"Economic Assessment of the Request to Modernize the U.S. Standards for Grades of Carcass Beef"

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BACKGROUND

On April 13, 2016, the National Cattlemen's Beef Association (NCBA) made a request to the Agricultural Marketing Service (AMS) to allow the use of dentition as an assessment of carcass maturity for the U.S. Standards for Grades of Carcass Beef. Previous research, funded by the Beef Checkoff, revealed physiological maturity and its relation to chronological age, as estimated by dentition, results in a gender dependent maturity misclassification. Further, carcasses from fed cattle under 30 months of age (MOA) resulted in equivalent tenderness and trained taste panel assessments between "A" and "B" maturity groups. Gender bias in maturity misclassification of carcasses from cattle under 30 MOA results in decreased carcass value even though tenderness and expert taste panel outcomes are the same. Further research has shown this technique to be more accurate in assessing cattle age than measures of ossification. As a result, the NCBA asserted that approximately one percent of graded cattle are falsely identified as over 30 months of age MOA, and are therefore incorrectly discounted in payments to producers, as well as removed from higher grade categories. This also has some implications for international trade in beef, as the use of the 30 MOA cutoff is common as a criterion for beef exports to other countries.

The NCBA provided AMS with data from a recent study of beef packing plant slaughter. Results of that study are summarized in Table 1 in the attachments. The study period ranged from the beginning of May 2014 through the end of April 2015. Data were compiled monthly, however, for simplicity the following discussion describes the yearly sum of these monthly data. Monthly data are included in the table to show variations through the year.

ANALYSIS

Of the 21,431,056 total cattle reported as graded by the Quality Assessment Division, 15,508,989, or 72 percent were slaughtered in facilities participating in the study. The vast majority, a total of 15,084,808 head, or 97.3 percent were found to be less than 30 MOA using dentition. A total of 352,859 head were found to be equal to or greater than 30 MOA, 2.28 percent of cattle slaughtered in the study group. An additional 71,322 cattle, 0.46 percent of the total, were age-verified. The sum of cattle less than 30 MOA, 30 or more MOA, and age-verified is equal to the total number of cattle in the study.

Using ossification as the measure of maturity, 261,162 cattle were deemed to be age-discounted, 1.68 percent of the study population. However, using dentition, 154,950 were actually found to be less than 30 MOA. This represents 1 percent of all animals in the study. If we were to apply this percentage to the universe of all cattle slaughter that was graded (i.e. including animals that were not part of the study) a universal total of 213,357 carcasses would have been judged to be less than 30 MOA by dentition, and not discounted as hardbone.

Table 2 proceeds with the last row of Table 1, which estimates the number of carcasses that would have been deemed less than 30 MOA and not hardbone, using dentition, not ossification to assess maturity. This volume is located in the last line of the upper half of Table 2. The lower half of the table shows the actual distribution of grades found in the study of carcasses that were incorrectly deemed by ossification standards to be hardbone. Multiplying the shares in the lower portion of Table 2 by the Total line in the upper half of the table yields the distribution of carcasses across the grades. These numbers represent the addition to each grade category that would have been made if dentition would have been used for the universe of all cattle slaughtered during the study period, rather than by ossification, assuming the percentage distribution across grade categories in the study also applies to the additional slaughter animals outside the study.

In other words, Table 2 shows that if dentition had been used to identify cattle according to age group, rather than ossification, during the time frame of the study, an additional 213,357 cattle would have been identified as less than 30 MOA. Of this volume, 9,603 carcasses, or 4.5 percent, would have been graded as Prime, 135,522 carcasses, or 63.6 percent would have been graded as Choice, and 68,232 carcasses, or 31.9 percent would have been graded as Select. Within the Choice category, 52,060 carcasses, or 24.4 percent of all newly graded carcasses, would have been placed in the top one-third Choice category, 35,553 or 16.7 percent of all added carcasses would have been placed in the mid-one third Choice category (both of which could qualify for branded Choice programs), and 47,909 carcasses, or 22.5 percent of total added carcasses would have been classified as the bottom one-third of the Choice category. Note that the total number of carcasses which could have been added to the total volume of graded product is roughly equal to one percent of the total graded slaughter carcasses for this time period, 21.4 million head.

Also note that the share of carcasses in each grade category varies throughout the year, ranging from 3.1 percent to 6.6 percent for Prime, from 51.7 percent to 72.4 percent for Choice, and from 22.7 percent to 44.7 percent for Select. Also note the variability in volume, ranging from an additional 8,544 carcasses graded in June 2015, to 29,515 carcasses in March 2015. As this data was only provided for one year, it is not possible to determine if this is truly a seasonal phenomenon, however, later discussion indicates that is a distinct possibility, as this degree of variability is supportive of trends we see in the overall market on a yearly basis.

Table 3 shows the total volume of graded carcasses by category, if all slaughter in the time period of the study had been evaluated with the dentition measures. Hence, it includes all carcasses in the study that were initially identified as less than 30 MOA (shown Table 1), carcasses that were initially identified as hardbone through ossification measures, but then were reclassified by dentition as being less than 30 MOA and then graded (shown Table 2), and carcasses that were not in the study, but assumed to follow the same pattern of grade categorization as carcasses in the study (also Table 2). The Total line in the top half of Table 3 is the sum of the Total line in the top half of Table 2, plus the very first line of Table 1. It represents the universe of graded carcasses, had all cattle been evaluated in the study period, and the carcasses not in the study had the same characteristics as the carcasses in the study. The lower portion of Table 3 represents the distribution of graded carcasses by category that were determined in the study, and were also applied to the universe of graded cattle to determine the numerical breakdown if all slaughter in the time period were evaluated through dentition rather than ossification.

Market changes through the year can be seen in price patterns, including patterns showing the differences between prices that might otherwise be considered to be fixed. One such pattern is the price differential, or spread, between the cutout values for Choice and Select beef. Table 4 lists the monthly cutout values for Choice and Select beef during the period of the dentition study, and the spread between these cutout values. It

also shows the average monthly cutout values and spreads for the three years prior to the study period. The comparison of the values for the study period with the historical values indicates that price differentials between Choice and Select beef during the study were fairly representative, and not unusual.

For various reasons on both the demand and the supply sides of the market, the Choice-Select spread has a pattern of falling in the early months of the calendar year, increasing in the spring and early summer, subsiding later in the summer, and rebounding in the fall, hitting its yearly height in the late fall/early winter months of the holiday season.

Table 5 compares the monthly Choice-Select spread for the study period with the total number of carcasses (study and non-study, i.e. the universe of slaughter) that would have been graded if dentition were used as a measure of maturity (Table 3). From this data, a few things can be seen that are helpful to the analysis. First, note that slaughter of all cattle tends to be relatively steady through the year, varying mainly due to the number of days of operation. Therefore, shorter months, and months with holidays tend to have lower slaughter. However, the distribution of grades is not as even through the year. Prime and Choice carcasses represent a higher portion of production in the early months of the calendar year, lower in the middle months, and higher again towards the end of the year. Conversely, Select grade carcasses tend to be underrepresented in the beginning and ending months of the year, and overrepresented in the middle portion of the calendar year. As a result, the Choice-Select spread tends to fall in those months when there is a higher share of Choice and a smaller share of Select. The relative abundance of Choice will suppress its cutout value, while the relative scarcity of Select will pull its cutout value up, and the spread narrows. The opposite holds when Select is more abundant and Choice is more scarce.

However, to look at the impact of a change to dentition for maturity evaluation, Table 6 compares the monthly Choice-Select spread with the data from Table 2, which shows the increase in graded volume (or reduction in hardbone discounts) using dentition rather than ossification as a measure. One significant difference in the data between Table 6 and Table 5 is that while monthly slaughter is not particularly variable, added volume to grading is significantly variable over the months, ranging from 8,544 carcasses in June 2014 to 29,515 in March 2015. Again, it should be emphasized that the study data only covers one year, so is not necessarily an indicator of yearly production patterns.

While the variability of volume of added carcasses is quite different between Tables 5 and 6, the grade distribution among the carcasses is very similar. Therefore, we see higher shares of Prime and Choice in the early months and the late months of the year, while the share of Select is higher in the middle months. Therefore, the grade composition of the carcasses being added by using dentition as a measure of age is not much different than the grade composition of carcasses graded with ossification. This suggests that using dentition rather than ossification is not likely to have a significant impact of the composition, or *consist*, of beef production.

However, the variability in volume is likely to reinforce the existing trend in the cutout spread over the course of a year. The reason is that the study data show much larger volumes in those months when the share of additional Select carcasses is low, and smaller volumes when the share of Select is high. Subsequently, the variation between the highest and the lowest amounts of Select carcasses added is roughly 4,200 carcasses, while the difference for Choice is nearly 17,000 carcasses. Those months in which a significantly larger volume of Choice is being added happen to be the months, February and March, when the Choice-Select spread is historically low (and on occasion on a daily basis may be negative). Hence, a higher share of more carcasses

will be added to the Choice category at precisely the time there is already an abundance of Choice beef. This could mean a greater tendency for the spread to go negative, reinforcing the existing pattern.

Supporting the conclusion that the consist is not likely to change significantly is the fact that use of dentition for age determination is likely to contribute only about 1 percent of current graded carcasses to production. Despite the differentials between Choice and Select volumes discussed above, the study data show an increase of 1.05 percent for Prime beef, 0.91 percent for Choice[1] and 1.29 percent for Select. These percentage increases in graded beef are not significant changes.

Price flexibility measures can tell us the potential change in price due to and change in volume produced. Price flexibilities can be derived by taking the inverse of price elasticity measures. According to calculations made from wholesale beef elasticities reported in a study by Lusk, et al (2001)[2], wholesale beef prices could decline between 1 to 1.5 percent for each of the grade categories as a result of the increased supply of graded beef.

NCBA also discussed the benefit to producers of using dentition to determine cattle maturity. According to NCBA, producers would yield approximately $59 million in added revenue from removal of discounts for cattle inaccurately identified as greater than 30 MOA. AMS evaluated this claim. Results of the evaluation are presented in Table 7.

We assume that all cattle discounted as hardbone, both study and non-study slaughter, but subsequently identified as less than 30 MOA through dentition, are subject to the full discount. We also assume that all the animals incorrectly discounted are heifers. Following the NCBA method, we could multiply the number of additional graded carcasses from Table 1, times the average monthly slaughter weight for heifers available from the National Agricultural Statistics Service, and also times the monthly average value for the hardbone discount (divided by 100 to adjust for the hundred weight value). However, if these carcasses are graded, they may be subject to other discounts or premiums. Therefore, we included a discount/premium adjustment, determined by taking grade distributions from Table 2, and monthly discount/premium data calculated from AMS's Market News Reports. This yielded a net gain to producers value, which totaled nearly $55 million in approximately gains to producers, primarily due to reduced hardbone discounts for incorrect age determinations under the ossification approach.

CONCLUSION

This economic evaluation finds the following likely outcomes if dentition is used as a method of determining cattle age, rather than using bone ossification.

1. Assuming the study is representative of future results, and of cattle slaughter that was not in the study itself, roughly one percent more beef could be added to graded beef production.
2. Additional beef graded breaks down as 1.05 percent more Prime beef, 0.91 more Choice beef, and 1.29 percent more Select beef.
3. While there is a slight distinction in the distribution of additional beef across grades, this distinction is not likely to have a significant impact on the consist of graded beef output.

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[1] While the volume of Choice carcasses added is large, the existing production of Choice beef is significantly large enough to result is a smaller proportion of Choice added than for Prime and Select.
[2] Lusk, J.L., T.L. Marsh, T.C. Schroeder, and J.A. Fox. "Wholesale Demand for USDA Quality Graded Boxed Beef and the Effects of Seasonality." *Journal of Agriculture and Resource Economics*. 26(2001):91-106.

4. Discrepancies in the volume of beef added, the distribution of beef added may contribute to existing market conditions to accentuate their impacts. In particular, the cutout value may have a slightly greater tendency to invert, or become negative in the late winter/early spring months.
5. Wholesale beef prices could be negatively impacted, but any possible impact would likely be in the 1 to 1.5 percent range, and is likely to be similar across grades.
6. Cattle producers are likely to see increased revenues totaling as much as $55 million per year, assuming this study is representative of future periods.

Description	May-14	Jun-14	Jul-14	Aug-14	Sep-14	Oct-14	Nov-14	Dec-14	Jan-15	Feb-15	Mar-15	Apr-15	Total
Total head for slaughter, graded	1,957,203	1,970,181	1,930,563	1,849,933	1,838,668	1,896,346	1,592,546	1,739,559	1,712,104	1,553,273	1,692,720	1,697,960	21,431,056
Total head from dentition study	1,460,123	1,389,982	1,325,130	1,402,178	1,303,415	1,318,688	1,250,594	1,213,259	1,214,963	1,224,170	1,204,606	1,201,881	15,508,989
Percent graded slaughter in dentition study	74.60%	70.55%	68.64%	75.80%	70.89%	69.54%	78.53%	69.75%	70.96%	78.81%	71.16%	70.78%	72.37%
Number < 30 MOA based on dentition study	1,423,524	1,360,850	1,295,111	1,373,325	1,273,992	1,287,688	1,216,995	1,173,227	1,176,390	1,186,717	1,156,821	1,160,168	15,084,808
Number ≥ 30 MOA based on dentition study	30,403	22,476	23,459	23,660	23,363	26,080	27,769	31,876	33,900	32,990	40,618	36,265	352,859
Number age-verified as <30 MOA	6,196	6,656	6,560	5,193	6,060	4,920	5,830	8,156	4,673	4,463	7,167	5,448	71,322
Number of hardbone carcasses, ossification	14,972	11,019	10,980	13,161	14,129	20,469	24,988	28,047	28,546	31,232	35,843	27,776	261,162
Number head discounted, dentition	8,716	6,028	5,973	7,850	9,446	12,748	15,463	16,695	16,093	19,184	21,004	15,750	154,950
Share discounted, dentition	0.60%	0.43%	0.45%	0.56%	0.72%	0.97%	1.24%	1.38%	1.32%	1.57%	1.74%	1.31%	1.00%
Estimated total head discounted	11,683	8,544	8,702	10,357	13,325	18,332	19,691	23,937	22,678	24,341	29,515	22,251	213,357

Table 1. Summary statistics from dentition study, and total slaughter information for the study period.

	May-14	Jun-14	Jul-14	Aug-14	Sep-14	Oct-14	Nov-14	Dec-14	Jan-15	Feb-15	Mar-15	Apr-15	Average	Total
Carcass Grade Volume--Maturity Discounted (Actual* and Estimated**)														
Prime	**480**	**398**	**319**	**422**	**419**	**594**	**750**	**1,055**	**1,029**	**1,224**	**1,435**	**1,459**	**800**	**9,603**
Total Choice	**6,918**	**4,537**	**4,496**	**5,566**	**7,097**	**10,222**	**12,215**	**15,101**	**15,185**	**17,572**	**21,370**	**15,242**	**11,293**	**135,522**
Choice-Top 1/3	2,875	1,945	1,702	2,034	2,431	3,381	4,193	5,468	5,468	7,230	8,947	6,712	4,338	52,060
Choice-Middle 1/3	1,708	1,171	1,139	1,453	1,978	2,888	3,489	4,034	4,034	4,536	5,375	3,782	2,963	35,553
Choice-Bottom 1/3	2,335	1,422	1,139	2,079	2,689	3,953	4,532	5,960	5,683	5,806	7,049	4,745	3,992	47,909
Select	**4,285**	**3,609**	**3,887**	**4,368**	**5,809**	**7,517**	**6,726**	**7,781**	**6,464**	**5,545**	**6,692**	**5,549**	**5,686**	**68,232**
Total	11,683	8,544	8,702	10,357	13,325	18,332	19,691	23,937	22,678	24,341	29,515	22,251	18,158	213,357
Carcass Grade Shares--Maturity Discounted (Actual*)														
Prime	**4.1%**	**4.7%**	**3.7%**	**4.1%**	**3.1%**	**3.2%**	**3.8%**	**4.4%**	**4.5%**	**5.0%**	**4.9%**	**6.6%**	**4.5%**	**4.5%**
Total Choice	**59.2%**	**53.1%**	**51.7%**	**53.7%**	**53.3%**	**55.8%**	**62.0%**	**63.1%**	**67.0%**	**72.2%**	**72.4%**	**68.5%**	**63.6%**	**63.6%**
Choice-Top 1/3	24.6%	22.8%	19.6%	19.6%	18.2%	18.4%	21.3%	21.5%	24.1%	29.7%	30.3%	30.2%	24.4%	24.4%
Choice-Middle 1/3	14.6%	13.7%	13.1%	14.0%	14.8%	15.8%	17.7%	16.7%	17.8%	18.6%	18.2%	17.0%	16.7%	16.7%
Choice-Bottom 1/3	20.0%	16.6%	19.0%	20.1%	20.2%	21.6%	23.0%	24.9%	25.1%	23.9%	23.9%	21.3%	22.5%	22.5%
Select	**36.7%**	**42.2%**	**44.7%**	**42.2%**	**43.6%**	**41.0%**	**34.2%**	**32.5%**	**28.5%**	**22.8%**	**22.7%**	**24.9%**	**31.9%**	**31.9%**
Total	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%

Table 2. Total Head Subject to Hardbone Discount Using Ossification: All cattle < 30 MOA, actual* and estimated** by marbling category if dentition was used.

*Actual numbers derived from the dentition study conducted by industry. **Estimated numbers derived from the remaining slaughter population using study grading distribution.

	May-14	Jun-14	Jul-14	Aug-14	Sep-14	Oct-14	Nov-14	Dec-14	Jan-15	Feb-15	Mar-15	Apr-15	Average	Total
Table 3. Total Head Graded Using Dentition: All cattle during study period that would not have been discounted for advanced maturity using dentition measure, by marbling category.														
Carcass Grade Volume--Not Discounted for Maturity (Actual* and Estimated**)														
Prime	62,827	65,608	73,009	74,488	80,540	88,296	82,671	87,853	82,196	74,157	85,931	85,666	78,604	943,243
Choice	1,333,949	1,352,120	1,349,591	1,275,377	1,267,767	1,296,301	1,101,859	1,237,795	1,263,458	1,177,119	1,291,121	1,261,611	1,267,370	15,208,439
Select	567,912	554,588	514,181	514,161	500,381	526,296	424,912	434,060	386,270	322,942	341,276	369,022	454,091	5,449,087
Other	4,198	6,409	2,504	2,504	3,305	3,786	2,795	3,788	2,858	3,396	3,357	3,911	3,637	43,644
Total	1,968,886	1,939,265	1,942,909	1,939,265	1,851,993	1,914,678	1,612,237	1,763,496	1,734,782	1,577,614	1,722,235	1,720,211	1,803,701	21,644,413
Carcass Grade Shares--Not Discounted for Maturity (Actual*)														
Prime	3.2%	3.3%	3.8%	4.0%	4.4%	4.6%	5.1%	5.0%	4.7%	4.7%	5.0%	5.0%	4.3%	4.3%
Choice	67.8%	68.3%	69.6%	68.5%	68.4%	67.7%	68.3%	70.2%	72.8%	74.6%	75.0%	73.3%	70.3%	70.3%
Select	28.8%	28.0%	26.5%	27.3%	27.0%	27.5%	26.4%	24.6%	22.3%	20.5%	19.8%	21.5%	25.2%	25.2%
Other	0.2%	0.3%	0.1%	0.2%	0.2%	0.2%	0.2%	0.2%	0.2%	0.2%	0.2%	0.2%	0.2%	0.2%
Total	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%

*Actual numbers derived from the dentition study conducted by industry. **Estimated numbers derived from the remaining slaughter population using study grading distribution.

	2014/2015 Study			2011/2014 Historical Average		
	Choice	Select	Spread	Choice	Select	Spread
May	$228.95	$217.86	$11.09	$209.14	$198.21	$10.93
Jun	$236.60	$228.46	$8.14	$211.55	$198.41	$13.14
Jul	$252.86	$246.89	$5.97	$209.64	$201.42	$8.23
Aug	$254.83	$246.45	$8.38	$211.52	$203.05	$8.47
Sep	$246.14	$232.61	$13.53	$210.74	$197.47	$13.27
Oct	$246.80	$233.66	$13.14	$213.75	$199.00	$14.76
Nov	$253.18	$240.64	$12.54	$216.47	$201.33	$15.14
Dec	$247.35	$235.91	$11.44	$213.79	$200.43	$13.36
Jan	$254.45	$245.97	$8.48	$222.25	$215.74	$6.50
Feb	$241.30	$237.04	$4.26	$213.11	$210.25	$2.85
Mar	$247.62	$245.29	$2.33	$226.81	$223.95	$2.86
Apr	$257.44	$249.34	$8.10	$225.86	$217.75	$8.11

Table 4. Choice and Select Cutout Values, and Choice-Select Cutout Spreads, Study and Historical Periods

	May-14	Jun-14	Jul-14	Aug-14	Sep-14	Oct-14	Nov-14	Dec-14	Jan-15	Feb-15	Mar-15	Apr-15	Average
Choice-Select Cutout Spread													
	$10.93	$13.14	$8.23	$8.47	$13.27	$14.76	$15.14	$13.36	$6.50	$2.85	$2.86	$8.11	$9.80
Carcass Grade Volume--Not Discounted for Maturity (Actual* and Estimated**)													
Prime	62,827	65,608	73,009	74,488	80,540	88,296	82,671	87,853	82,196	74,157	85,931	85,666	78,604
Choice	1,333,949	1,352,120	1,349,591	1,275,377	1,267,767	1,296,301	1,101,859	1,237,795	1,263,458	1,177,119	1,291,121	1,261,611	1,267,370
Select	567,912	554,588	514,181	514,161	500,381	526,296	424,912	434,060	386,270	322,942	341,276	369,022	454,091
Total	1,968,886	1,939,265	1,942,909	1,939,265	1,851,993	1,914,678	1,612,237	1,763,496	1,734,782	1,577,614	1,722,235	1,720,211	1,803,701
Carcass Grade Shares--Not Discounted for Maturity (Actual*)													
Prime	3.2%	3.3%	3.8%	4.0%	4.4%	4.6%	5.1%	5.0%	4.7%	4.7%	5.0%	5.0%	4.3%
Choice	67.8%	68.3%	69.6%	68.5%	68.4%	67.7%	68.3%	70.2%	72.8%	74.6%	75.0%	73.3%	70.3%
Select	28.8%	28.0%	26.5%	27.3%	27.0%	27.5%	26.4%	24.6%	22.3%	20.5%	19.8%	21.5%	25.2%
Total	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%

Table 5. Comparison of monthly data on monthly Choice-Select cutout value spreads with total number of graded carcasses, all slaughter.

*Actual numbers derived from the dentition study conducted by industry. **Estimated numbers derived from the remaining slaughter population using study grading distribution.

Table 6. Comparison of monthly data on monthly Choice-Select cutout value spreads with carcasses discounted for maturity but <30 MOA (dentition study).													
	May-14	Jun-14	Jul-14	Aug-14	Sep-14	Oct-14	Nov-14	Dec-14	Jan-15	Feb-15	Mar-15	Apr-15	Average
Choice-Select Cutout Spread													
	$10.93	$13.14	$8.23	$8.47	$13.27	$14.76	$15.14	$13.36	$6.50	$2.85	$2.86	$8.11	$9.80
Carcass Grade Volume--Maturity Discounted (Actual* and Estimated**)													
Prime	480	398	319	422	419	594	750	1,055	1,029	1,224	1,435	1,459	800
Total Choice	6,918	4,537	4,496	5,566	7,097	10,222	12,215	15,101	15,185	17,572	21,370	15,242	11,293
Choice-Top 1/3	2,875	1,945	1,702	2,034	2,431	3,381	4,193	5,468	5,468	7,230	8,947	6,712	4,338
Choice-Mid 1/3	1,708	1,171	1,139	1,453	1,978	2,888	3,489	4,034	4,034	4,536	5,375	3,782	2,963
Choice-Btm 1/3	2,335	1,422	1,139	2,079	2,689	3,953	4,532	5,960	5,683	5,806	7,049	4,745	3,992
Select	4,285	3,609	3,887	4,368	5,809	7,517	6,726	7,781	6,464	5,545	6,692	5,549	5,686
Total	11,683	8,544	8,702	10,357	13,325	18,332	19,691	23,937	22,678	24,341	29,515	22,251	18,158
Carcass Grade Shares--Maturity Discounted (Actual*)													
Prime	4.1%	4.7%	3.7%	4.1%	3.1%	3.2%	3.8%	4.4%	4.5%	5.0%	4.9%	6.6%	4.5%
Total Choice	59.2%	53.1%	51.7%	53.7%	53.3%	55.8%	62.0%	63.1%	67.0%	72.2%	72.4%	68.5%	63.6%
Choice-Top 1/3	24.6%	22.8%	19.6%	19.6%	18.2%	18.4%	21.3%	21.5%	24.1%	29.7%	30.3%	30.2%	24.4%
Choice-Mid 1/3	14.6%	13.7%	13.1%	14.0%	14.8%	15.8%	17.7%	16.7%	17.8%	18.6%	18.2%	17.0%	16.7%
Choice-Btm 1/3	20.0%	16.6%	19.0%	20.1%	20.2%	21.6%	23.0%	24.9%	25.1%	23.9%	23.9%	21.3%	22.5%
Select	36.7%	42.2%	44.7%	42.2%	43.6%	41.0%	34.2%	32.5%	28.5%	22.8%	22.7%	24.9%	31.9%
Total	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%

*Actual numbers derived from the dentition study conducted by industry. **Estimated numbers derived from the remaining slaughter population using study grading distribution.

	Additional Graded Carcasses	Average Heifer Weight	Hardbone Discount Removed	Premium/ Discount Added	Net Gain per cwt to Producers	Total Gain to Producers*
			Table 7. Calculation of Potential Gains to Producers from Use of Dentition for Maturity Estimation			
May-14	11,683	775	$31.70	-$2.21	$29.49	$2,670,440
Jun-14	8,544	777	$31.81	-$1.93	$29.87	$1,983,323
Jul-14	8,702	787	$31.31	-$1.53	$29.77	$2,038,982
Aug-14	10,357	795	$31.28	-$1.08	$30.20	$2,486,270
Sep-14	13,325	806	$32.69	-$4.19	$28.50	$3,061,214
Oct-14	18,332	822	$33.26	-$3.76	$29.51	$4,446,586
Nov-14	19,691	827	$33.85	-$2.16	$31.69	$5,160,217
Dec-14	23,937	824	$33.81	-$1.92	$31.89	$6,290,132
Jan-15	22,678	814	$33.17	-$0.37	$32.80	$6,055,676
Feb-15	24,341	817	$32.85	$0.85	$33.69	$6,700,714
Mar-15	29,515	818	$32.45	$1.48	$33.92	$8,190,489
Apr-15	22,251	807	$33.54	$1.00	$34.54	$6,201,554
Average	18,158	806	$32.64	-$0.84	$31.81	$4,653,284
Total	213,357	--	--	--	--	$54,677,132

*Equals the product of number of carcasses times heifer weight times net gain to
producers divided by 100.