56.3	38.7	43.8	24.7	19.1	14.6
New Mexico	24	24	58.3	45.8	50.8	38.9	22.0	25.0
New York	66	65	57.6	55.4	50.9	50.4	23.3	28.2
North Carolina	59	52	78.0	76.9	91.7	99.3	0.2	0.3
North Dakota	56	63	75.0	61.9	82.4	81.4	0.5	0.4
Ohio	265	289	50.9	56.1	60.7	51.4	0.8	1.0
Oklahoma	54	60	66.7	28.3	99.5	98.5	0.2	0.1
Oregon	42	58	40.5	31.0	15.3	11.8	28.9	23.7
Pennsylvania	160	166	43.8	41.6	82.2	84.4	0.9	1.0
Rhode Island	17	21	29.4	23.8	13.6	13.0	0.0	28.0
South Carolina	46	45	50.0	42.2	79.4	95.7	1.3	1.4
South Dakota	195	201	63.6	46.8	70.3	66.3	1.7	2.1
Tennessee	56	50	58.9	48.0	95.9	93.7	0.9	1.4
Texas	61	82	59.0	61.0	96.7	92.2	2.4	3.8
Utah	34	32	85.3	84.4	99.0	99.2	0.2	0.1
Vermont	45	42	64.4	54.8	16.1	15.1	56.4	62.5
Virginia	34	36	70.6	47.2	98.6	97.6	0.7	0.7
Washington	45	50	51.1	40.0	43.0	53.9	26.7	30.5
West Virginia	43	37	79.1	67.6	39.8	49.2	35.1	27.4
Wisconsin	193	209	56.5	51.2	58.3	47.9	16.3	8.3
Wyoming	23	22	82.6	59.1	99.3	99.2	0.6	0.5
Alabama and Florida	(NA)	97	(NA)	45.4	(NA)	47.4	(NA)	21.1
United States	5,589	5,770	58.7	48.4	77.3	73.8	0.4	0.6

(D) Withheld to avoid disclosing data for individual operations.
(NA) Not available.
(Z) Less than half of the unit shown.

Information Contacts

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Estimation	Livestock Branch	(202) 720-3570	HQ_SD_LB@usda.gov
Data Collection	Survey Administration Branch	(202) 720-3895	HQ_CSD_SAB@usda.gov
Questionnaires	Data Collection Branch	(202) 720-6201	HQ_CSD_DCB@usda.gov
Sampling and Editing	Sampling Editing and Imputation Methodology Branch	(202) 690-8141	HQ_CSD_SB@usda.gov
Summary and Estimators	Summary Estimation and Disclosure Methodology Branch	(202) 690-8141	HQ_SD_SMB@usda.gov
Dissemination	Data Dissemination Office	(202) 720-3869	HQSDOD@usda.gov
Media Contact and Webmaster	Public Affairs Office	(202) 720-2639	HQOAPAO@usda.gov

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- Cornell's Mann Library has launched a new website housing NASS's and other agency's archived reports. The new website, https://usda.library.cornell.edu. All email subscriptions containing reports will be sent from the new website, https://usda.library.cornell.edu. To continue receiving the reports via e-mail, you will have to go to the new website, create a new account and re-subscribe to the reports. If you need instructions to set up an account or subscribe, they are located at: https://usda.library.cornell.edu/help. You should whitelist notifications@usda-esmis.library.cornell.edu in your email client to avoid the emails going into spam/junk folders.

For more information on NASS surveys and reports, call the NASS Agricultural Statistics Hotline at (800) 727-9540, 7:30 a.m. to 4:00 p.m. ET, or e-mail: nass@usda.gov.