ANALYSIS OF RESPONSE BIAS IN THE JANUARY 1993 CATTLE ON FEED SURVEY QUALITY ASSESSMENT

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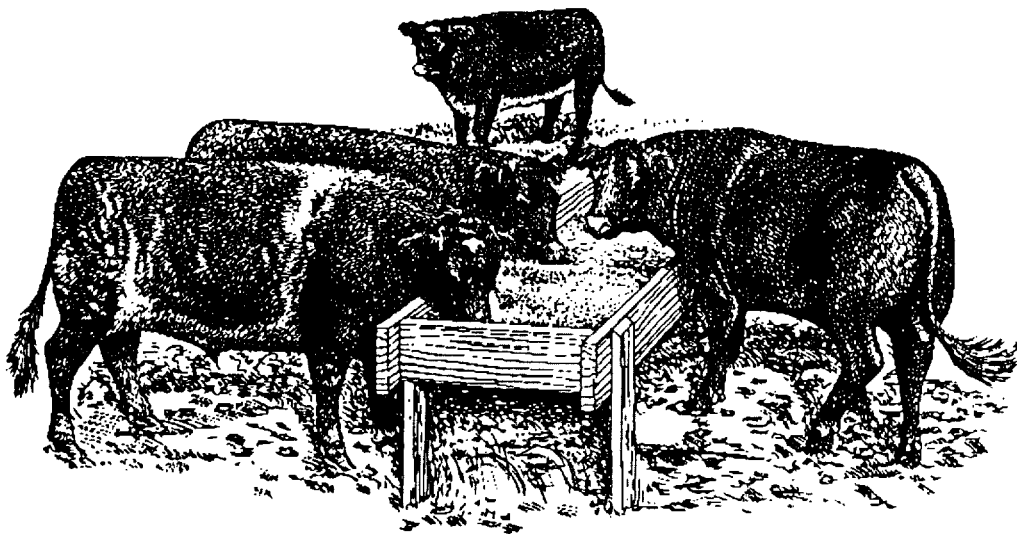
ANALYSIS OF RESPONSE BIAS IN THE JANUARY 1993 CATTLE ON FEED SURVEY QUALITY ASSESSMENT, by Robert G. Hood, Survey Quality Research Section, Survey Research Branch, Research Division, National Agricultural Statistics Service, United States Department of Agriculture, Washington, DC 20250-2000, August 1993, Report No. SRB-93-07.

ABSTRACT

A reinterview survey was conducted in January 1993 in Illinois, Iowa, Minnesota, Nebraska and South Dakota. This survey, the January 1993 Cattle on Feed Survey Quality Assessment (COFQA), was the third and final step of a three-phase plan to implement an operational program for cattle on feed inventory in the farmer-feeder states. The purpose was to evaluate the quality of the survey data through response bias estimation and to gather cognitive information on reporting problems associated with cattle on feed.

A subsample of respondents to the January Agricultural Survey was recontacted for face-to-face reinterviews in which a subset of the original questions was re-asked. Differences between the reinterview responses and the initial survey responses were reconciled to determine a final "true" value which was used to measure response bias. The January 1993 survey featured refinements in the sample design to provide "richer" data from the small sample size. Both CATI (Computer Assisted Telephone Interviewing) and non-CATI domains were eligible for reinterview.

Overreporting of COF capacity was the only significant response bias detected at the five-state regional level. Significant state level overreporting for capacity was indicated in all five states and for steer inventory in Iowa, while underreporting for cattle on feed inventory in Illinois and for steer inventory in Nebraska was indicated. Although many reporting problems were found for cattle and cattle on feed inventories, they tended to be off-setting when aggregated. Domain estimation indicated that all operations, regardless of size, tended to overreport COF capacity. Cattle on feed and total cattle inventory exhibited similar trends in response bias when categorized by size (based on reconciled inventory), with smaller operations overreporting and all other size groups underreporting. While differences due to "estimation or rounding" errors occurred more often than any other type of errors for cattle on feed inventory, overall they contributed very little to the expanded response bias. Differences due to "definitional" and "other" reasons had the most influence on the absolute response error for COF inventory. Difficulty in correctly classifying animals based on the 500 pound criterion for calves was cited most often in reporting problems associated with steer and calf inventories.

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SUMMARY

The January 1993 Cattle on Feed Survey Quality Assessment (COFQA) was the third and final step in implementing a reinterview program for cattle on feed inventory. The program began in January 1992 with a pilot study in Iowa, and continued in July 1992 with a two-state reinterview survey conducted in Iowa and Minnesota. The January 1993 COFQA was a fully operational reinterview survey conducted in Illinois, Iowa, Minnesota, Nebraska and South Dakota.

One purpose of the January 1993 Cattle on Feed Survey Quality Assessment was to assess the quality of reported cattle on feed inventory in the farmer-feeder states through the analysis of response bias. Equally important was the determination of reasons for reporting errors. By identifying common sources of these errors, we may be able to implement improvements in the survey process that would reduce the occurrence of the errors that contributed most to the response bias. This would result in the collection of better quality data for future surveys.

A sub-sample of both Computer Assisted Telephone Interviewing (CATI) and non-CATI (telephone, mail, and personal enumeration) respondents to the January Agricultural Survey were selected for face-to-face reinterviews. Modifications were made in the sampling procedure used in the July 1992 study to provide "richer" data. Only strata expected to contribute at least 0.3% of the five-state regional cattle on feed inventory were sampled. Also, only quality assessment samples that had positive reports for total cattle and calves inventory on the January Agricultural Survey were reinterviewed.

Reinterview procedures were similar to those used in previous NASS reinterview studies. All reinterviews were to be completed by face-to-face enumeration within 10 days of the initial interview. After the reinterview was completed, the initial and reinterview responses were compared, and any differences were reconciled to determine a final "true" value. Reasons for each difference were also recorded. The final value obtained during the reconciliation process was used as the proxy for the truth in response bias estimation.

Response bias estimates were generated for cattle on feed, total cattle and calf, steer, all heifer, calf, bull, beef cow, and milk cow inventories and cattle on feed capacity. Results are presented in the form of ratios (ratio=final reconciled total/initial survey total), or equivalently, a response bias percentage to indicate a relative error in reporting.

While differences between initial and reinterview responses were frequent, the reporting errors tended to be symmetric about zero for most items (except capacity), with a lot of variation, resulting in non-significant offsetting response biases. Cattle on feed capacity was the only item for which significant response biases were detected at the five-state regional level, indicating overreporting of over 33%. Significant overreporting was also detected at the state level for capacity in all five states and for steer inventory in Iowa. Significant underreporting was detected for cattle on feed inventory in Illinois and for steer inventory in Nebraska.

Reasons for the differences between responses were grouped into four categories - "estimation", "definition", "other" and "no reason available". Of the first three "real reason" categories, the "estimation" category contributed the least to the response bias. While the "no reason available" category accounted for only 11% of the differences for COF inventory, almost one-fifth of the total absolute response error was attributable to this category. For cattle on feed inventory, the expanded response bias was at the same level but in opposite directions for "definitional" and "other" reasons. While differences due to "estimation" errors occurred most frequently, these were generally smaller so that the total absolute response error was spread fairly evenly across all four categories.

For total cattle inventory, the expanded response biases were at the same level but in opposite directions for "definitional" and "other" reasons. "Other" reasons occurred over 4.5 times as often as "definitional" reasons. Component differences or responses to a prior question were cited the most as the reasons for the differences, and these reasons contributed the most to the total absolute response error. Many differences for cattle inventory were due to differences for steer and calf inventories. Difficulty with the weight groups accounted for 19% of the differences for steer inventory and 31% of the differences for calf inventory. The "no reason available" category accounted for only 3% of the differences, yet was responsible for 20% of the total absolute response error.

The respondents' perception that we were asking two different questions for cattle on feed capacity in the initial survey and reinterview instruments was the primary cause of the significant response bias for this item. It appears that, while the term "feedlot capacity" may be appropriate for large cattle on feed operations or commercial feedlots, it may not be the best terminology to use to collect capacity data for smaller operations.

With the large amount of variability in the reported data, sample sizes were too small to establish statistical significance by size domains. In spite of the lack of statistical significance, some size related trends were suggested by the data. Domain estimation indicated that smaller operations showed more overreporting of capacity than did larger ones. Also, when operations were categorized based on reconciled cattle on feed inventory, overreporting was indicated for both total cattle and cattle on feed inventories in the smallest size group (0-99). Cattle on feed inventory reporting was most variable in the 0-99 size group. Although these results were not statistically significant, they do provide some support to the conjecture that the smaller operations are a major source of reporting error for cattle on feed inventory.

Respondent categories were generated based on the initial and reinterview respondents. The operator was the respondent for both interviews nearly 89% of the time. There was practically no bias for the "operator-operator" or "other combinations" categories, but the "other-operator" category showed about 18% overreporting.

Although no significant response bias was detected at the five-state regional level except for cattle on feed capacity, there was a high degree of variability between the initial and reinterview responses for cattle on feed and total cattle and calf inventories. In fact, the January 1993

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COFQA showed that one-third of the respondents initially reported a cattle on feed inventory value different from what was ultimately reconciled as the truth. This level of response variability indicates that there are problems in the Cattle on Feed Survey program and decreases the precision of our survey estimates.

This report is the second of three research reports documenting the results of the January 1992-January 1993 reinterview studies on cattle on feed inventory. The first (Hood 1992) documented the results of the January 1992 and July 1992 studies. The third in this series, "An Analysis of the Cognitive Aspects of the January 1993 Cattle on Feed Survey Quality Assessment" by Terry O'Connor, will focus on the cognitive aspects of the January 1993 study.

This report, along with "An Analysis of the Cognitive Aspects of the January 1993 Cattle on Feed Survey Quality Assessment" (O'Connor 1993) and "An Examination of the Cognitive Processes Involved in Answering Cattle on Feed Inventory Questions" (Stanley 1993), identifies some of the problems with the COF Survey program, and demonstrates the need for continuing the quality assessment program for cattle on feed. The Research Division feels that NASS should continue the Cattle on Feed Survey Quality Assessment Program, either through the reinterview program which is now in place, or through some other means such as an "internal consistency" validation study.

INTRODUCTION

In January 1992, the National Agricultural Statistics Service (NASS) began conducting a series of reinterview studies to assess the quality of its Agricultural Survey data for cattle on feed inventories. The objectives of this reinterview program are to provide real-time, regional response bias estimates for cattle on feed inventory for Agricultural Statistics Board use for the five states and to determine reasons for reporting errors to improve survey instruments, procedures and training. The primary focus of this program is cattle on feed inventory reporting by farmer-feeders, as opposed to commercial feedlots. Currently, cattle on feed inventory is thought to be overreported, and the smaller farmer-feeder operations are believed to be the major source of the reporting error. A three-phase plan was designed to integrate a reinterview program for cattle on feed inventory into the operational program at NASS. The first step was a small pilot study conducted in Iowa in January 1992. The second step was a two state semi-operational survey conducted in July 1992 in Iowa and Minnesota. The final step in the implementation process was a fully operational survey conducted in January 1993 that included all five farmer-feeder states (Illinois, Iowa, Minnesota, Nebraska and South Dakota).

This paper will discuss the program and the results of the January 1993 Cattle on Feed Survey Quality Assessment, which was the last step in the implementation of the reinterview program for cattle on feed. Analyses include summarization of response bias at both the state and five-state levels, as well as domain estimation based on the size of the operation and mode of data collection. Characteristics of the response errors (biases) are examined, including reasons for the differences, respondent effects and outlier effects. As with previous reinterview surveys conducted by NASS, the focus of the cattle on feed quality assessment program is on response bias rather than response variance.

BACKGROUND

The National Agricultural Statistics Service has conducted reinterview studies in the past few years to evaluate the quality of its agricultural surveys. From December 1987 to 1990, annual reinterview surveys were conducted specifically for crop acreage, grain stocks and hog inventories. Special purpose reinterview surveys have also been conducted to assess the accuracy of grain storage (McClung, Tolomeo, and Pafford 1990) and acreage (Hanuschak, Atkinson, Iwig and Tolomeo 1991) reporting. The main objectives of all these reinterview surveys were to measure response bias and to identify reasons for reporting errors.

In January 1992, a new series of reinterview studies was begun to assess the quality of Agricultural Survey reported cattle on feed inventories. Reporting by farmer-feeder operations, as opposed to commercial feedlots (Atkinson 1992), was to be targeted. A three phase plan was designed to integrate a reinterview survey into the operational program at NASS. The first step was a one-state pilot conducted in January 1992. The second step was a two-state semi-operational survey conducted in July 1992. The final phase was the fully operational January 1993 Cattle on Feed Survey Quality Assessment conducted in the five farmer-feeder states.

No response bias estimates or other statistics were produced for the small non-random sample of the January 1992 pilot study, nor was this the purpose of the pilot study. Logistics for conducting a reinterview survey for cattle on feed were worked out and cognitive information was gathered. For July, response bias estimates for total cattle on feed, total cattle and calf, calf, steer and all heifer inventories and cattle on feed capacity were generated at both the state and two-state combined levels. No significant overall response biases were found except for capacity, for which significant differences were detected at all levels. There was wide variability in the response bias estimates between the two states in both magnitude and direction (i.e., positive or negative) for all items except total cattle inventory. Larger absolute response errors were found to be associated with "definition or interpretation" and "other" reasons, while "estimation" reasons were associated with smaller biases (Hood 1992).

SURVEY PROCEDURES

The January 1993 Cattle on Feed Survey Quality Assessment followed the same basic procedures used in the January 1992 pilot study and the July 1992 semi-operational study (Hood 1992), as well as other previous reinterview studies conducted at NASS (Pafford 1989). The quality assessment was a reinterview survey consisting of face-to-face enumeration of a subsample of the respondents to the January 1993 Agricultural Survey. These reinterviews were conducted by supervisory and experienced enumerators and were to be completed within ten days of the initial survey, in order to minimize recall bias. To get the most accurate data possible, enumerators were instructed to contact the person most knowledgeable about the operation, even if that person was not the same as the initial survey respondent.

Enumerators were instructed to approach potential reinterview respondents with an appropriate opening statement which stressed NASS' concern for ensuring the quality of our survey data. After this opening statement, the enumerators were to conduct the reinterview following the questionnaire order and wording exactly so that the effects of specific wordings could be studied. Immediately after conducting the reinterview, the enumerator informed the respondent that he/she had the responses from the initial interview and asked if the respondent would help in reconciling any differences between the initial and reinterview responses. For each difference (no matter how small), the enumerator was instructed to record which response was correct and to provide a written explanation for the difference.

Responses to the initial survey were provided to the enumerators in a sealed envelope on a reconciliation form (see Appendix B). In addition to the initial responses for the questions that appeared on both the initial survey and the QA survey, this form contained spaces to record the reinterview response, the reconciled "correct" response and a written explanation in the event that a difference between responses occurred. To maintain the independence between the initial and reinterview responses, the envelopes containing the initial survey responses were not to be opened until after the reinterview was completed. Having two independent responses and asking the respondent to resolve any discrepancies enabled us to obtain the best possible data.

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The QA questionnaire, used to collect a second independent response for comparison to the initial survey response, was similar to but shorter than the initial survey instrument. The January 1993 QA form was nearly identical to both the January and July 1992 reinterview questionnaires, containing only minor modifications. Questions that were common to both the January 1993 Ag Survey and the QA questionnaire (see Appendix A) included those pertaining to basic operation description and cattle and cattle on feed inventories. The cattle and cattle on feed sections were condensed versions of the operational questionnaire. Some questions were shortened by omitting "include" and/or "exclude" phrases, while others were re-worded to ensure that the reinterview/reconciliation process obtained the best "proxy to truth" value. In particular, the questions for cattle on feed inventory and capacity were reworded on the QA questionnaire to best reflect the underlying concept we were trying to measure. The two versions for total cattle on feed inventory are listed below.

Operational Version:
We need to know about the cattle and calves on feed for the slaughter market. Their ration would include grain, silage, hay or protein supplement.

(INCLUDE cattle being fed by you for others.
EXCLUDE any of your cattle being custom fed in feedlots operated by others and cattle being "backgrounded only" for sale as feeders, for later placement on feed in another feedlot or to be returned to pasture.)

*How many cattle and calves were on feed January 1 that will be shipped **directly** from your feedlot to slaughter market?*

QA Version:
Now I would like to discuss Cattle and Calves on Feed for the slaughter market.

How many cattle and calves were on feed January 1 that will go DIRECTLY from this operation to the slaughter market?

The two versions for cattle on feed capacity are listed below.
Operational Version:
What is the total capacity of your feedlot(s)?

QA Version:
What is the maximum number of cattle and calves you normally feed for the slaughter market at any one time on the [Section 2, Item 1] acres?

Why re-word the questions? If a cognitive problem exists with the current operational wording of a particular question, then simply re-asking the question the same way may not uncover an underlying response bias. Since the effect of questionnaire wording was to be examined, enumerators were instructed to read the reinterview questions exactly as worded on the questionnaire.

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The QA questionnaire, like the January and July 1992 questionnaires, also contained additional "cognitive" questions as well as a section on terminology (in which the respondent was asked to give his/her definition of some terms currently being used in NASS surveys) to be used in evaluating survey definitions, concepts and questionnaire wording. "Probing" questions were asked to determine if all cattle on feed were being reported accurately. For results on cognitive issues see "An Analysis of the Cognitive Aspects of the January 1993 Cattle on Feed Survey Quality Assessment" by Terry O'Connor.

The reconciliation form used in January 1993 was similar to but a somewhat abbreviated version of the forms used in January and July 1992. It was shortened to make the reconciliation process easier and quicker for both enumerators and respondents. Sections pertaining to partners and change in the operator contributed little to what we were trying to accomplish and were dropped from the January 1993 version of the reconciliation form. In the previous cattle on feed reinterview surveys, each time a difference occurred between the initial survey and reinterview responses, the enumerators were instructed to determine the source of the difference as part of the reconciliation process. This was often very confusing to do since the source could be assigned to any combination of initial or reinterview enumerator or respondent. Also, by asking for the source of the difference, some respondents (and enumerators) felt as if we were looking for someone to "place the blame on for a different response", which could cause tension between enumerator and respondent and cause the respondent to have a negative attitude toward the reinterview survey (as well as possible future NASS surveys). Therefore, determining the source of the difference was dropped from the reconciliation process.

SAMPLE DESIGN

The January 1993 Cattle on Feed Survey Quality Assessment continued and furthered the innovations in reinterview sampling procedures that were begun in the July 1992 reinterview study. As in July, the initial survey samples eligible for reinterview included both the CATI and non-CATI domains. Approximately 6.5% of the January Agricultural Survey list samples were designated for the quality assessment. Quality assessment samples were selected for the CATI and non-CATI domains in roughly a 2:1 ratio for all states except Illinois, where there was no initial survey CATI domain. The quality assessment samples in Illinois, therefore, came only from the non-CATI domain (Atkinson 1993).

Because of budgetary restrictions, the use of expensive personal interviews and concerns about respondent burden, reinterview sample sizes were kept relatively small. In order to collect "richer" data with a small sample size, several refinements were made in the sampling procedures for the January quality assessment.

Only strata expected to contribute at least 0.3% of the five-state multiple frame expansion for cattle on feed were sampled. These strata were expected to account for almost 50% of the 5-state multiple frame expansion for COF and nearly 90% of the list expansion excluding stratum 39. No samples from the preselect cattle on feed stratum 39 (in which all operations have a

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probability of selection equal to 1) were selected for the quality assessment (Atkinson 1993).

Also, only quality assessment samples with an initial survey report of positive total cattle inventory were reinterviewed. Quality assessment samples that had initial survey reports of zero total cattle or that were out-of-business were considered usable reports with a response bias of zero. In the July 1992 reinterview study, not one initial survey sample that reported zero total cattle or that reported being out-of-business, had positive cattle on feed inventory on the reinterview survey (Hood 1992).

Table 1 shows the composition of the quality assessment sample. There were a total of 1250 samples selected for reinterview. Of these, only completed initial survey samples with positive total cattle inventory were eligible for reinterview. Initial survey refusals and inaccessibles were ineligible for reinterview.

Table 1. January Cattle on Feed Survey Quality Assessment Sample Sizes.

State	Jan. Ag Sample Size	CATI QA Sample Size	Non-CATI QA Sample Size	Total QA Sample Size	Expected Reinterview Usables
Illinois	3,752	---	230	230	160
Iowa	4,473	175	95	270	195
Minnesota	4,233	175	85	260	185
Nebraska	3,586	180	90	270	150
S. Dakota	3,366	170	50	220	160
Total	19,410	700	550	1,250	850

Response Rates

Table 2 below shows the response coding for all 1250 samples selected for the quality assessment survey. There was a total of 871 usable reports, slightly more than the expected number of usables shown in Table 1. The QA refusal rate, only 5% (36/727), was relatively low compared to that of other NASS operational surveys. Refusal rates have historically been much lower for reinterview studies than for regular Ag Surveys [8, 9, 10]. This implies that farm operators may not be opposed to responding to reinterview surveys, which seems contrary to the belief that operators have a negative attitude toward reinterview surveys. The low refusal rate is a result of the emphasis put on data quality by the enumerators before the reinterview begins, the brevity of the reinterview/reconciliation process, and the fact that we are only going back to initial survey respondents.

The QA inaccessible rate (13.5%) was much higher than in July 1992. Extreme snowstorms during the survey period accounted for some QA samples not being reinterviewed at all or not being reinterviewed within the ten day time limit. Recall that all reinterviews are to be completed within ten days of the initial contact to minimize recall bias. After the ten day time limit has expired, enumerators coded the reinterview sample as "inaccessible".

Table 2. Response Coding on the January 1993 COF Survey Quality Assessment.

State	QA Complete	Jan Ag Zero[1]	Total Usable	QA Refusal	QA Inacc	Jan Ag Ref/Inacc	Total Nonusable	Total Allocated
Illinois	145	21	166	8	12	44	64	230
Iowa	165	48	213	7	9	41	57	270
Minnesota	145	44	189	4	17	50	71	260
Nebraska	109	49	158	13	29	70	112	270
S. Dakota	127	20	147	4	46	23	73	220
Total	691	182	873	36	113	228	377	1250

[1] Includes reports of zero total cattle and out-of-business on the initial January Ag survey.

STATISTICAL MEASURES

In estimating response bias, a "proxy to the true value" must first be obtained (Hanuschak, Atkinson, Iwig and Tolomeo 1991). In this study, as in previous reinterview studies at NASS, the reconciled value was considered to the "true" or final value. Considerable cost and effort was expended to ensure that the value obtained during reconciliation was the best proxy to the true value, as reinterviews were performed face-to-face by supervisory and experienced enumerators. When the initial and reinterview responses differed, the enumerators were instructed to determine the "correct" response during the reconciliation process. If there was no difference, the common response was considered the final value. If the respondent could not determine which response was correct, or if a difference was not reconciled by the enumerator, the final value was set to missing and the observation was not used in the analyses for that item. If the respondent indicated that either response could be correct, then the average of the two responses was used as the final value. A third response, different from both the initial and reinterview responses, was also possible if the reinterview respondent said that neither the initial nor the reinterview response was correct.

The formulas used to calculate response bias and variance estimates were based on a stratified sample design. Estimates and tests of significance were computed for ratios of both the initial survey unedited data to the final or "true" reconciled value and the Survey Processing System (SPS) edited data to the final "true" value. Since the initial survey unedited data and the initial survey edited data provided similar results, only the results pertaining to the edited data are presented for most analyses. All references to edited data in this report refer to the initial survey edited data, unless otherwise specified. Relating "true" values to the initial survey edited data provides an assessment of the direct impact of response bias on survey estimates. Results based on the initial survey unedited data are given for the analyses pertaining to reasons for differences, since the reasons were collected for differences between initial and reinterview responses and editing created additional differences for which no reasons were available.

For the ith observation in stratum h, response bias was measured as:

$$B_{hi} = I_{hi} - F_{hi} \qquad \text{stratum } h = 1,...,L \text{ and unit } i = 1,...,n_h$$

where I_{hi} = Initial survey response (edited or unedited value)
F_{hi} = Final or reconciled value

A negative bias indicates underreporting of a survey item on the initial survey, whereas a positive bias indicates overreporting. Instead of presenting raw response bias estimates, ratios of the form R = F/E, where F estimates the total of the final responses and E estimates the total of the edited data (for matched respondents), were generated for most analyses (Kott 1990). Significance tests were performed to determine if the ratios differed from unity (H_0: R = 1 vs. H_1: R ≠ 1). The ratios are more informative than raw differences as they indicate the percent of relative bias in the initial survey. The percent bias, calculated as [(1 - R) * 100%] where R = F/E, is given for most results. A negative percent bias indicates a ratio greater than one and underreporting on the initial survey. A positive percent bias indicates a ratio less than one and overreporting on the initial survey.

RESULTS

Response Bias Summary

Response bias estimates were calculated for nine survey items at the individual state and five-state regional levels. Table 3 shows the percent response biases for the initial survey edited data and their associated standard errors. Results are given for all usable observations and for usable reports excluding outliers. As noted above, initial survey edited and unedited responses produced similar results. Univariate tests to determine if the ratio of the final reconciled value to the initial survey edited value was significantly different from one were performed for all survey items at both the individual state and five-state regional levels. Response bias results for cattle on feed capacity were significant at both levels (p-values < < 0.001). The response bias ratio for steer inventory in Iowa and Nebraska, and for cattle on feed inventory in Illinois was also significantly different from one (p-value < .01). These were the only significant results for the edited data, with outliers removed. While results varied by state, the ratios were close to one at the five-state regional level for most items, except capacity. The effect of outliers on response bias estimation from reinterview studies is often very strong; most analyses include results with and without outliers, so that their effect can be seen.

The percent response bias in Table 3 is indicative of the amount of over or underreporting for each survey item. The percent bias for total cattle inventory indicates that the initial Ag Survey expansion is about 4.5% too high [(1.000 - 0.955) * 100%] with all observations, but when two outliers are excluded, the expansion is only about 0.6% [(1.000 - 0.994) * 100%] too high. Outliers had the most affect on steer, calf, all heifer and total cattle inventories. By excluding one extreme observation for steer inventory, the amount of overreporting changed from 16.4% to only 2.8%.

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Table 3. January 1993 Cattle on Feed Survey Quality Assessment Response Bias Summary for the January 1993 Agricultural Survey Edited Data.

Inventory Item/State	All Usable Reports			Usable Reports Excluding Outliers		
	# Obs	% Bias	Std. Error	# Obs	% Bias	Std. Error
Total COF						
Illinois	166	-15.3*	6.1	166	-15.3*	6.1
Iowa	210	3.8	2.3	210	3.8	2.3
Minnesota	189	-9.3	11.4	188	-0.7	6.4
Nebraska	153	-4.6	4.2	153	-4.6	4.2
S. Dakota	144	23.5	16.8	143	1.7	5.0
Total	862	-1.3	2.9	860	-1.3	1.9
Total Cattle						
Illinois	166	-2.4	1.6	166	-2.4	1.6
Iowa	210	2.4	1.7	210	2.4	1.7
Minnesota	188	2.1	2.2	188	2.1	2.2
Nebraska	155	-2.3	1.7	155	-2.3	1.7
S. Dakota	146	30.1	19.2	145	4.4	5.0
Total	865	4.5	3.9	864	0.6	1.0
COF Capacity						
Illinois	166	26.1*	7.2	166	26.1*	7.2
Iowa	210	31.6*	4.8	210	31.6*	4.8
Minnesota	183	26.8*	5.8	183	26.8*	5.8
Nebraska	149	38.4*	10.6	149	38.4*	10.6
S. Dakota	141	44.4*	7.8	141	44.4*	7.8
Total	849	33.4*	3.9	849	33.4*	3.9
All Heifers						
Illinois	166	-2.6	3.9	166	-2.6	3.9
Iowa	210	-0.2	3.1	210	-0.2	3.1
Minnesota	187	-0.9	4.2	187	-0.9	4.2
Nebraska	155	-14.3	10.5	153	0.4	1.7
S. Dakota	146	-3.6	1.9	146	-3.6	1.9
Total	864	-5.3	3.6	862	-0.8	1.4
Steers						
Illinois	166	-4.3	5.3	166	-4.3	5.3
Iowa	210	11.8*	3.9	210	11.8*	3.9
Minnesota	188	-7.6	6.7	188	-7.6	6.7
Nebraska	153	-4.7*	2.0	153	-4.7*	2.0
S. Dakota	146	59.4*	22.0	145	12.4	12.4
Total	863	16.4	12.0	862	2.8	2.7

Table 3. January 1993 Cattle on Feed Survey Quality Assessment Response Bias Summary for the January 1993 Agricultural Survey Edited Data.

Inventory Item/State	All Usable Reports			Usable Reports Excluding Outliers		
	# Obs.	% Bias	Std. Error	# Obs.	% Bias	Std. Error
Calves						
Illinois	166	-9.4	8.6	166	-9.4	8.6
Iowa	210	-14.3	10.1	210	-14.3	10.1
Minnesota	188	12.9	9.5	188	12.9	9.5
Nebraska	154	9.7	15.3	153	**-5.3**	**7.3**
S. Dakota	146	12.2	10.4	146	12.2	10.4
Total	864	3.6	6.1	863	**-0.9**	**4.4**
Beef Cows						
Illinois	166	0.8	1.1	166	0.8	1.1
Iowa	210	1.2	3.2	210	1.2	3.2
Minnesota	188	6.8	6.3	188	6.8	6.3
Nebraska	155	1.9	5.5	155	1.9	5.5
S. Dakota	146	-1.4	2.8	146	-1.4	2.8
Total	865	1.7	2.2	865	1.7	2.2
Bulls						
Illinois	166	0.4	1.5	166	0.4	1.5
Iowa	210	7.7	7.1	209	**0.0**	**3.3**
Minnesota	188	1.8	2.8	188	1.8	2.8
Nebraska	155	3.3	3.9	155	3.3	3.9
S. Dakota	146	-4.9	4.5	146	-4.9	4.5
Total	865	3.6	3.3	864	**0.5**	**1.7**
Milk Cows						
Illinois	166	-20.9	27.3	166	-20.9	27.2
Iowa	210	12.3	7.0	209	**2.7**	**2.7**
Minnesota	188	0.0	0.2	188	0.0	0.2
Nebraska	155	0.5	0.8	155	0.5	0.8
S. Dakota	146	-15.2	16.9	145	**3.1**	**3.4**
Total	865	0.8	1.5	863	**0.3**	**0.3**

*Indicates a significant result (at α=0.05) for the test of Ho:F/E = 1. Numbers in bold represent changes due to omitting outlier(s).

The percent bias (% bias) is calculated as [(1 - F/E) * 100%]. This bias indicates the amount of overreporting (positive percentages) or underreporting (negative percentages). The percentage for COF Capacity indicates that the initial survey expansion was about 33.4% too high.

The significant results for cattle on feed capacity were not unexpected, since two different wordings were used to obtain initial and reinterview responses for capacity. Evaluating the wording of certain questions (including capacity) was one of the goals of the quality assessment. These results support those of the January and July 1992 COF reinterview studies which indicated that the current wording tends to overstate the maximum number of cattle that an operation would normally feed for the slaughter market at any one time (Hood 1992). The importance of this is discussed later in the section "Response Bias and Reasons for Differences".

As noted above, initial unedited and edited survey data produced similar response bias results. There was only one case in which the results of the tests were not the same -- steer inventory in Iowa. The ratio of the edited value to the final reconciled value was significantly smaller than one (p-value < 0.01), while the unedited initial survey data was not (p-value = 0.08). This implies that, in this case, maybe significance was due to editing and not response bias.

Although only a couple of results were found to be significant, Table 3 provides interesting information. The precision for most items appears to be relatively high, as indicated by the small standard errors. However, there are a few items for which explanations are called for. Since cattle on feed inventory was underreported in Illinois by about 15%, it may appear strange that no outliers were detected. Illinois had only one observation in the ten largest expanded differences and it was eighth in magnitude. The large standard error for the percent bias for steer inventory in South Dakota (12.4) was due to one observation. South Dakota had two large differences (between edited data and reconciled data) for steers, but only one was treated as an outlier. The five largest expanded differences were 334,932, 43,267, 20,610, 12,253 and 11,366. Since the difference of 334,932 was so large in comparison with the other differences, it was the only one considered an outlier. However, by removing the next largest absolute difference (43,267) the ratio for steers in South Dakota changes to -3.4% and the standard error drops to 2.7 for South Dakota and 1.9 for the five-state level. This is indicative of the type of sensitivity inherent in the response bias estimates, particularly for items with a low percentage of positive reports.

Table 4 helps to explain why the overall precision for calves is the lowest among the survey items. A few large differences within states resulted in large variances and large standard errors for the percent bias. Table 4 shows the five largest expanded differences (in absolute value) for each state and the percentage of the total absolute response error that they accounted for. Note that Iowa is the only state without any potential outliers. Interestingly, the percent bias was greater in magnitude for Iowa than for any other state. It should be noted here that for the summary of response bias in Table 3, potential outliers were examined at the five-state aggregate level, not at the state level. While there appear to be six extreme observations at the state level (one for Illinois and South Dakota and two for Minnesota and Nebraska), at the combined five-state level only one observation (the largest observation from Nebraska) appeared extreme enough to be considered an outlier.

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Table 4. The 5 Largest Expanded Differences (Absolute Value) for Calf Inventory and the Percent of the Total Absolute Response Error They Accounted For.

Illinois	Iowa	Minnesota	Nebraska	South Dakota
9,156	11,917	31,708	51,100	6,621
2,890	10,487	16,585	20,148	1,892
2,835	9,534	1,677	4,488	1,182
2,629	7,822	1,450	3,545	1,113
2,437	6,495	1,375	3,053	798
19,947	46,255	52,795	82,334	11,606
(6.5%)	(15.1%)	(17.2%)	(26.8%)	(3.8%)

As mentioned earlier, different wording was used to collect the reinterview responses for cattle on feed inventory and capacity. As the overall bias for cattle on feed inventory indicated a non-significant level of 1.3 percent underreporting, it is difficult to tell what impact, if any, that the different version had on the total COF inventory estimate. It would seem that with the small level of bias detected that there was no effect. As discussed below, the respondents were very aware of the change in wording for capacity, as demonstrated by the fact that almost one-half of all differences for capacity was attributed to the use of two different questions. However, for total cattle on feed inventory, not one difference was reported to be due specifically to a change in the wording of the question. Thus, if a more succinct version of the question achieves the same results, using the shorter version would be an improvement, especially when asking enumerators to read questions exactly as worded.

Two different questions were also used to collect "cattle on feed" capacity. This was the only item for which the response bias was significant at the five-state regional level. Response bias for this item was also significant at the state level for all five states. Results indicate that, based on the assumption that the QA version collects the actual data we desire, cattle on feed capacity was greatly overreported. The most frequently reported reason for differences between the initial survey response and the reinterview response was "two different questions were asked - wording was different". This one reason was given for almost one-half of all differences and accounted for over 60% of the total absolute response error. Based on these results, and the January and July 1992 reinterview studies, the current operational "feedlot capacity" estimate probably better indicates the number of cattle on feed that an operation **could ever** hold, than the maximum number that **would normally** be fed for slaughter.

Although the results were not statistically significant, the QA survey indicated calf inventory underreporting of about 14% in Iowa. Steer inventory was significantly overreported (by about 12%) in Iowa. These reporting errors are possibly explained by the fact that the most frequent reason given and the reason that contributed most to the total absolute response error for both steers and calves was "respondent had difficulty with weight groups". It appears that some calves could have been mistakenly included in the steer category due to a failure to accurately classify the animals by the 500 pound criterion.

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Another interesting observation from Table 3 is that South Dakota was the only state in which bias estimates indicated overreporting for all the following survey items: total cattle, cattle on feed, capacity, steers, and calves. Illinois was the only state to underreport for all the following items: total cattle, cattle on feed, heifer, steer and calf inventories.

Characteristics of the Response Biases

Although the only item for which significant response bias was detected was capacity, this does not imply that there were no differences between the initial survey (original or edited) and the final reconciled responses. Many individual reporting differences were found, but they were largely offsetting. Appendix C shows the distribution of the expanded (non-zero) differences for total cattle inventory, cattle on feed inventory and cattle on feed capacity. Table 5 and the graphs in Appendix C demonstrate the symmetric nature of the response errors.

Table 5 shows the distributions of the absolute values of the expanded differences for total cattle on feed inventory. Results from chi-square tests showed that the distributions of the negative and positive deviations were not significantly different. This also implies that there is no tendency for either overreporting or underreporting. Similar results were found for total cattle inventory (Borus 1966). Symmetric tendencies were indicated for both the expanded and unexpanded response errors.

Table 5. Distribution of Absolute Expanded Differences Between Reconciled Values and Initial Survey Edited Values for Total Cattle on Feed Inventory.

Absolute Difference	Positive Deviations		Negative Deviations		Cumulative Total	
	# Usable Reports	%	# Usable Reports	%	# Usable Reports	%
No Difference					629	73.0
0 < Diff ≤ 250	51	41.8	43	38.7	723	83.9
250 < Diff ≤ 750	25	20.5	27	24.3	775	90.0
750 < Diff ≤ 1500	20	16.4	14	12.6	809	93.9
Diff > 1500	26	21.3	29	24.3	862	100.0
Total	122	100.0	111	99.9*	862	100.0

*Does not add to 100.0% due to rounding.

Domain Estimation

Response bias was further examined by grouping the data into domains based on three different criteria. The first two groupings were related to size of the reporting operation, while the third grouping was based on the mode of data collection. By grouping the responses in this manner, we could examine response characteristics by operation size and data collection mode. The domain ranges were selected to ensure that an adequate number of observations were available for comparison in each domain.

Domains Based on COF Inventory

The first grouping was based on final reconciled cattle on feed inventory values. The percent response bias for the edited data, standard errors for the percent bias and frequencies are presented in Table 6 for selected survey items. As noted earlier, a negative percent indicates underreporting of a survey item, while a positive percent implies overreporting. Looking at the percentages derived by excluding "domain outliers", we can see some interesting trends.

While sample sizes were too small to establish statistical significance between domains, some interesting "trends" emerged. Table 6 shows that when domain outliers are excluded, the smallest operations overreported cattle on feed inventory by about 4%, while the other three size classes underreported by 2-3%. There was also more variability in the differences for COF

Table 6. Percent Response Bias by Size of Operation -- Size Based on January 1993 COFQA Final Reconciled Total Cattle on Feed Inventory.

Item	Final Reconciled Total Cattle on Feed Inventory [1]							
	0 - 99		100 - 199		200 - 499		500 +	
Total COF								
% Bias	3.3	3.8	-3.2	-3.2	-2.9	-1.6	-2.4	-2.4
Std. Error	11.4	7.1	2.8	2.8	2.1	1.5	2.4	2.4
# Obs.	649	647	96	96	69	68	48	48
Total Cattle								
% Bias	6.4	1.0	1.8	-1.0	-1.4	-1.4	-2.0	-2.0
Std. Error	5.2	1.4	2.9	2.3	1.1	1.1	0.7	0.7
# Obs.	652	651	94	93	69	69	45	45
COF Capacity								
% Bias	49.3	43.7	16.6	8.8	4.8	4.8	7.8	7.8
Std. Error	5.5	4.6	5.5	2.1	2.8	2.8	3.1	3.1
# Obs.	642	640	94	92	68	68	44	44
Steers								
% Bias	31.0	6.2	-1.3	0.7	3.8	1.2	-1.2	-1.2
Std. Error	18.6	5.2	2.5	1.5	4.5	1.4	1.4	1.4
# Obs.	651	650	94	93	68	66	45	45
All Heifers								
% Bias	-7.4	-0.2	-1.0	-1.0	-0.8	-0.8	-2.5	-2.5
Std. Error	5.6	2.1	3.3	3.3	1.8	1.8	1.9	1.9
# Obs.	651	649	94	94	69	69	45	45
Calves								
% Bias	5.9	-2.3	-36.1	-5.4	8.0	-6.5	-1.5	-1.5
Std. Error	6.4	3.3	35.2	7.6	16.2	13.7	9.8	9.8
# Obs.	651	649	94	93	69	68	45	45

[1] Results excluding "domain outliers" are indicated in the shaded columns.

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PERCENT RESPONSE BIAS FOR COF INVENTORY USING FINAL COF INVENTORY TO CREATE DOMAINS

Legend: — Total COF + Total Cattle ⁕ All Heifers ⁃ Steers ⨯ Calves

January 1993 COF QA Survey
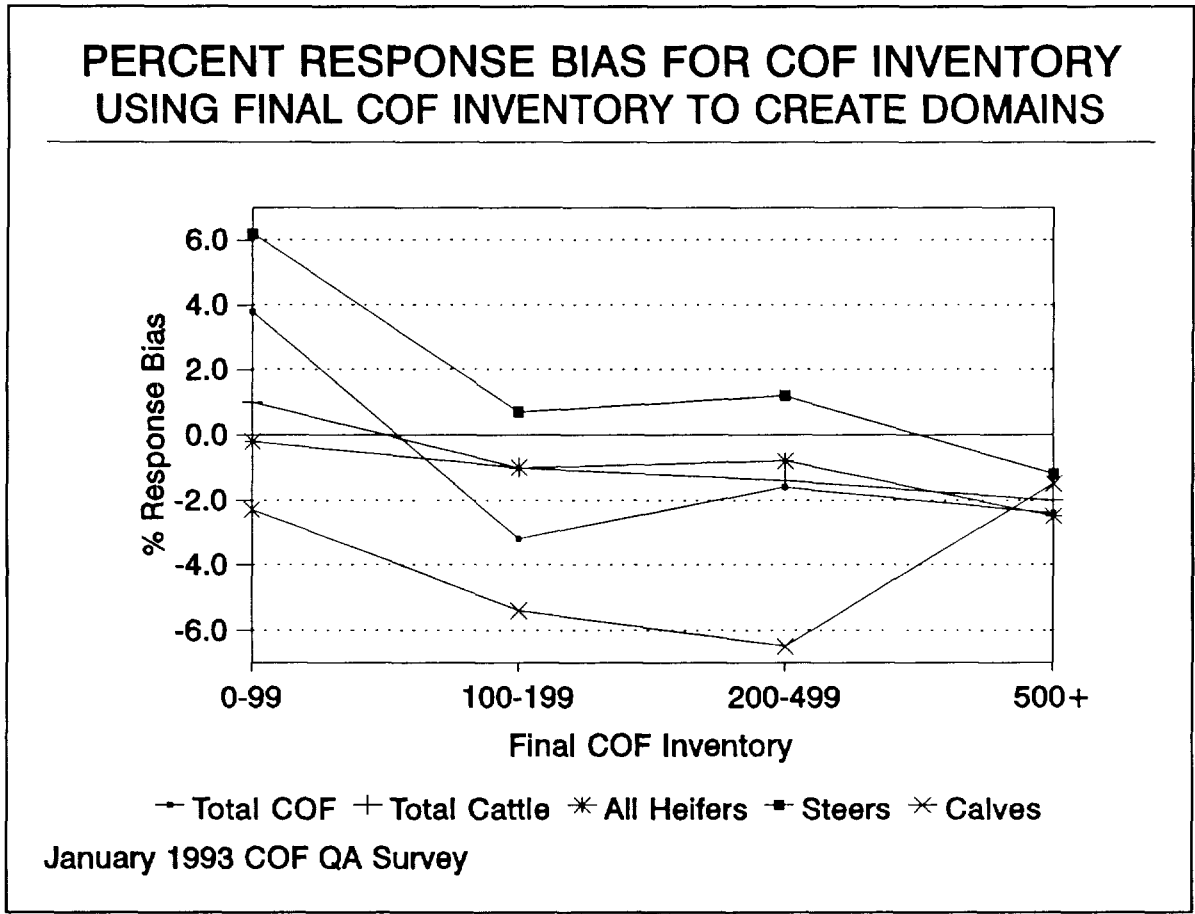
Figure 1. Percent response bias for initial survey edited data for selected survey items by domain. Domains were created using final reconciled cattle on feed inventory as an indication of operation size. Negative percentages indicate underreporting or negative bias, while positive percentages indicate overreporting or positive bias.

inventory in the 0-99 domain, as indicated by the relatively large standard error. The standard error of the percent bias for the smallest size group was almost 3 times as large as that of the other three size classes.

Total cattle inventory reporting showed a similar, yet not so extreme, trend. Operations with less than 100 head of COF overreported by about 1%, while the other three size classes showed very slight underreporting of about 1-2%. The range between smallest and largest size classes was only 3 percentage points. As with COF inventory, the 0-99 size group was the only domain that overreported. Again, these results show nothing more than overall trends, since sample sizes at this level were inadequate to show statistically significant differences. The precision was greater for the larger operations represented by the 200-499 and 500+ domains.

COF capacity was overreported in all size classes, with smaller operations overreporting substantially more than larger operations. Reconciled COF capacities for operations with less

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than 100 head of COF were about half of what was reported in the initial survey. For larger operations with over 200 COF, the percent of response bias dropped to around 5-9%. These results are an indication that the two capacity questions do not collect the same data, especially for farmer feeders. Which one to use is a question that will be discussed later in this paper.

Underreporting of calf and heifer inventories was indicated in all four size classes. The precision was greater for the smaller domains than the larger ones for calf inventory. There was very little response bias for steer inventory in any domain except for the 0-99 size group, which indicated about 6% overreporting.

Overall, the smallest size group overreported for all items, except for heifer and calf inventories, in which all size groups underreported. The largest size group (500+) underreported (1.2 to 2.5%) for all items except capacity, in which all domains overreported.

Domains Based on COF Capacity

The second grouping was based on final reconciled cattle on feed capacity values as an indication of operation size. Table 7 shows the percent response bias, standard errors of the percent response bias and sample size for each domain, with and without "domain outliers", for selected items. Listed below are some general observations based on using the final capacity data to create domains. The section "Response Bias and COF Capacity" takes a more extensive look at the 1000+ class.

Table 7 indicates that when domain outliers are excluded, cattle on feed inventory was fairly consistently underreported in all five size groups. There does not appear to be the same relationship between bias for COF inventory and capacity as there was when domains were created using COF inventory. However, as when size was based on inventory, the smallest size group is the most variable in reporting COF inventory.

The response bias trend for total cattle inventory of slight overreporting for smaller operations to slight underreporting for larger operations is similar to the trend when size was based on inventory. Cattle on feed capacity also shows the same trend of smaller operations overreporting substantially more than the other size classes.

Steer inventories were overreported in the smallest size group by about 2.5%, while all other size groups showed underreporting ranging from 0.1% to 3.0%. Heifer and calf inventory reporting exhibited opposite trends in all five size classes. That is if calf inventory was overreported in one domain, then heifer inventory was underreported in that same domain (but not by the same amount).

Recently, there has been discussion of differential sampling and estimation for operations having list frame control data for COF capacity (or feedlot capacity) of 1,000 or more head to estimate COF inventory for the entire U.S. Currently, there are fewer than 2,000 such operations, which account for approximately 75% of the U.S. total COF inventory estimate. The current proposal calls for setting estimates for the "1000+" population and for all cattle on feed.

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Table 7.   Percent Response Bias by Size of Operation -- Size Based on January 1993 COFQA Final Reconciled COF Capacity.

Item	Final Reconciled COF Capacity [1]									
	0 - 99		100 - 199		200 - 299		300 - 499		500 +	
Total COF										
% Bias	-1.7	-1.7	-12.2	-1.4	1.7	-1.4	7.7	-3.5	-2.5	-1.0
Std Err	9.8	9.8	12.0	2.3	3.6	2.3	10.5	4.5	1.8	1.2
# Obs.	525	525	109	108	70	69	63	62	81	80
Total Cattle										
% Bias	8.4	1.9	3.1	1.1	0.2	0.2	-2.8	-1.4	-3.7	-2.1
Std Err	6.2	1.5	2.6	2.3	1.6	1.6	1.5	0.7	1.5	0.7
# Obs.	523	522	109	108	70	70	63	62	82	81
COF Capacity										
% Bias	68.0	62.2	18.7	11.3	5.4	5.4	3.9	3.9	12.7	8.5
Std Err	5.2	4.2	5.1	2.2	2.1	2.1	4.6	4.6	4.6	2.8
# Obs.	524	522	109	107	70	70	63	63	83	82
Steers										
% Bias	40.2	2.5	-1.1	-1.1	9.1	-0.1	1.7	-3.0	-2.2	-2.2
Std Err	21.0	5.4	2.0	2.0	7.2	1.6	5.2	2.8	1.3	1.3
# Obs.	522	520	109	109	70	68	62	61	82	82
All Heifers										
% Bias	-8.2	1.0	-5.1	-2.9	0.8	1.9	-3.2	-3.2	-1.9	-1.9
Std Err	7.0	2.6	3.2	2.2	5.1	1.8	1.9	1.9	1.6	1.6
# Obs.	522	520	109	108	70	68	63	63	82	82
Calves										
% Bias	6.0	-4.7	-10.5	0.8	-30.2	-5.0	9.4	9.4	5.7	5.7
Std Err	8.0	4.0	19.0	5.2	21.6	4.8	11.3	11.3	5.7	5.7
# Obs.	522	520	109	107	70	68	63	63	82	82

1 Results excluding "domain outliers" are indicated in the shaded columns.

How do these "1000+" operations compare to "smaller" operations with respect to response bias for cattle on feed inventory? While the QA survey was designed to target smaller farmer-feeder operations, some large operations (reported capacity ≥ 1,000) were sampled. Out of 862 usable reports, 33 had initial survey edited data for capacity of 1,000 or more. The following analyses summarize some comparisons between "small" and "large" operations. Figure 2 shows the distribution for the expanded reporting errors for cattle on feed inventory for operations with reported capacity less than 1,000 and for operations with capacity greater than or equal to 1,000.

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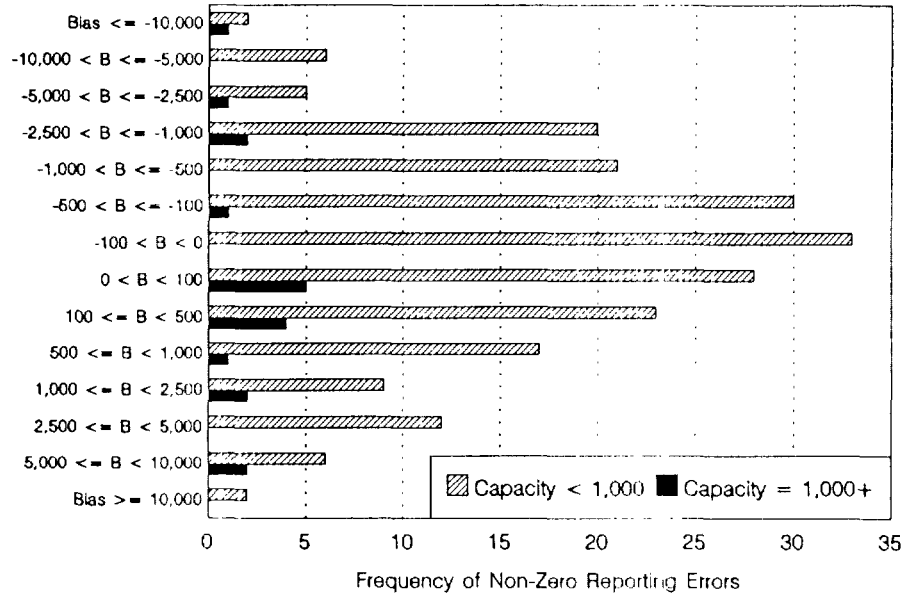
Figure 2. Figure 2 shows how variable the expanded response errors (initial survey edited value - final value) were. The reporting errors have a wide range, with offsetting large positive and negative values.

Table 8 shows that there is little difference between the two groups of "capacity ≤ 1,000" and "capacity ≥ 1,000", with respect to reporting errors. Outliers had little effect on either group. There was about 1.62% underreporting for the "capacity ≤ 1,000" group and about 0.16% underreporting for the "capacity ≥ 1,000" group, both of which were statistically insignificant. Of the 33 reports in the 1,000+ category, 14 had a reporting error of zero, while 19 had expanded reported errors ranging from -13,693 to 8,140.

Table 8. Comparison of Percent Response Bias for Cattle on Feed Inventory by Reported Capacity.

Domain	# of Obs.	# of Biases ≠ 0	Response Bias	% Bias	% Bias (Excl. 2 Outliers)
Capacity < 1,000	829	214	-29,931	-1.67	-1.62
Capacity ≥ 1,000	33	19	-783	-0.16	-0.16
Total	862	233	-30,714	-1.34	-1.30

Domains Based on Mode of Data Collection

The final grouping was based on the mode of data collection, to determine if response bias varied between the CATI mode and the non-CATI mode. The non-CATI domain includes mail, non-CATI telephone and personal enumeration. Of all the usable reinterview samples, only 7 were initially enumerated by mail and only 60 were personally enumerated. The seven mail samples contributed no response error to the overall response bias (all differences were zero). Each domain contained approximately 430 observations - the actual number varied slightly by survey item. Table 9 shows the results with and without "domain outliers" for selected survey items.

NOTE: The samples (and therefore the strata) were not randomly assigned to the modes of data collection (CATI vs. non-CATI). The mode of data collection often depends upon the stratum into which the sample falls. Thus, the CATI population is in general different than the non-CATI population. Smaller operations (based on total cattle or COF inventory) are generally reserved for CATI enumeration. So, the assessment of response bias by mode of collection is highly confounded with the size of the operation.

Table 9 illustrates several interesting contrasts between the two domains. Cattle on feed capacity was the only survey item for which overreporting occurred in both domains when domain outliers were excluded. For the non-CATI domain, non-significant underreporting of about 1 to 2% occurred for inventories of total COF, total cattle and all heifers, while overreporting was more prevalent in the CATI domain. Significant (p-value=0.01) underreporting for calf inventories of about 12% was indicated in the non-CATI domain (with one outlier removed), while non-significant overreporting of more than 6 percent occurred in the CATI domain. There was slight overreporting for steer inventories in both domains.

When domain outliers were excluded, the percent response bias in the CATI domain was larger than the bias obtained from the non-CATI domain for all items except steer inventory. This result may indicate that CATI samples tend to overreport more often than non-CATI samples, or that smaller operations (smaller strata) tend to overreport more than larger operations (larger strata). This latter tendency was observed for total cattle, cattle on feed, and steer inventories and capacity when final reconciled cattle on feed was used to summarize by operation size.

All percent biases were positive in the CATI domain except for steer inventory, which implies possible overreporting in lower strata or smaller operations. The percent of overreporting ranged from 34% for capacity to 2- 7% for the other 4 items. Precision was greater in the non-CATI domain for all items except calf inventory as is indicated by the smaller standard errors for the percent response bias.

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Table 9.   Percent Response Bias by Mode of Data Collection.

Item	All Usable Observations		Excluding Domain Outliers	
	CATI	Non-CATI	CATI	Non-CATI
Total COF				
% Bias	2.2	-2.5	2.2	-2.5
Std. Error	5.9	3.5	5.9	1.7
# Obs.	431	431	431	429
Total Cattle				
% Bias	12.4	-1.2	3.3	-2.1
Std. Error	8.4	1.3	1.6	0.9
# Obs.	435	430	434	429
COF Capacity				
% Bias	40.3	29.1	34.0	29.1
Std. Error	7.3	4.3	5.9	4.3
# Obs.	425	424	423	424
Steers				
% Bias	35.1	5.5	-1.1	2.7
Std. Error	25.2	3.2	2.3	1.9
# Obs.	435	428	433	427
Heifers				
% Bias	-7.5	-4.3	2.3	-1.2
Std. Error	9.7	2.6	2.9	1.1
# Obs.	434	430	433	428
Calves				
% Bias	19.0	-16.0	6.8	-11.9
Std. Error	9.7	6.4	4.2	4.8
# Obs.	435	429	433	428

Response Bias and Reasons for Differences

One objective of the reinterview program for cattle on feed inventory is to identify the reasons for discrepancies between the initial and reinterview responses. This information can be used to determine what cognitive problems may be contributing to our COF estimation problems, to evaluate the questionnaires, and to determine how much of the response bias may be fixable. The reinterview enumerator was instructed to ask the respondent to provide a reason for each difference that occurred between an initial survey and reinterview response. These explanations were recorded on the reconciliation form and were later coded by the state survey statistician.

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The specific reasons for the differences between responses were grouped into four categories, "estimation or rounding", "definition or interpretation", "other" and "no reason available".

The first category, **"estimation and rounding"** reasons, included cases in which the respondent indicated that the answer for at least one of the two interviews was estimated. The second category, **"definition and interpretation"** reasons, are related to problems of interpreting what should or should not be included in the response to a particular question. Examples of reasons that fall into this category included reporting animals over 500 pounds as calves, not reporting as of the January 1 reference date, or including cattle from another operation. The third category, **"other"** reasons, included all other reasons that could not be attributed to either of the previous two classes, except cases in which no reason was given. This category consists of a wide range of reasons, including problems associated with telephone interviewing and recording errors by enumerators. The last category, **"no reason available"** consists of cases in which a difference was reconciled with no reason recorded by the enumerator, and when a difference was not reconciled by the enumerator but enough information was available for the editing statistician to manually impute a final value (Tolomeo and McClung 1991).

The explanations obtained during the reconciliation process were used to identify specific reasons for differences, the frequency of each reason, and the response bias associated with specific reasons or categories. In general, differences due to "definition or interpretation" reasons can be viewed as being potentially fixable by changes in the survey process including questionnaire wording and design, procedures and training. Differences due to "estimation or rounding" and "other" reasons probably are not as correctable, if correctable at all (Pafford 1989).

Since individual response errors can be positive or negative, and therefore can cancel each other out, using the net response bias could be misleading when analyzing response errors with respect to reasons. Therefore, the absolute value of each non-zero difference was expanded to obtain the total absolute response error for each reason category. The total absolute response error along with the frequencies, average absolute response error and the magnitude of the response biases were examined in determining the importance of the reason categories and specific reasons. Appendix D provides a complete summary of the response bias reasons for the six major survey items.

Table 10 shows the frequencies of the non-zero response errors and the average absolute size by reason category. The average absolute response error is the average of the absolute values of each unexpanded difference (Pallesen 1991). The category **"no reason available"** occurred the least and accounted for the smallest percentage of the total absolute response error for all items except total cattle inventory. This particular category was created primarily so as to not inflate the **"other"** category statistics. In previous NASS reinterview studies, all explanations other than "definitional" or "estimation" were grouped into the **"other"** category. By creating a fourth category, we are able to avoid artificially inflating the contribution of the **"other"** category and to show the importance of collecting explanations when differences occur.

Table 10. Frequency of Non-zero Response Errors and Their Average Absolute Size by Reason Category for the January 1993 COF Survey Quality Assessment.

Survey Item	Frequency				Avg Unexp Abs Response Error			
	Def	Est	Oth	NRA	Def	Est	Oth	NRA
Total COF	51	83	66	25	64.5	30.2	57.3	45.6
Total Cattle	43	106	196	11	48.8	18.8	38.6	149.9
COF Capacity	190	54	50	27	129.7	45.3	333.5	80.4
Steers	89	105	35	13	38.6	17.1	17.9	36.0
All Heifers	84	102	43	8	27.1	18.2	32.2	42.0
Calves	84	60	29	6	36.5	19.8	27.3	30.1

Frequency of Reason Categories
For Unedited Initial - Reconciled Values
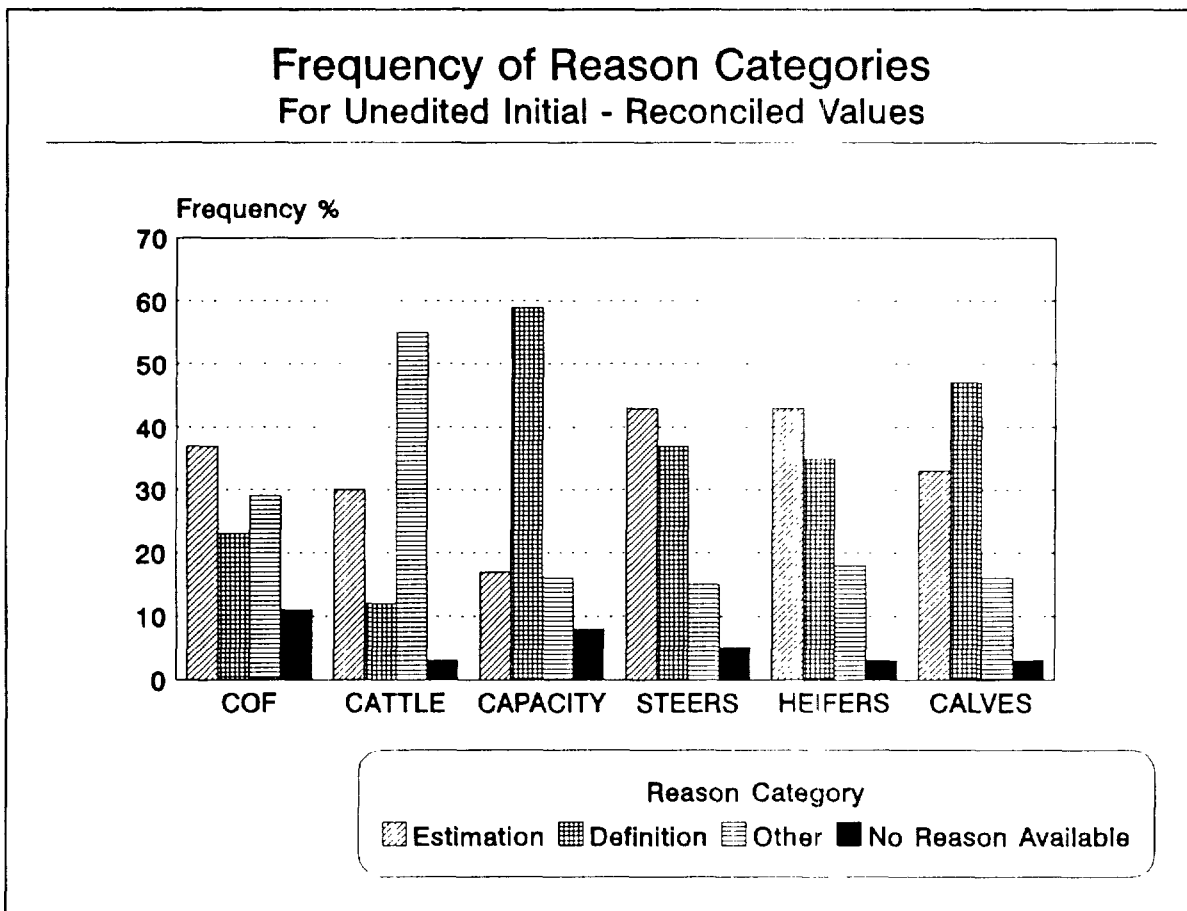
Figure 3. Frequency of reported reasons for differences between initial and reinterview responses, by category for selected survey items. Reporting errors attributable to definition or interpretation problems during one of the surveys occurred most often for capacity and calf inventory. "Estimation" reasons were given most frequently for cattle on feed, steer and heifer inventories, while "other" reasons were reported most often for total cattle inventory.

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While the frequency of differences due to "estimation" reasons varied by item, this category consistently had the lowest unexpanded average absolute response error of all four categories. For all categories excluding **"no reason available"**, reasons in the **"definition"** category occurred least frequently for total cattle and cattle on feed inventories, yet this category had the highest average absolute response error. "Definitional" reasons were given most frequently for COF capacity and calf inventory, while "estimation" reasons occurred most often for steer and all heifer inventories.

Table 11 shows the frequency of differences for each reason category and the associated percent of the total absolute response error attributable to each category. The total absolute response error was calculated by expanding the absolute value for each difference. As Tables 10 and 11 show, the frequency of biases for each category varied widely by survey item. However, the **"definition"** category accounted for the largest percentage of the absolute response error for capacity and steer, all heifer, and calf inventories. "Other" reasons contributed the most to the absolute response error for total cattle on feed and total cattle inventories. Overall, "no reason available" and "estimation" reasons contributed the least to the absolute response error.

Table 11. Frequency of Differences and Percentage of the Total Absolute Response Error by Reason Category for the January 1993 COFQA.

Survey Item	Frequency %				% Total Expanded Absolute Response Error			
	Def	Est	Oth	NRA	Def	Est	Oth	NRA
Total COF	23	37	29	11	27	25	29	19
Total Cattle	12	30	55	3	17	14	49	20
COF Capacity	59	17	16	8	70	4	24	2
Steers	37	43	15	5	63	23	10	4
All Heifers	36	43	18	3	40	38	19	3
Calves	47	34	16	3	67	13	12	8

Table 11 demonstrates the importance of the "no reason available" category. First of all, the creation of this fourth group prevents the "other" category from appearing more severe than it already is. Second, and more importantly, while this category consists of only two situations (either the enumerator did not record an explanation or the final value was manually imputed by office staff), it accounted for nearly one-fifth of the total absolute response error for both total cattle inventory and cattle on feed inventory, while accounting for only 11% and 3%, respectively, of the differences. This result emphasizes the importance of collecting good reasons for making conclusions about response bias.
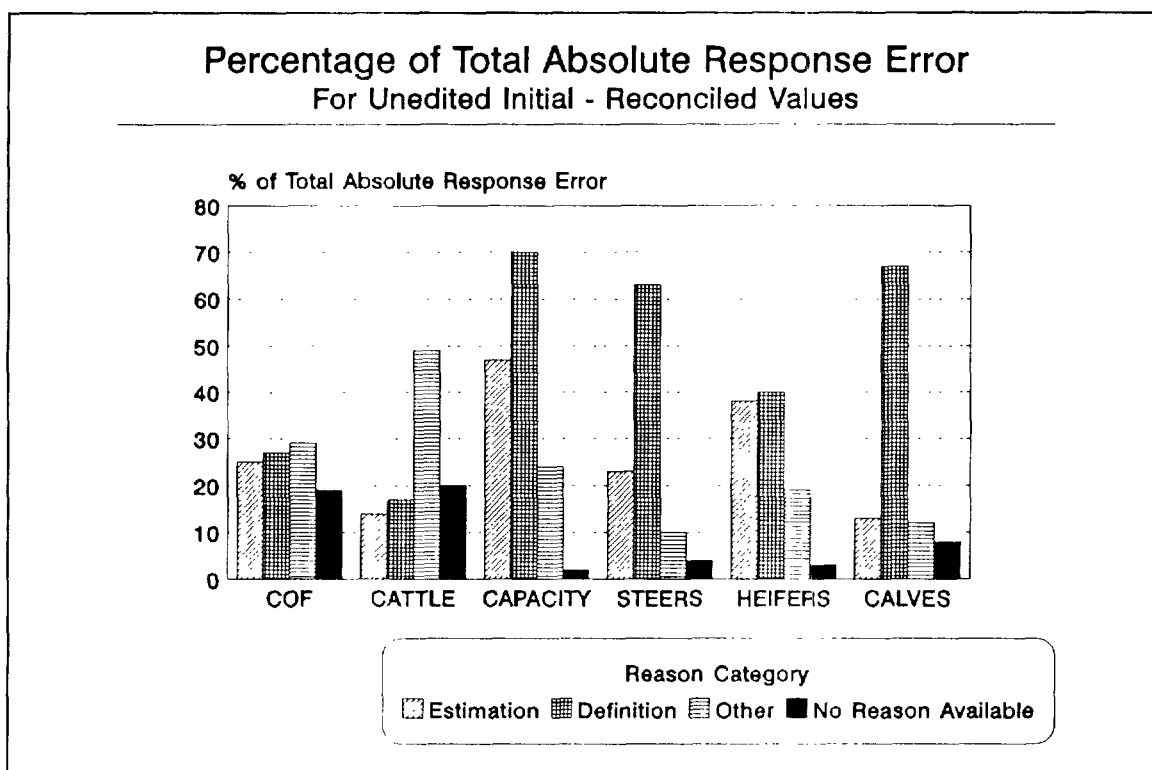
Figure 4. Percentage of the total absolute response error for unedited initial survey values minus reconciled values, by reason category for selected survey items.

Cattle on Feed Inventory

For total cattle on feed inventory, the "**definition**" and "**other**" categories had essentially the same level of expanded response bias, only the direction (i.e., positive or negative) of the bias differed (see Appendix D). Differences attributed to definitional reasons occurred less frequently than differences due to "other" reasons, but contributed more, on average, to the overall bias. The "**definition**" category also had the largest average absolute unexpanded response error.

The most frequent reason given for differences between initial survey and final reconciled responses for cattle on feed inventory was "figure was estimated". Reported 31 times, the expanded net bias due to this reason was only -134, but this reason was responsible for the second largest expanded absolute response error overall. The large absolute response error and small overall response bias indicate that there were large individual reporting errors, both positive and negative for this reason. The "**estimation**" category accounted for more reasons than any other category.

The two definitional reasons that occurred most frequently and contributed most to the total definitional absolute response error were "misunderstanding between enumerator and respondent" and "respondent did not understand question". The reason with the overall largest unexpanded

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average absolute response error was "counted animals not really on feed". With only 4 reports, this reason contributed most to the overall expanded response bias.

The two non-reasons that make up the **"no reason available"** category were "no explanation for the difference" and "enumerator did not reconcile - final value manually imputed". These two non-reasons accounted for nearly 20% of the total absolute response error for cattle on feed inventory. This result is disconcerting since one of the main goals of any NASS reinterview study is to determine reasons for reporting errors. Without explanations, any conclusions pertaining to reason effects are weakened.

The overall response bias (initial unedited - final) for cattle on feed inventory was statistically insignificant, however, there was substantial response variability. In light of the fact that almost 20% of the total absolute response error (and 11% of all differences) was unaccounted for, attributing the cause of this variability to any one reason or group or reasons is difficult, but improved survey procedures could correct most of the "definitional" errors and possibly some of the "other" errors at the same time.

Total Cattle and Calves

Results for total cattle inventory were similar to those of cattle on feed in that the **"definition"** and **"other"** reason categories had the same level of bias but different directions. While the magnitudes of bias were the same, "other" reasons occurred over 4.5 times as often as definitional reasons, indicating that, on average, reporting errors due to definitional problems were more severe. Recall that the **"definition"** category also had the largest unexpanded average absolute response error of the four categories (see Table 11).

The most frequently reported reasons in the **"estimation"** category were "figure was estimated" and "respondent forgot to include some cattle and/or calves", accounting for 19% of all differences. The most frequently reported **"definition"** reasons were "respondent had difficulty with weight groups" and "respondent did not report as of the January 1 reference date". These two reasons accounted for over 60% of the definitional absolute response error and 10% of the total absolute response error.

Ten of the eleven reports of "respondent had difficulty with weight groups" involved changes in the number of initially reported calves. Six reports lowered the initial number of calves during reconciliation, while four reports increased the number of calves. However, for these 11 reports involving weight groups, there was actually more involved than just placing one specific group of animals into the wrong category. All 11 cases involved differences within two or more component items (particularly calves, heifers and steers), resulting in differences for total cattle and calf inventory.

There were 158 differences between the initial and reinterview responses for total cattle and calf inventory in which the reason given for the difference was either "totals differ due to component differences" (84) or "difference due to response to a prior question" (74). Of these 158

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differences, about 18% involved only one component item, 21% involved two component items, about 33% involved three component items, about 19% involved four items and 9% involved 5 or more component items.

There were 11 reports of "no explanation" and "enumerator did not attempt to reconcile" in the "no reason available" category for total cattle inventory. However, these 11 reports accounted for over 20% of the total absolute response error and were the second and third most influential "explanations" for the overall response bias. Once again, any conclusions made on reason effects are only as good as the reasons that are provided, and with 20% of the total absolute response error unaccounted for, it is hard to make any general conclusions with much confidence.

For the six items that make up total cattle inventory (steers, heifers, calves, beef cows, bulls and milk cows), definitional reasons accounted for the greatest percentage of the total absolute response error and had the largest average (unexpanded) absolute response error for four of the items. The solution for any problems with total cattle inventory must be addressed through definitional and interpretation problems with its component parts. A substantial number of the 158 differences attributed to "differences on prior question" or "difference due to a component difference" (and therefore included in the "other" category) should really be classified as "definitional" differences.

The most frequent reason given for differences for steer and calf inventories was "respondent had difficulty with weight groups". This reason was responsible for 19% of the differences for steers and 31% for calves. It contributed the most to the total absolute response error for both items, but had very little effect on the net response bias for steer inventory. However, it was the most influential (in terms of magnitude) reason on the net response bias for calf inventory.

Cattle on Feed Capacity
The only significant response bias detected at the five-state regional level was for cattle on feed capacity. By examining the reported reasons for differences, it is obvious that the primary cause for the response bias was the difference in the wording of the two versions of questions used to collect the data. The most frequently reported reason was "two different questions were asked - wording was different", which accounted for nearly one-half of all reported reasons. This reason resulted in the largest net response bias and absolute response error, and was responsible for almost 60% of the total absolute response error. Since the wording for the QA version was developed through discussions with Livestock Branch staff to best reflect the underlying concept we are trying to measure, these results indicated that strong consideration ought to be given to changing the operational version of the question if "maximum number of cattle and calves normally fed for slaughter at any one time" is the information we want collected.

What does all this mean? The current operational wording, which asks for "feedlot capacity", appears to provide an overstatement of the maximum number of cattle on feed that an operation would normally feed for the slaughter market. Also, the current wording appears to have more

meaning to larger cattle on feed operations. Results indicated that the more cattle on feed inventory an operation had the less response bias indicated for capacity, implying that using different wording had less effect on the "larger" operations.

Analyzing indicated response bias by size of the feeding operation demonstrated much smaller differences in the questions for larger feedlots than for farmer-feeder operations. As Tables 6 and 7 indicated, all operations, regardless of size, tended to overreport capacity. However, smaller operations overreported by a much larger percentage than did larger ones. Asking for "feedlot capacity" may be adequate for commercial feedlots, but perhaps not for smaller operations, which significantly overreport capacity based on the current operational question. Reporting for the larger operations does not seem to be as "wording sensitive" as it is for the smaller ones.

Respondent Analysis
In order to analyze the composition of respondents and the effect of respondents on the response bias, a respondent combination was generated for each reinterview sample based on the respondents to the initial survey and the quality assessment survey. Combinations were created only for the completed QA interviews. That is, those samples that reported zero total cattle or were coded "out-of-business" on the initial survey were not included. The response bias for these samples was assumed to be zero, and no QA interview was attempted.

The combinations of "original respondent-reinterview respondent" were grouped into three categories. The first category, "operator-operator", includes all of the combinations in which the operator responded both times. Operators include individual operators, partners, and hired managers. This category can be used to determine the amount of response bias attributable to interviewing the operator. The second category, "other-operator", consists of all combinations in which someone other than the operator responded to the initial interview, and the operator responded to the reinterview. The amount of response bias due to interviewing someone other than the operator can be determined from this category, since we assume the reconciled value is the "true" value. The final category, which contains any other combinations, is "other combinations". This category is difficult to interpret.

Table 12 shows the frequency of the respondent combinations for all five states combined. As with previous NASS reinterview studies, the operator was involved in a large percentage of both interviews. The "operator-operator" category accounted for 88.7% of all combinations, compared to 74.1% from the July 1992 reinterview study. The "other-operator" accounted for only a very small percentage of the respondents (3.2%), while the "other combinations" group accounted for 8.1%. In July, these two groups accounted for 13.2% and 12.8%, respectively, of the respondents. Enumerators are instructed to contact the operator whenever possible for agricultural surveys, because the operator is considered to be the most knowledgeable person regarding the operation. The above information indicates that enumerators do a commendable job in contacting the operators.

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Table 12. Frequency Distribution of Original and Reinterview Respondent Combinations for the January 1993 COF Survey QA.[1]

Respondent Combination	Frequency		% of All Obs.	
Operator-Operator	612		88.7	
Operator-Operator		582		84.3
Partner-Same Partner		19		2.8
Partner-Different Partner		10		1.5
Manager-Manager		1		0.1
Other-Operator	22		3.2	
Spouse-Operator		17		2.5
Other-Operator		4		0.6
Spouse-Partner		1		0.1
Other Combinations	56		8.1	
Operator-Spouse		24		3.5
Spouse-Spouse		16		2.3
Operator-Other		12		1.7
Any Other Combination		4		0.6

[1] Includes only those samples with completed reinterviews

Table 13 shows the percent response bias for edited cattle on feed inventory data by respondent category. Results for all observations and results excluding two outliers are shown. Considering all observations, it appears that the "operator-operator" group has little bias, while the "other-operator" group tended to overreport by about 17.7% and the "other combinations" group underreported by about 21.9%. However, when two extreme observations identified as outliers were removed, the "other combinations" group showed less than 1% underreporting, while the "other-operator" group remained the same. The "operator-operator" group still showed practically no response bias. These results demonstrate the importance of interviewing the operator whenever possible. The "other-operator" category appears to result in the more severe reporting errors, a tendency that has been documented by other NASS reinterview studies (Pafford 1989).

Table 13. Response Bias Ratios by Respondent Combination Categories for Cattle on Feed Inventory.

Respondent Category	All Observations		Excluding 2 Outliers	
	# Obs.	% Bias	# Obs.	% Bias
Operator-Operator	609	-0.3	608	-0.2
Other-Operator	22	17.7	22	17.7
Other Combinations	53	-21.9	52	-0.9

Record Usage

The QA questionnaire also contained a section pertaining to the use of written records during either the initial survey or the reinterview. These questions were asked to determine if the use of written records during either interview resulted in fewer differences between the initial and reinterview responses. The ability to anticipate a zero bias could help to improve the estimates, particularly the variance of the response bias, by reducing the large number of zeroes that currently go into variance calculations. However, only 7.2% of the respondents for the completed QA questionnaires (not including those initial survey reports of zero cattle or out-of-business) reported using written records on the initial survey, and only 8.1% reported using written records during the reinterview survey. Results of the July 1992 reinterview study (Hood 1992) showed that only about 6% of the respondents used written records on either the initial or reinterview survey. This is far too few to be of any use.

DISCUSSION AND RECOMMENDATIONS

The Cattle on Feed Survey Quality Assessment Program was developed for the same reasons previous NASS reinterview projects were -- to detect response biases if they exist and to determine the reasons for the biases. The ratios of final reconciled responses to survey edited responses (for matched respondents) were examined to determine the relative impact of any existing response biases on survey estimates.

The only item for which significant response bias was detected at the five-state level was cattle on feed capacity, for which overreporting was found. Significant positive response bias was also detected at the state level for all five states for capacity. Iowa results indicated significant overreporting for steer inventory. Significant underreporting was detected for cattle on feed inventory in Illinois and for steer inventory in Nebraska. Although there was a large number of individual reporting errors for the survey items, the distributions of expanded positive and negative biases were very symmetric, in general resulting in small overall net response biases.

Questionnaire wording was tested for cattle on feed inventory and capacity. The effect of omitting the "Include/Exclude" phrases (used in the operational version of the cattle on feed inventory question) during the reinterview survey was not obvious, as the response bias was not significant, and no individual differences found were attributable to this source.

The effect of re-wording the capacity question was quite evident. The most frequently given reason for differences between the initial and reinterview responses for capacity was "**two different questions were asked - wording was different**". Using the reinterview version results in significantly lower estimates for capacity. Which version is preferable depends on what the true underlying concept is we are trying to measure. The operational version appears to provide an upper limit for capacity, with capacity overreported for the non-commercial operations.

Response bias was analyzed with respect to size of operation (based on final reconciled values for cattle on feed inventory and capacity) and mode of data collection (CATI vs. non-CATI). Indications of response bias were higher in the CATI samples. Overreporting was indicated for every survey item except steer inventory in the CATI domain, whereas only COF capacity and steer inventory showed overreporting in the non-CATI domain. This could mean that data collected by CATI are overreported or that operations in smaller strata tend to overreport more than larger ones, since operations in smaller strata are generally those designated for CATI enumeration.

When grouping was done by reconciled cattle on feed inventory, the smallest size group (0-99) showed overreporting of about 4%, while the other three size classes indicated 2-3% underreporting. Reporting in the smallest domain was also the most variable, with a standard deviation of the percent bias almost three times larger than that of the other three domains. The 0-99 domain was also the only domain to indicate overreporting of total cattle inventory. While all size groups overreported COF capacity, the highest degree of overreporting (by about

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44%) occurred in the smallest domain. Overreporting of COF capacity for the other three size classes ranged from 5 to 9%.

Total "estimation" bias was negative for all cattle items (excluding capacity), indicating that when estimation errors occur the respondent tends to underreport. This tendency has been found in previous NASS reinterview studies. "Estimation" reasons, both historically and currently, have been found to contribute the least to the overall response bias and to the total absolute response error for the majority of survey items that were studied.

Total "definitional" bias was positive for all items, except heifers, indicating that overreporting generally occurred when reporting errors due to definitional or interpretation reasons occurred. Since many "definitional" reporting errors may be corrected through improved survey procedures, including enumerator training, questionnaire design and survey design, any action based on reinterview results should begin with trying to reduce response bias based on "definitional" reasons detected in the reinterview study.

Total "other" bias was negative for all items, except for COF capacity and steer inventory, indicating that underreporting generally resulted when reporting errors due to "other" reasons occurred. The "other" category consisted of a wide range of reasons which could not be attributed to the other three reason categories. The frequency of each reason given during the reconciliation process is shown in Appendix D. The most frequently reported "other" reasons for differences between the initial and reinterview responses may be summarized by a few general causes. Problems related to telephone interviewing, recording errors by enumerators, and respondents just not knowing the information being asked for were some of the more prevelent occurrences in the "other" reasons category. These problems are probably among the most difficult to "fix". By following correct survey procedures, making sure the respondent understands what information is being asked for and being aware of the information that is being recorded (especially in relation to other data within the questionnaire), we may be able to reduce the frequency and influence of reporting errors due to "other" reasons.

Estimates for survey items are only as good as the data that are collected, and response bias analysis with respect to reasons is only as good as the reasons given during the reconciliation process. The "no reason available" category, which consisted of the two non-reasons "no explanation" and "enumerator did not reconcile - final value manually imputed", was created to show the importance of collecting good explanations for differences between initial and reinterview responses. These two non-reasons occurred more frequently than we had hoped they would. They accounted for nearly 20% of the total absolute reporting error and about 11% of all differences for cattle on feed inventory. Eleven reports of these two non-reasons accounted for over 20% of the total absolute reporting error for total cattle inventory and contributed the second and third largest expanded response biases. It is difficult to do analyses or make statements with respect to reasons when one-fifth of the total absolute response error is essentially unaccounted for. This is most disconcerting when the goal of the reinterview program is to determine the reasons for reporting problems. If adequate reasons cannot be determined, then the usefulness of the reinterview program is weakened.

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Attention needs to be given to correcting any problems identified in the reasons for discrepancies. The best place to start is probably with enumerator training. Emphasis on the importance of data quality should be stressed by everyone at every level. By examining these reasons, we may find ways to improve upon current survey procedures or questionnaire design to help reduce the nonsampling errors in our Ag Survey estimates.

All the developmental work for the Cattle on Feed Survey Quality Assessment Program culminated in the operational survey conducted in January 1993. Considerable time and effort went into developing the program to integrate well with the Agricultural Survey Program. All phases of the processing - sampling, editing and summarization - utilized operational systems, so as to minimize the maintenance burden on the Agency's operational units.

The Research Division feels that NASS needs to continue the Cattle on Feed Survey Quality Assessment Program, in some form, into 1994. If respondent burden concerns preclude continuing it as a reinterview survey, an alternative approach would be to validate responses with an "internal consistency" study. In such a study, a subsample of the January 1994 Agricultural Survey sample could be asked a series of additional probing questions to validate their initial responses <u>during the initial survey contact</u>. This would result in long and short versions of each survey instrument. If this approach is taken, the additional probing, "cognitive" questions developed for the reinterview questionnaire could be used as a starting point for developing the long versions.

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Appendix A: Cattle on Feed Survey Quality Assessment Questionnaire.

NATIONAL AGRICULTURAL STATISTICS SERVICE

U.S. Department of Agriculture

Washington, D.C. 20250

AGRICULTURAL SURVEY
January 1993

Optional	Optional
407	408

Office Use	
999	1

Strata	ID	Tract	Subtr
_ _ _ _	_ _ _ _ _ _ _ _	_ _	_ _

Office Use		
Date	Time	Notes

INTRODUCTION

Hello, I am _____ with the (*State*) Agricultural Statistics Service One of our interviewers contacted this household recently to obtain information for our January Agricultural Survey We are reinterviewing a few of the people in the original survey, asking a few of the questions from that survey and a few different questions in order to evaluate the quality of our survey procedures. I would like to speak with the person most knowledgeable about this cattle operation. I would appreciate it if you would take the time to help me

SECTION 1 - IDENTIFICATION

Office Use
998

Please verify name and address of this operation. Make corrections on label.

1. On the land operated by the farm, ranch or individual(s) listed on the label

   a. were any cattle or calves on this operation January 1, 1993? _ _ _ _ _ ☐ YES   ☐ NO → [If NO go to Section 7 on last page]

2. Does this operation do business under any name, other than as shown on label?

   ☐ YES - Enter name: _____

   ☐ NO   (Do you want this name to appear on the label?) ☐ YES   ☐ NO

3. Are the day-to-day decisions for this farming (or ranching) operation made by

   ☐ An Individual Operator?   ☐

   ☐ Partners? Enter number of partners, including self _ _ _ _ ☐
   (Partners jointly operate land and share in decision making
   DO NOT include landlord as partner)

   ☐ A Hired Manager?

   3a. Are the decisions still made by the same person(s) making them on June 1, 1992?

   ☐ YES -   ☐ NO - Would you please explain what changed?

   _____

   _____

Office Use
R Unit
921
Change
923
Substitution
941

1. How many total acres of land were in this operation on January 1? _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ | 900 |

    Include: The farmstead, all cropland, woodland, pastureland, waste and, and
                government program land that is owned, rented from others, or
                managed.

    Exclude: Land rented to others and public, industrial, or grazing association land
                used on a fee per head or AUM basis

SECTION 3 - CATTLE AND CALVES

1. Of the total cattle and calves, regardless of ownership, on the *[Section 2, Item 1]* acres
    operated **January 1,** how many were:

    a. beef cows ?_ _ _ _ _ _ _ _ _ _ _ _   _   ★ | 351 |

    b. milk cows, whether dry or in milk? _   ★ | 352 |

    c. bulls weighing 500 lbs. or more?_   ★ | 353 |

    d. heifers, weighing 500 lbs. or more including replacement heifers
        and other heifers that had not calved? _   ★ | 359 |

    e. steers weighing 500 lbs. or more? _   ★ | 357 |

    f. calves weighing less than 500 pounds, including newborn calves?   _ _ _ _ _ _ _ _ _ _ _   ★ | 358 |

2. *[Add ★ Items 1a through 1f]*
    Then the **total cattle and calves** on hand January 1 was: _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ | 350 |

3. Were there any other cattle or calves on this operation January 1, that we have
    not already counted (*in item 1 above*), even if they belonged to someone else? _ _ _ _ _ _ _ _ | 860 |

    ☐ YES -   *[Enter code 1, show corrections to include*   ☐ **NO** -   *[Enter code 3 and continue.]*
               them in item 1 above and explain.]

4. I have already asked about calves less than 500 pounds.
    Were there any calves on this operation **over** 500 pounds?

    ☐ YES ——▶ 4a. How many?_ | 870 |

            4b. What was their average weight? _ pounds | 871 |

            4c. Did you include them earlier in the item 1 categories
                 above (beef cows, milk cows, bulls, heifers, steers and
                 calves under 500 pounds)?
                 [YES, Code 1 and explain; NO, Code 3] _ _ _ _ _ _ _   _ _ _ _ _ _ _ _ _ _ _ | 872 |

                 _ _ _ _ _ _ _ _   _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _

                 _ _ _ _ _ _ _ _   _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _

    ☐ NO

Now I would like to discuss Cattle and Calves on Feed for the slaughter market.

1. How many cattle and calves were on feed January 1 that will go
    DIRECTLY from this operation to the slaughter market? _ _ _ _ _ _ _ _ _ _ _ Number on feed January 1

    | 652 |

2. Do you (this operation) have any cattle or calves that will go to another feedlot,
    be returned to pasture or go somewhere else before going to the slaughter market?

    ☐ NO   ☐ YES - 2a.   How many? _ Number

    | 210 |

3. Have we missed any cattle or calves that you feel should be included as
    Cattle on Feed?

    ☐ NO   ☐ YES - 3a.   How many? _ Number
                        3b.   Why were they not included?

    | 212 |

    _____

    _____

4. Are there any CALVES less than 500 pounds on this operation that are being fed some
    grain, silage or protein concentrate?

    ☐ NO   ☐ YES

    4a. Will any of these calves be finished on this operation for the
        slaughter market?

        ☐ YES - 4a1. How many? _

        | 213 |

        4a2. Did you count them in the [Item 1]
             cattle on feed?
             [YES = Code 1;No = Code 3]_ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _ _

        | 214 |

        ☐ NO -   [Go to question 4b.]

    4b. Will any of them be moved to another feedlot, returned to pasture,
        or sold as feeders?

        ☐ YES - 4b1. How many? _

        | 215 |

        4b2. Did you count them in the [Item 1]
             cattle on feed?
             [YES = Code 1;No = 3]. _

        | 216 |

        ☐ NO -   [Go to question 5.]

5. Sometimes the decision to finish calves for the slaughter market yourself or sell them as
    feeders has not been made at the time of our survey. If you (this operation) had some
    calves on feed but had not yet made a decision about them, would you INCLUDE or
    EXCLUDE them in the number of Cattle and Calves on Feed for the slaughter market?
    [Include = Code 1, Don't Know = 2, Exclude = Code 3] _

    | 217 |

6. What is the maximum number of cattle and calves you normally feed for the slaughter
    market at any one time on the [Section 2, Item 1] acres? _ Head

    | 676 |

1   Now I would like to discuss what some terms or words mean to you   Many times, terms mean different things to people living in different areas   This information will help us obtain the exact information that we are interested in   Please look at this card [hand card to respondent, and tell me in your own words what each term means to you   If you are not familiar with a term, let me know and go on to the next one

a. cattle and calves on feed:

b. backgrounding:

c. calves (calf):
[Enumerator Note:
If necessary probe with, "To you, are calves a certain weight, age size, or something else?"]

2   [Enumerator Note: Did the respondent use any written records for this survey?]

☐ YES   = 1
☐ NO   = 3   ⟶ [218]

3   Did the respondent on the first survey use written records when providing information to the interviewer?

☐ YES   = 1
☐ DON'T KNOW   = 2   ⟶ [219]
☐ NO   = 3

[If Code 2 or 3 go to Section 6, Page 5]

3a Were these written records from the operation's books, or from another source?

☐ Operation's books = 1
☐ Other Source   = 2   ⟶ [220]
      Identify _____

1. Did you check partners in Section 1, Item 3, on Page 1?

    ☐ YES - [Continue]   ☐ NO - [Go to Section 8 on the back page]

2. Please identify the other person(s) in this partnership, then go to Section 8 on the back page.
    (Make necessary corrections if names have already been entered)

925
924

Name: _____ Phone: _____
     (First)   (Middle)   (Last)

Address: _____
     (Rt. or St.)   (City)   (State)   (Zip)

Did this person operate land individually in this State on June 1, 1992? ☐ YES ☐ NO

926
924

Name: _____ Phone: _____
     (First)   (Middle)   (Last)

Address: _____
     (Rt. or St.)   (City)   (State)   (Zip)

Did this person operate land individually in this State on June 1, 1992? ☐ YES ☐ NO

927
924

Name: _____ Phone: _____
     (First)   (Middle)   (Last)

Address: _____
     (Rt. or St.)   (City)   (State)   (Zip)

Did this person operate land individually in this State on June 1, 1992? ☐ YES ☐ NO

928
924

Name: _____ Phone: _____
     (First)   (Middle)   (Last)

Address: _____
     (Rt. or St.)   (City)   (State)   (Zip)

Did this person operate land individually in this State on June 1, 1992? ☐ YES ☐ NO

[Go to Section 8 on the back page]

1. Has this operation (name on label) been sold, or turned over to someone else?

☐ NO - [Go to next Section]   ☐ YES - Please identify the new operator(s)

Name _____

Address _____ Phone _____

City _____ State _____ Zip _____

1a. Did this person operate land individually in this State on June 1, 1992? _____ ☐ YES   ☐ NO

SECTION 8 - CONCLUSION

1. Do you make any day-to-day decisions for another farm or ranch?

☐ NO   ☐ YES - 1a. What is the name of this operation? _____

1b. Was this operation in business before June 1, 1992? _____ ☐ YES   ☐ NO

2 Thank you for your help in completing this questionnaire. Now I would like to compare these responses with those from the original interview

---
GO TO RECONCILIATION FORM.
---

3. Do you have any comments or suggestions about this or any of our other surveys that would make it easier for you to report?

This completes the survey. Thanks for your help.

Reported by: _____   Date: _____

Telephone (area code): _____   (number): _____

Respondent		Response Code		Enum	Eval	Jul Date
1-Op 2-Sp 3-Oth	101	3-Int 8-IR 9-Inac	910	098	100	987
Enumerator						

RECONCILIATION FORM

CATTLE ON FEED
SURVEY QUALITY ASSESSMENT
JANUARY 1993

THIS FORM IS NOT TO BE OPENED UNTIL AFTER THE REINTERVIEW
RESPONSES HAVE BEEN OBTAINED.   In order to obtain
measures of quality of our data, we must maintain
independence between the initial and reinterview surveys.
Viewing the initial response before the reinterview may
damage this relationship.

Stratum	ID	Tract	Subtract	County

LABEL

Respondent Combination
Office Use
950

40

QUESTION	ORIGINAL RESPONSE (1)	REINTERVIEW RESPONSE (2)	WHICH IS CORRECT? -------- 1=orig 2=reint 3=either (3)	REASON FOR DIFFERENCE (Explain in detail below) (4)
SECTION 1 --- IDENTIFICATION				Office Use
1. Label Correct? (yes/no)	310	410	510	810
Corrections to Label:		411 Office Use	511	811
2. Any cattle or calves on this operation January 1, 1993? (yes/no)	312	412	512	812
3. Does operation do business under any other name? (yes/no)	313	413	513	813
Name:			514	814
4. Day-to-day decisions made by: 1=indiv. oper 2-5=partners 8=hired manager	315	415	515	815
4a. Are decisions made by the same person(s) making them on June 1, 1992? (yes/no)	316	416	516	816
SECTION 2 --- ACRES OPERATED				
1. How many total acres of land in this operation on Jan. 1?	317	417	517	817

EXPLANATION (Explain as fully as possible why the original and reinterview differ)		
Section	Item	Reason for difference

Initial Respondent: Initial Int:

QUESTION	ORIGINAL RESPONSE (1)	REINTERVIEW RESPONSE (2)	WHICH IS CORRECT? -------- 1=orig 2=reint 3=either (3)	REASON FOR DIFFERENCE (Explain in detail below) (4)
SECTION 3 --- CATTLE AND CALVES				Office Use
1. Of the total **cattle and calves**, regardless of ownership, on the total acres operated **January 1,** how many were:				
a. Beef Cows	318	418	518	818
b. Milk Cows	319	419	519	819
c. Bulls weighing 500 lbs. or more	320	420	520	820
d. Heifers, weighing 500 lbs. or more that had not calved	321	421	521	821
e. Steers weighing 500 lbs. or more	322	422	522	822
f. Calves weighing less than 500 lbs, including newborn calves	323	423	523	823
2. **Total cattle and calves** on hand January 1 was:	324	424	524	824
SECTION 4 --- CATTLE AND CALVES ON FEED				
1. Total **cattle and calves** on feed Jan 1 that will go **DIRECTLY** from this operation to the slaughter market?	325	425	525	825
2. Maximum number of cattle and calves you normally feed for the slaughter market at any one time?	326	426	526	826

EXPLANATION (Explain as fully as possible why the original and reinterview differ)		
Section	Item	Reason for difference

**IF NO FURTHER EXPLANATIONS, RETURN TO
REINTERVIEW FORM - SECTION 8   QUESTION #3**

EXPLANATION		
(Explain as fully as possible why the original and reinterview differ)		
Section	Item	Reason for difference

43

FREQUENCY OF EXPANDED DIFFERENCES FOR TOTAL COF

DIFFERENCE = EDITED INITIAL VALUE − RECONCILED VALUE
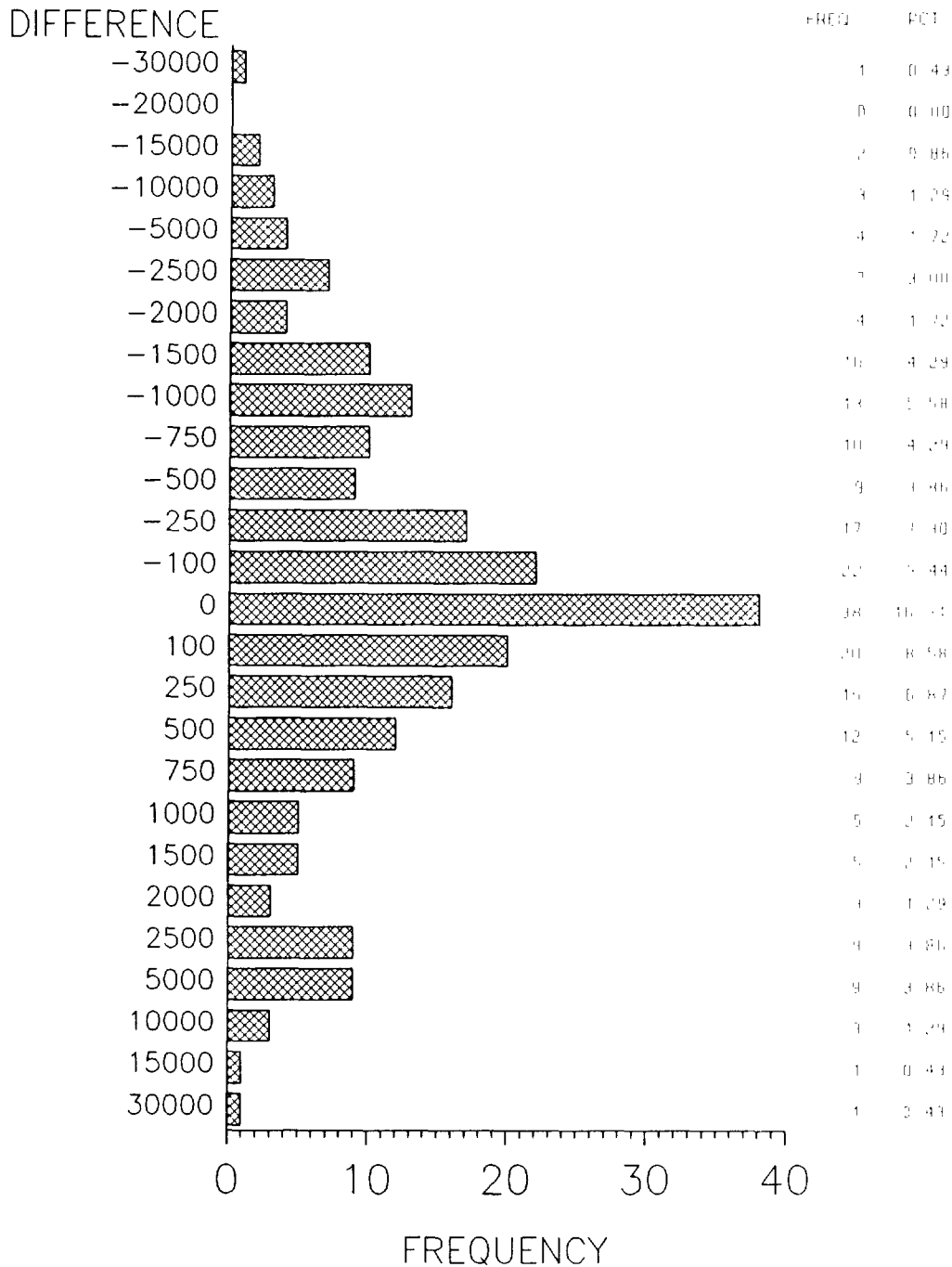
DIFFERENCE

DIFFERENCE	FREQ	PCT
−30000	1	0.43
−20000	0	0.00
−15000	2	0.86
−10000	3	1.29
−5000	4	1.72
−2500	7	3.00
−2000	4	1.72
−1500	10	4.29
−1000	13	5.58
−750	10	4.29
−500	9	3.86
−250	17	7.30
−100	22	9.44
0	38	16.31
100	20	8.58
250	16	6.87
500	12	5.15
750	9	3.86
1000	5	2.15
1500	5	2.15
2000	3	1.29
2500	9	3.86
5000	9	3.86
10000	3	1.29
15000	1	0.43
30000	1	0.43

FREQUENCY

FREQUENCY OF EXPANDED DIFFERENCES FOR TOTAL CATTLE

DIFFERENCE = EDITED INITIAL VALUE − RECONCILED VALUE
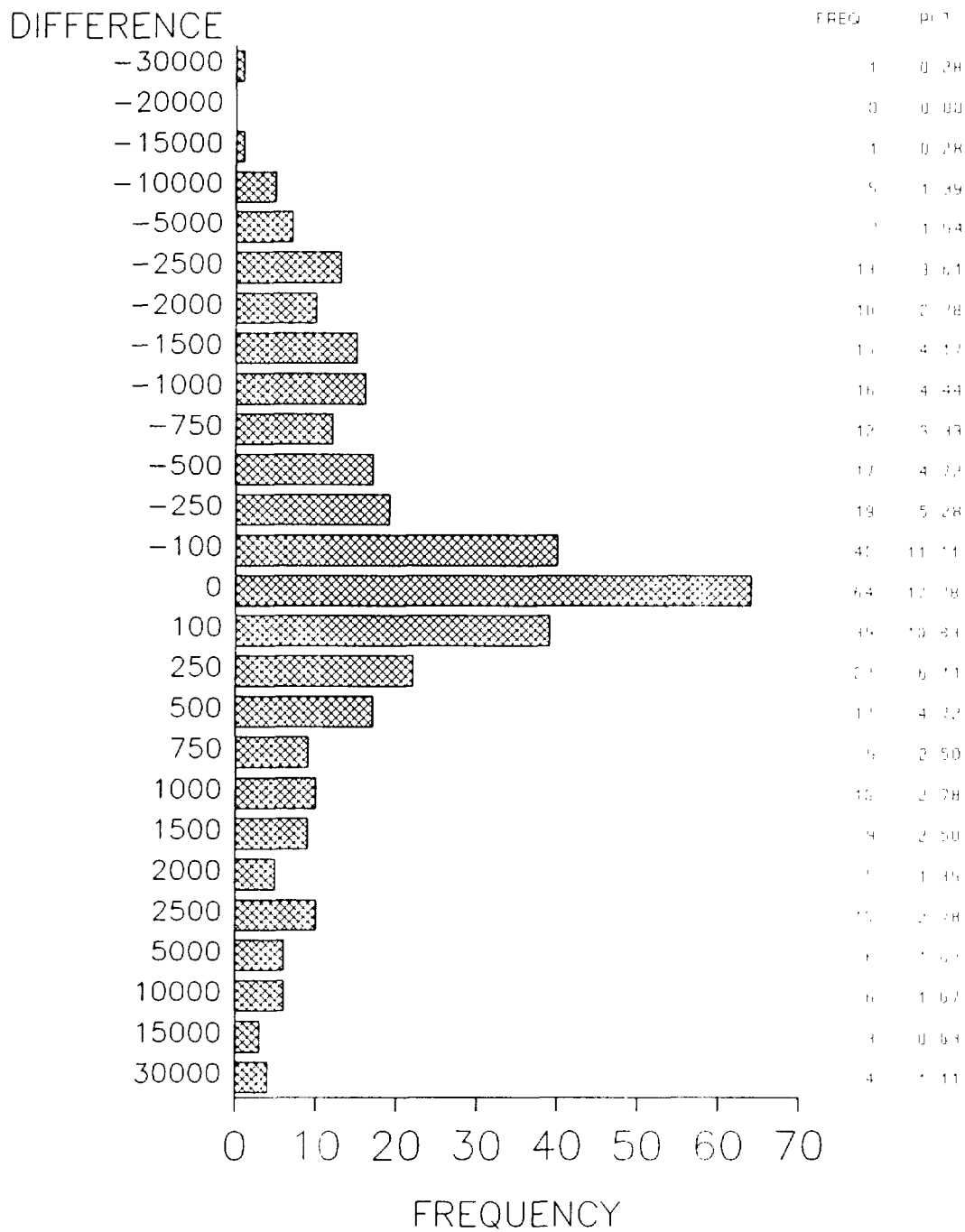
DIFFERENCE

FREQUENCY

FREQUENCY OF EXPANDED DIFFERENCES FOR COF CAPACITY

DIFFERENCE = EDITED INITIAL VALUE − RECONCILED VALUE

DIFFERENCE	FREQ	PCT
−30000	0	0.00
−20000	1	0.28
−15000	0	0.00
−10000	1	0.28
−5000	4	1.11
−2500	2	0.55
−2000	5	1.39
−1500	6	1.66
−1000	6	1.66
−750	6	1.66
−500	3	0.83
−250	9	2.49
−100	11	3.05
0	7	1.94
100	24	6.65
250	22	6.09
500	21	5.82
750	22	6.09
1000	28	7.76
1500	27	7.48
2000	24	6.65
2500	28	7.76
5000	45	12.47
10000	13	3.60
15000	19	5.26
30000	27	7.48

FREQUENCY

46
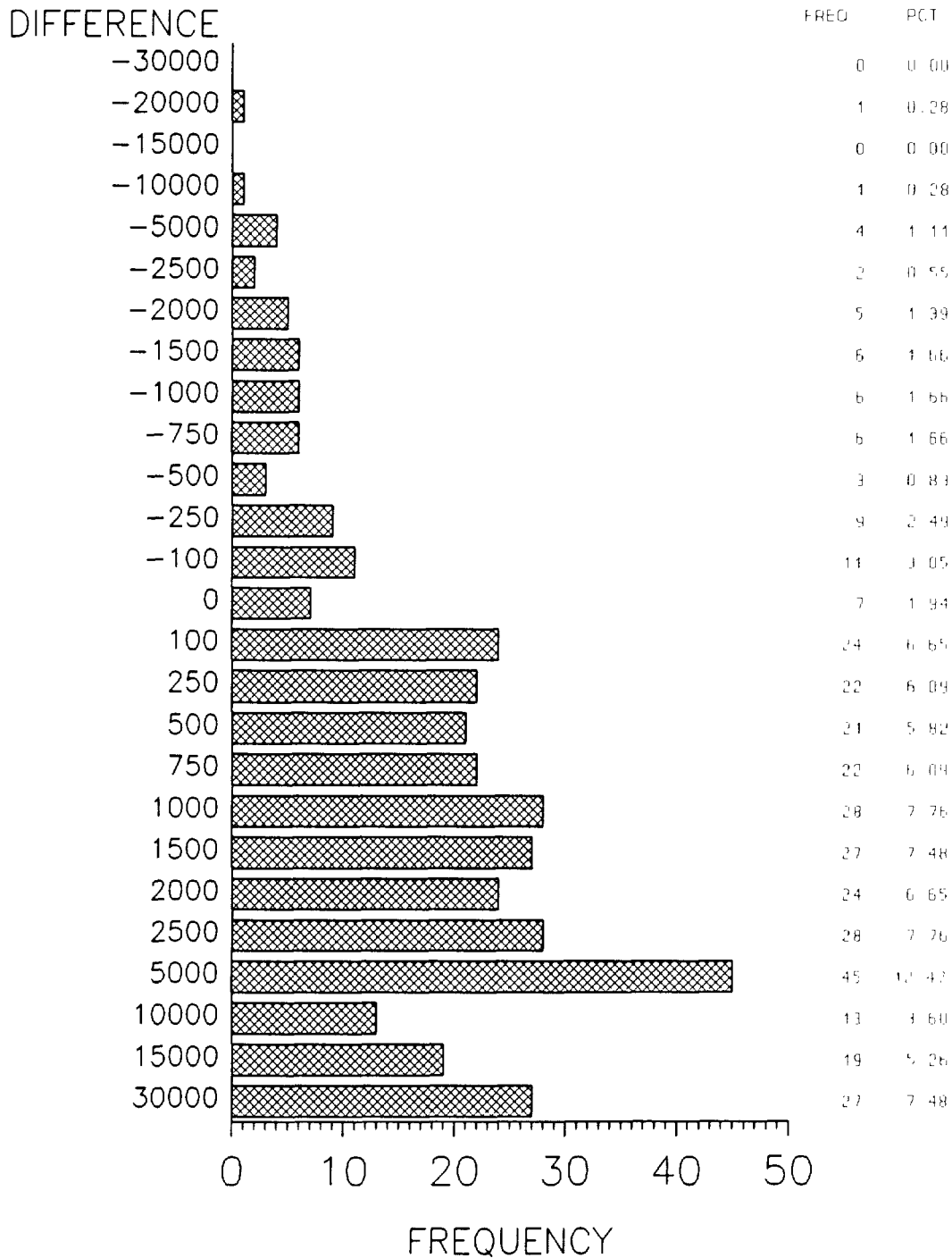
Appendix D: Response Bias Summary by Reason Category (Five-State Regional Level).

Table 1. Reason Summary for **Cattle on Feed Inventory**. Reasons are for
Non-Zero Differences Between Initial and Reinterview Responses.

Reason Category	Frequency	Response Bias (Expanded)	Abs. Resp. Error (Exp)	Avg Abs. Resp. Error (Unexp)
Estimation	83	-6,611	73,646	30.2
Definition	51	18,234	80,132	64.5
Other	66	-17,085	86,936	57.3
No Reason	25	-1,769	57,822	45.6
Total	225	-7,231	298,536	47.6

	Freq.	Response Bias (Expanded)	Absolute Resp. Error (Expanded)
Estimation Bias			
Figure was estimated	31	-134	27,978
Respondent forgot to include some cattle/calves	9	-12,563	12,563
Respondent counted some cattle/calves twice	2	9,666	9,666
Some cattle/calves were not counted	14	-7,518	7,726
Used records or counted	10	1,360	7,476
Either could be correct - both were estimates	8	4,526	5,961
Rounding	7	-1,507	1,817
Respondent didn't think it enough to report	1	-451	451
Respondent did not figure in death loss	1	9	9
Definition Bias			
Misunderstanding between enumerator & respondent	15	-14,420	21,672
Respondent did not understand question	11	-12,348	17,501
Counted animals not really on feed	4	14,424	14,424
Enumerator asked wrong question	6	727	10,136
Included cattle/calves from another operation	3	5,648	5,648
Respondent forgot some cattle/calves were sold	3	3,499	3,499
Did not report as of the reference date	5	109	3,152
Did not include all cattle regardless of ownership	1	-2,225	2,225
Did not include calves as cattle on feed	2	-1,802	1,802
Respondent had difficulty with weight groups	1	-73	73
Other Bias			
Respondent had not made decision on marketings	19	-14,304	21,441
Enumerator recorded wrong number	5	-2,237	16,202
Difference due to response to a prior question	10	3,547	12,266
Wrong answer or added wrong	8	8,070	11,633
Enumerator forgot to ask	2	-8,982	10,166
Respondent did not know	6	-2,498	5,524
Respondent had difficulty hearing on phone	1	-3,196	3,196
Respondent was tired or hurried on phone	3	-195	1,781
Totals differ due to component differences	2	1,006	1,644
Other	2	1,217	1,217
Respondent did not report for operation on label	1	568	568
Correct data not brought forward	3	497	560
Respondent does not know where answer came from	1	-395	395
Respondent said not asked this on phone interview	1	-210	210
Respondent does not give accurate info on phone	2	27	136
No Reason Available			
No explanation	20	14,412	32,102
Enumerator didn't reconcile-manually imputed	5	-16,181	25,720

Appendix D: Response Bias Summary by Reason Category (Five-State Regional Level).

Table 2.   Reason Summary for **Total Cattle and Calves**.   Reasons are for
Non-Zero Differences Between Initial and Reinterview Responses.

Reason Category	Frequency	Response Bias (Expanded)	Abs. Resp. Error (Exp)	Avg Abs. Resp. Error (Unexp)
Estimation	106	-19,395	88,838	18.8
Definition	43	45,897	101,913	48.8
Other	196	-45,618	302,933	38.6
No Reason	11	1,666	126,453	149.9
Total	356	-17,450	620,137	37.4

	Freq.	Response Bias (Expanded)	Absolute Resp. Error (Expanded)
Estimation Bias			
Respondent forgot to include some cattle/calves	31	-13,051	35,386
Figure was estimated	37	-7,436	25,486
Used records or counted	10	-7,791	11,496
Respondent counted some cattle/calves twice	8	8,163	8,624
Rounding	7	229	3,147
Respondent did not figure in death loss	4	2,512	2,512
Either could be correct - both were estimates	9	-2,022	2,187
Definition Bias			
Did not report as of reference date	7	40,100	48,253
Respondent had difficulty with weight groups	11	-12,835	13,999
Respondent had difficulty separating cows & heifers	2	12,838	12,838
Misunderstanding between enumerator & respondent	7	1,531	7,843
Included cattle/calves from another operation	6	7,289	7,417
Did not include all cattle regardless of ownership	5	-7,295	7,295
Enumerator asked wrong question	2	3,816	3,816
Respondent forgot some cattle/calves were sold	2	289	289
Respondent did not understand question	1	164	164
Other Bias			
Totals differ due to component differences	84	-53,739	159,882
Difference due to response to a prior question	74	-18,037	92,370
Respondent does not know where answer came from	2	13,184	13,184
Enumerator recorded wrong number	7	6,565	11,834
Respondent was tired or hurried on phone	6	5,431	6,746
Respondent did not know	4	2,894	4,843
Wrong answer or added wrong	8	-1,517	4,065
Respondent said this was reported first time	2	-2,046	2,309
Different response due to 2 different respondents	1	1,769	1,769
Respondent does not give accurate info on phone	2	-1,608	1,608
Respondent did not report for operation on label	1	1,514	1,514
Enumerator forgot to ask	2	-987	1,316
Other	1	1,145	1,145
Respondent had difficulty hearing on phone	1	-266	266
Respondent had not made decisions on marketings	1	82	82
No Reason Available			
Enumerator didn't reconcile-manually imputed	3	-48,233	75,189
No explanation	8	49,899	51,264

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Appendix D: Response Bias Summary by Reason Category (Five-State Regional Level).

Table 3.   Reason Summary for **Cattle on Feed Capacity**. Reasons are for
Non-Zero Differences Between Initial & Reinterview Responses.

Reason Category	Frequency	Response Bias (Expanded)	Abs. Resp. Error (Exp)	Avg Abs. Resp. Error (Unexp)
Estimation	54	20,352	81,192	45.3
Definition	109	1,478,872	1,562,943	129.7
Other	50	447,526	534,031	333.5
No Reason	27	40,148	57,664	80.4
Total	321	1,986,898	2,235,330	143.1

	Freq.	Response Bias (Expanded)	Absolute Resp. Error (Expanded)
Estimation Bias			
Figure was estimated	17	-5,361	43,138
Either could be correct - both were estimates	32	22,063	32,864
Respondent did not think it enough to report	1	2,471	2,471
Used records or counted	3	1,949	1,949
Rounding	1	-770	770
Definition Bias			
Two different questions - wording was different	155	1,253,072	1,322,923
Respondent did not understand question	13	129,980	139,515
Misunderstanding between enumerator and respondent	14	44,578	48,648
Reported for the wrong year	2	24,198	24,198
Enumerator asked wrong question	1	16,770	16,770
Included cattle/calves from another operation	2	9,580	9,580
Did not report as of the reference date	2	1,002	1,002
Respondent had difficulty with weight groups	1	-307	307
Other Bias			
Respondent does not know where answer came from	5	212,392	223,107
Does not feed for slaughter market	6	132,737	132,737
Difference due to response to a prior question	5	43,291	43,291
Wrong answer or added wrong	3	36,892	36,892
Respondent did not report for operation on label	1	28,385	28,385
Other	3	-3,538	16,082
Respondent does not give accurate info on phone	6	13,893	14,254
Enumerator forgot to ask	2	-11,083	11,083
Respondent said not asked this on phone interview	2	-7,128	7,128
Respondent did not know	5	1,500	6,446
Correct data not brought forward	3	4,960	4,960
Difference response due to 2 different respondents	1	-2,534	2,534
Respondent was tired or hurried on phone	2	-1,506	2,199
Enumerator recorded wrong number	1	-1,689	1,689
Respondent forgot to report	1	-1,144	1,144
Respondent had not made decision on marketings	3	1,089	1,089
Respondent does not remember phone interview	1	1,011	1,011
No Reason Available			
No explanation	24	36,557	51,850
Enumerator didn't reconcile-manually imputed	3	3,591	5,814

Appendix D: Response Bias Summary by Reason Category (Five-State Regional Level).

Table 4. Reason Summary for **Steers**. Reasons are for Non-Zero Differences Between Initial & Reinterview Responses.

Reason Category	Frequency	Response Bias (Expanded)	Abs. Resp. Error (Exp)	Avg Abs. Resp. Error (Unexp)
Estimation	105	-21,708	58,895	17.1
Definition	89	41,751	164,020	38.6
Other	35	925	26,462	17.9
No Reason	13	2,018	10,929	36.0
Total	242	22,986	260,306	26.1

	Freq.	Response Bias (Expanded)	Absolute Resp. Error (Expanded)
Estimation Bias			
Respondent forgot to include some cattle/calves	22	-22,882	22,882
Figure was estimated	45	-4,005	22,808
Used records or counted	10	3,684	5,898
Respondent counted some cattle/calves twice	6	-111	2,426
Rounding	6	1,604	1,899
Either could be correct - both were estimates	13	-741	1,876
Respondent did not figure in death loss	2	925	925
Some cattle/calves were not counted	1	-181	181
Definition Bias			
Respondent had difficulty with weight groups	47	1,654	76,418
Did not report as of reference date	9	42,293	46,822
Included cattle/calves from another operation	5	240	13,116
Misunderstanding between enumerator and respondent	9	2,091	8,586
Did not include all cattle regardless of ownership	5	-4,975	7,433
Respondent did not understand question	4	-3,465	4,254
Reported for the wrong year	2	2,936	2,936
Respondent forgot some cattle/calves were sold	3	2,163	2,163
Enumerator asked wrong question	3	-1,501	1,977
Got heifers and steers switched	1	177	177
Respondent had difficulty separating cows & heifers	1	138	138
Other Bias			
Wrong answer or added wrong	11	3,612	12,384
Respondent does not know where answer came from	4	3,000	3,709
Respondent was tired or hurried on phone	5	-1,842	3,665
Respondent said not asked this on phone interview	1	-2,943	2,943
Enumerator forgot to ask	1	-776	776
Respondent did not know	2	-159	750
Enumerator recorded wrong number	3	-592	592
Respondent does not give accurate info on phone	2	-508	508
Respondent did not report for operation on label	1	473	473
Respondent had difficulty hearing on phone	1	263	263
Difference due to response to a prior question	1	136	136
Respondent had not made decision on marketings	1	132	132
Respondent said this was reported first time	2	131	131
No Reason Available			
No explanation	13	2,018	10,929

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Appendix D: Response Bias Summary by Reason Category (Five-State Regional Level).

Table 5.   Reason Summary for **All Heifers**. Reasons are for Non-Zero
Differences Between Initial & Reinterview Responses.

Reason Category	Frequency	Response Bias (Expanded)	Abs. Resp. Error (Exp)	Avg Abs. Resp. Error (Unexp)
Estimation	102	-11,677	80,206	18.2
Definition	84	-7,935	83,809	27.1
Other	43	-936	41,214	32.2
No Reason	8	5,722	6,195	42.0
Total	237	-14,826	211,424	24.7

	Freq.	Response Bias (Expanded)	Absolute Resp. Error (Expanded)
Estimation Bias			
Respondent forgot to include some cattle/calves	24	-13,287	33,406
Figure was estimated	35	1,232	24,227
Used records or counted	13	-1,122	14,455
Respondent counted some cattle/calves twice	7	168	3,026
Respondent did not figure in death loss	3	1,868	1,868
Rounding	6	-1,281	1,751
Either could be correct - both were estimates	13	880	1,339
Some cattle/calves were not counted	1	-136	136
Definition Bias			
Respondent had difficulty with weight groups	36	-22,323	41,079
Misunderstanding between enumerator and respondent	9	5,233	11,660
Respondent had difficulty separating cows & heifers	16	3,346	11,257
Did not report as of reference date	4	6,966	7,206
Enumerator asked wrong question	4	2,232	4,923
Respondent did not understand question	5	-2,313	3,175
Did not include all cattle regardless of ownership	5	-2,793	2,793
Reported for the wrong year	2	1,109	1,109
Included cattle/calves from another operation	1	388	388
Got heifers and steers switched	1	139	139
Respondent forgot some cattle/calves were sold	1	80	80
Other Bias			
Wrong answer or added wrong	9	-363	11,202
Respondent does not know where answer came from	2	8,391	8,391
Respondent does not give accurate info on phone	6	-4,038	6,000
Enumerator forgot to ask	2	-4,212	4,212
Respondent said not asked this on phone interview	1	-2,616	2,616
Different response due to different respondents	1	2,101	2,101
Enumerator recorded wrong number	3	-1,766	1,766
Respondent did not know	2	939	1,530
Respondent had difficulty hearing on phone	3	-342	1,051
Respondent was tired or hurried on phone	3	-120	783
Respondent did not report for operation on label	1	473	473
Correct data not brought forward	3	342	468
Respondent said this was reported first time	3	330	330
Other	1	-164	164
Respondent did not remember phone interview	1	99	99
Difference due to response on a prior question	1	18	18
Totals differ due to component differences	1	-9	9
No Reason Available			
No explanation	8	5,722	6,195

Appendix D: Response Bias Summary by Reason Category (Five-State Regional Level).

Table 6.   Reason Summary for **Calves**. Reasons are for Non-Zero Differences
Between Initial & Reinterview Responses.

Reason Category	Frequency	Response Bias (Expanded)	Abs. Resp. Error (Exp)	Avg Abs. Resp. Error (Unexp)
Estimation	60	-17,253	39,462	19.8
Definition	84	49,403	204,355	36.5
Other	29	-8,859	37,997	27.3
No Reason	6	21,895	24,875	30.0
Total	179	45,186	306,689	29.2

Estimation Bias	**Freq.**	**Response Bias (Expanded)**	**Absolute Resp. Error (Expanded)**
Respondent forgot to include some cattle/calves	31	-6,334	21,781
Figure was estimated	10	-7,791	7,949
Used records or counted	8	-3,983	5,089
Respondent counted some cattle/calves twice	2	2,551	2,551
Either could be correct - both were estimates	5	-1,549	1,730
Rounding	2	-190	321
Respondent did not figure in death loss	2	42	42
Definition Bias			
Respondent had difficulty with weight groups	56	64,478	169,387
Reported for the wrong year	1	-11,917	11,917
Misunderstanding between enumerator and respondent	10	-5,548	11,143
Respondent did not understand question	9	1,431	9,441
Included cattle/calves from another operation	2	1,393	1,393
Did not report as of reference date	2	4	536
Got heifers and steers switched	1	-315	315
Respondent had difficulty separating cows & heifers	1	-172	172
Did not include all cattle regardless of ownership	1	32	32
Respondent forgot some cattle/calves were sold	1	18	18
Other Bias			
Respondent said not asked this on phone interview	1	-9,156	9,156
Respondent does not know where answer came from	4	4,414	6,428
Wrong number or added wrong	5	-2,411	4,228
Respondent was tired or hurried on phone	5	2,542	4,094
Different response due to different respondents	1	-3,317	3,317
Respondent had difficulty hearing on phone	2	-2,646	3,178
Respondent said this reported first time	2	956	2,823
Respondent did not know	2	1,108	2,148
Enumerator forgot to ask	2	-1,161	1,161
Other	1	654	654
Correct data not brought forward	1	355	355
Respondent did not report for operation on label	1	-284	284
Enumerator had problems with computer (initial)	1	129	129
Respondent forgot to report	1	-40	40
No Reason Available			
No explanation	4	16,456	17,072
Enumerator didn't reconcile-manually imputed	2	5,439	7,803

Appendix E: Formulas for Ratio Estimates, Percent Bias and Associated Variances.

The ratios presented within this paper were derived in the same manner as ratio estimates used in the Survey Processing System (SPS) Summary. See Kott, 1990 for a complete discussion of ratio estimates used in the SPS Summary. Hansen, Hurwitz, and Madow, 1953 is an excellent source for a discussion on ratio estimates in stratified simple random sampling.

Estimates for ratios presented in this paper take the form

$$R = F/E$$

where

F = Estimate of the total expanded final reconciled responses
E = Estimate of the total expanded SPS edited responses

for data in which both the final and edited values were usable.

So,

$$R = F/E = \frac{\displaystyle\sum_{h=1}^{L} \frac{N_h}{n_h} \sum_{i=1}^{n_h} f_{hi}}{\displaystyle\sum_{h=1}^{L} \frac{N_h}{n_h} \sum_{i=1}^{n_h} e_{hi}}$$

where

f_{hi} = the final reconciled value of the ith unit in stratum h
e_{hi} = the SPS edited value of the ith unit in stratum h.

The variance of the ratio can be expressed as:

$$Var(R) = Var(F/E) = rel\text{-}var(F/E) * (F/E)^2$$

where rel-var(F/E) is the relative variance of F/E is calculated as:

$$rel\text{-}var(F/E) = \frac{Var(F)}{F^2} + \frac{Var(E)}{E^2} - \frac{2cov(F,E)}{F*E}$$

and the covariance is calculated as:

$$cov(F,E) = \frac{\displaystyle\sum_{h=1}^{L} \sum_{i=1}^{N_h} (f_{hi} - \overline{f}_h)(e_{hi} - \overline{e}_h)}{N_h - 1}$$

The variance (of F or E) is just a special case of the covariance in which e and f are the same.

Appendix E: Formulas for Ratio Estimates, Percent Bias and Associated Variances.

Formulas for the percent response bias were based on the previous formulas for ratios. The percent response bias was calculated as:

$$\% \text{ bias} = [(E - F)/E] * 100 = (1 - F/E) * 100$$

where E and F are as defined earlier.

The variance of the percent bias can also be expressed in terms of the variance of the ratio R.

$$\text{Var}(\% \text{ bias}) = \text{Var}[(1 - R) * 100] = 100^2 * \text{Var}(R)$$

where $R = F/E$.

The standard error of the percent response bias can be obtained as:

$$100 * \text{s.e.}(R) \qquad \text{where } R = F/E$$

Appendix F: Formulas for Stratified Univariate Test.

Significance levels reported in this paper were for tests of the form:

$$H_0: \mu = \mu_0 \quad vs. \quad H_1: \mu \neq \mu_0$$

This hypothesis was tested using the statistic:

$$Z = \frac{R - 1}{\sqrt{Var(R)}} \quad for \quad R = F/E$$

where

      F = Estimate of the total expanded final reconciled responses
      E = Estimate of the total expanded SPS edited responses

are as defined in Appendix E.

The variance of the ratio, Var(R), is also as defined in Appendix E.