Cattle Grading Predictions vs. Final Outcome
FY 2011

Feeder cattle grading is performed by USDA at the time of sale as a means of standardizing and reporting on the prices received by ranchers for feeder cattle of different levels of quality. These standards allow ranchers and cattle feeders throughout the U.S. to compare feeder calf cost and value in different regions. In order to have value to cattle producers, it is paramount that the grading standards reflect true, inherent quality and performance potential of the calves after they enter the feedyard.

However, the challenge presented to USDA graders is that the standard is subjective and relies entirely on the training and experience of the graders, so that age and flesh condition of the calves at time of sale can be properly accounted for and the true genetic merit of the calves can be estimated visually. The objective of this study was to compare the actual numeric frame and muscle scores applied to feeder cattle from across the southeastern and Midwestern U.S. at the time of shipment to the feedlot to the actual final body weight and ribeye size when the cattle reached a standardized level of finish fatness. The study confirmed that the present system of Frame and Muscle scoring cattle accurately represents the vast majority of cattle in the current feedlot cattle population. The USDA feeder scoring system as implemented in the cattle evaluated in the present data set is a useful tool for estimating final body weight outcome of feeder cattle.

FINAL REPORT

Contact:
Chris D. Reinhardt (Project Director)
Associate Professor
Animal Sciences and Industry
Kansas State University
785-532-1672
cdr3@ksu.edu

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Final Project Report

Project Title
Cattle Grading Predictions vs. Final Outcome

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United States Department of Agriculture

Principal Investigator
Chris D. Reinhardt (Project Director)
Associate Professor
Animal Sciences and Industry
Kansas State University
Manhattan, KS 66506
Phone: 785-532-1672
e-mail: cdr3@ksu.edu

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Background Problem Statement
Feeder cattle grading is performed by USDA at the time of sale as a means of standardizing and reporting on the prices received by ranchers for feeder cattle of different levels of quality. These standards allow ranchers and cattle feeders throughout the U.S. to compare feeder calf cost and value in different regions. In order to have value to cattle producers, it is paramount that the grading standards reflect true, inherent quality and performance potential of the calves after they enter the feedyard.

However, the challenge presented to USDA graders is that the standard is subjective and relies entirely on the training and experience of the graders, so that age and flesh condition of the calves at time of sale can be properly accounted for and the true genetic merit of the calves can be estimated visually. The objective of this study was to compare the actual numeric frame and muscle scores applied to feeder cattle from across the southeastern and Midwestern U.S. at the time of shipment to the feedlot to the actual final body weight and ribeye size when the cattle reached a standardized level of finish fatness.

Activities Performed and Milestones Achieved

Objectives

1. To improve the accuracy of pre-slaughter grade determinations through an analysis of beef carcass data from 23 Midwestern and Southeastern States.

Contributions of Public or Private Agency Cooperators

The Tri County Steer Futurity, directed by Darrell Busby, oversees feeding of all cattle in the program, and cattle are fed through slaughter at 18 area feedlots across southwestern Iowa. Busby ensures that grading conditions, processing, feeding, and the marketing endpoint of all cattle in the program remain consistent across time, feedlots, and groups of cattle.

Results, Conclusions, and Lessons Learned

A total of 23,057 individual steers and heifers originating from 16 different states in the Midwest and Southeast of the U.S. were fed through slaughter in 17 feedlots in southwest Iowa. Frame and Muscle Scores were evaluated and recorded for cattle either prior to leaving their state of origin or upon arrival at the feedlot. Other data collected upon arrival included initial weight and body condition score. Cattle were fed to a visually-estimated target body composition endpoint (yield grade 3). Final body weight and carcass traits (hot carcass weight, quality grade, marbling score, fat thickness, ribeye area, and KPH fat) were recorded at harvest.

Mixed model procedures were used to investigate relationships between USDA Feeder Scores (Frame Score and Muscle Score) and measures of live performance (ADG, final weight) and carcass traits (carcass weight, marbling score, and yield grade). Fixed effects in the model included either Frame Score or Muscle Score, and other potentially influential animal factors, such as initial weight, arrival body condition score, number of respiratory treatments, sex, and location of scoring. Random effects in the model included year of harvest and feedlot.

1. One interesting outcome is that the relationships between Frame Score and Muscle Score and many performance variables were affected by the location where cattle were scored: either upon arrival at the feedlots in Iowa or prior to leaving their home state in Georgia.
2. Regression equations were developed using the mixed model regression estimates for the relationship between frame score and actual final body weight, adjusted to 0.50 inches of backfat, for steers and for heifers.
    a. Final wt (kg; steers) = 26.89*frame score + 481.7; $R^2 = 0.92$
    b. Final wt (kg; heifers) = 27.18*frame score + 439.7; $R^2 = 0.93$
    c. These regressions indicate that the current frame scoring system very accurately predicts the final body weight of frame score 3.0 (the transition from medium to large frame). In comparison to the standards of 1,250 and 1,150 lb for steers and heifers, respectively, frame score 3.0 steers and heifers in the current system (adjusted to 0.50 inches back fat) weighed 1,237 and 1,146 lb, respectively.

3. The actual final weight was used to categorize cattle to theoretical small, medium, or large frame score; this calculated retrospective frame score was compared to the actual frame score assigned at the beginning of the feeding period (k = 0.01; $P < 0.01$).
    a. The percentage of small frame cattle was under-predicted for both steers (0.7% predicted vs. 14.9% calculated) and heifers (0.6% predicted vs. 10.4% calculated)
    b. The percentage of medium frame cattle were under-predicted for both steers (37.3% predicted vs. 50.6% calculated) and heifers (45.7% predicted vs. 57.9% calculated)
    c. The percentage of large frame cattle was over-predicted for both steers (62.0% predicted vs. 34.6% calculated) and heifers (53.7% predicted vs. 31.7% calculated).

Conclusions

The present system of Frame and Muscle scoring cattle accurately represents the vast majority of cattle in the current feedlot cattle population.

Based on a recent assessment of the national cattle population (n = 2.4 million carcasses; Gray et al. 2012), the average carcass weight of all cattle harvested in the U.S. between November, 2010 and November, 2011 was estimated to be 816 pounds (± s.d. 96.9 lb), which translates to a live weight of 1,285 pounds (± s.d. 152.6 lb) assuming the steers and heifers in the published survey had an average dressing percent of 63.5%. The average fat thickness and marbling score of carcasses in that survey were 0.47 in. and Small^{49}, very near the 0.50 and Small^{00} targets of the frame score standard.

So, although the frame score system over-predicted the percentage of large-framed cattle in the present dataset, which was accumulated over an 8 year period, it likely accurately reflects the current U.S. cattle population.

Lessons Learned

The USDA feeder scoring system as implemented in the cattle evaluated in the present data set is a useful tool for estimating final body weight outcome of feeder cattle.

Gray, G. D., M. C. Moore, D. S. Hale, C. R. Kerth, D. B. Griffin, J. W. Savell, C. R. Raines, T. E. Lawrence, K. E. Belk, D. R. Woerner, J. D. Tatum, D. L. VanOverbeke, G. G. Mafi, R. J. Delmore, Jr, S. D. Shackelford, D. A. King, T. L. Wheeler, L. R. Meadows and M. E. O'Connor. 2012. National Beef Quality Audit-2011: Survey of instrument grading assessments of beef carcass characteristics. J Anim. Sci. 90:5152-5158.

Current and Future Benefits Derived from this Project

1. It is imperative that USDA graders continue to check their standard of frame score against actual animal final body weight. This analysis will give current USDA graders confidence that their current practices accurately reflect the cattle graded.
2. Beef producers must have confidence that standards applied throughout the U.S. and reported for feedlot cattle sold at various markets by USDA personnel accurately reflect

the cattle sold and the prices paid for various classes and grades of feeder cattle. The present analysis can help ensure confidence in the current feeder cattle grading system.

3. The model used in the present analysis can be used to periodically correlate feeder scores to actual live and carcass outcome of feedlot cattle to check the system for accuracy, and help make adjustments as determined necessary.

Future Research

1. It is recommended that an analysis similar to that conducted herein be conducted annually to provide an ongoing database from which to monitor accuracy of the feeder scoring system.
2. A larger study should be conducted using feedlot and carcass data from a larger subset of cattle representing cattle feeding operations from across the entire feedlot geography, to account for a broader range of genetics and production and marketing practices.

Project Beneficiaries

Targeted beneficiaries of this project included beef ranchers, stocker and feedlot operators and USDA graders and administrators of the USDA grading system. The U.S. has about 758,000 beef cow-calf operations, 90% of which have less than 100 head. Genetics determine the greatest proportion of final body weight at a given level of carcass fatness, and ranchers can benefit greatly from comparing the price received for their calves against the perceived quality of those calves, as judged by USDA graders.

The feedlot sector is comprised of more than 2,000 operations that finish cattle. The price received for finished cattle and the cost of inputs such as grain and hay are highly inflexible and largely out of the control of the operator. Therefore, the portion of ultimate feedlot profitability which is within the control of the cattle feeder is purchase price. Feedlot operators, and their customers who own feedlot cattle, must have confidence that the price they may pay for feeder cattle for a given grade of feeder cattle is equitable with that given elsewhere in the country.

Additional Information Generated by the Project

Reinhardt, C.D., and W.D. Busby. 2013. An audit of the current U.S.D.A. Frame size scoring system. J. Anim. Sci. (submitted).

Reinhardt, C.D., and W.D. Busby. 2013. Relationship between U.S.D.A. Frame and Muscle Scores with feedlot performance and carcass traits. USDA Feeder Cattle Grading Presentation, St. Joseph, Missouri, February 6, 2013.

Queck-Matzie, Terri. 2013. “Graders get it right”, Drover’s Journal / Drover’s CattleNetwork, Updated: 05/14/2013. http://www.cattlenetwork.com/drovers/Graders-get-it-right-207402961.html.

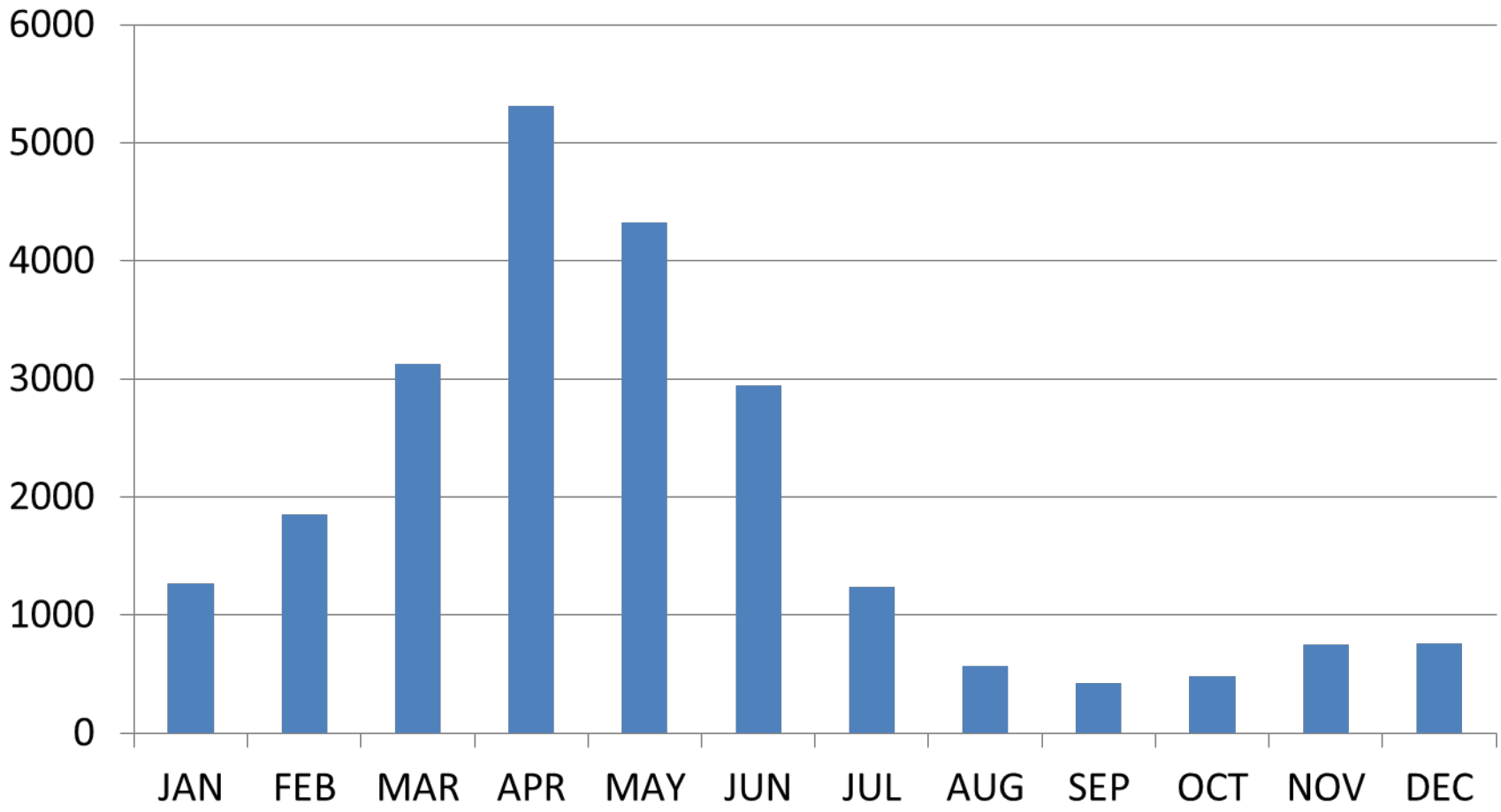
Cattle Grading Predictions vs. Final Outcome

Federal State Marketing Improvement Program
United States Department of Agriculture

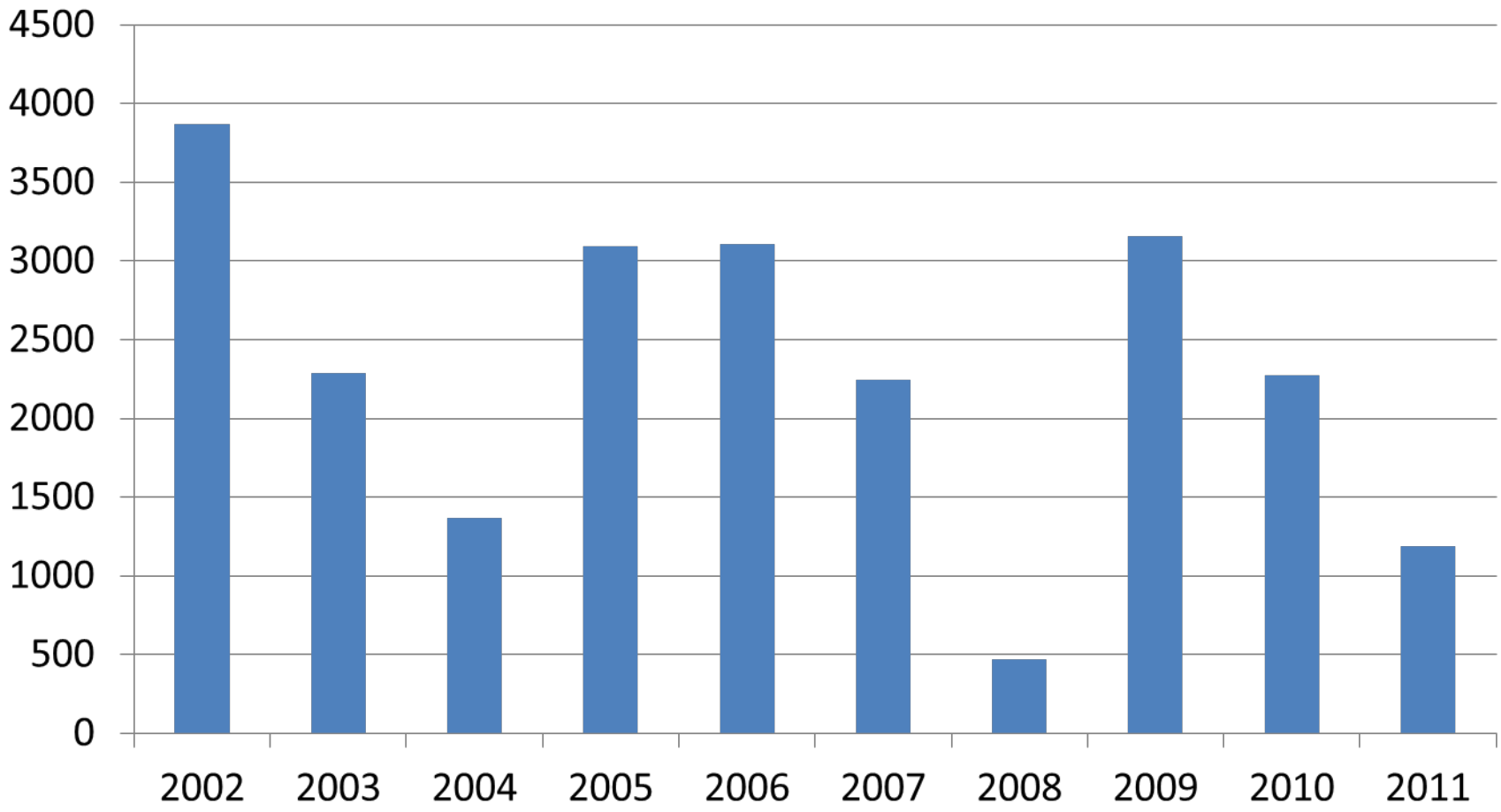
Chris D. Reinhardt
Kansas State University
and
Darrell Busby
Tri-County Steer Carcass Futurity

K·STATE
Research and Extension

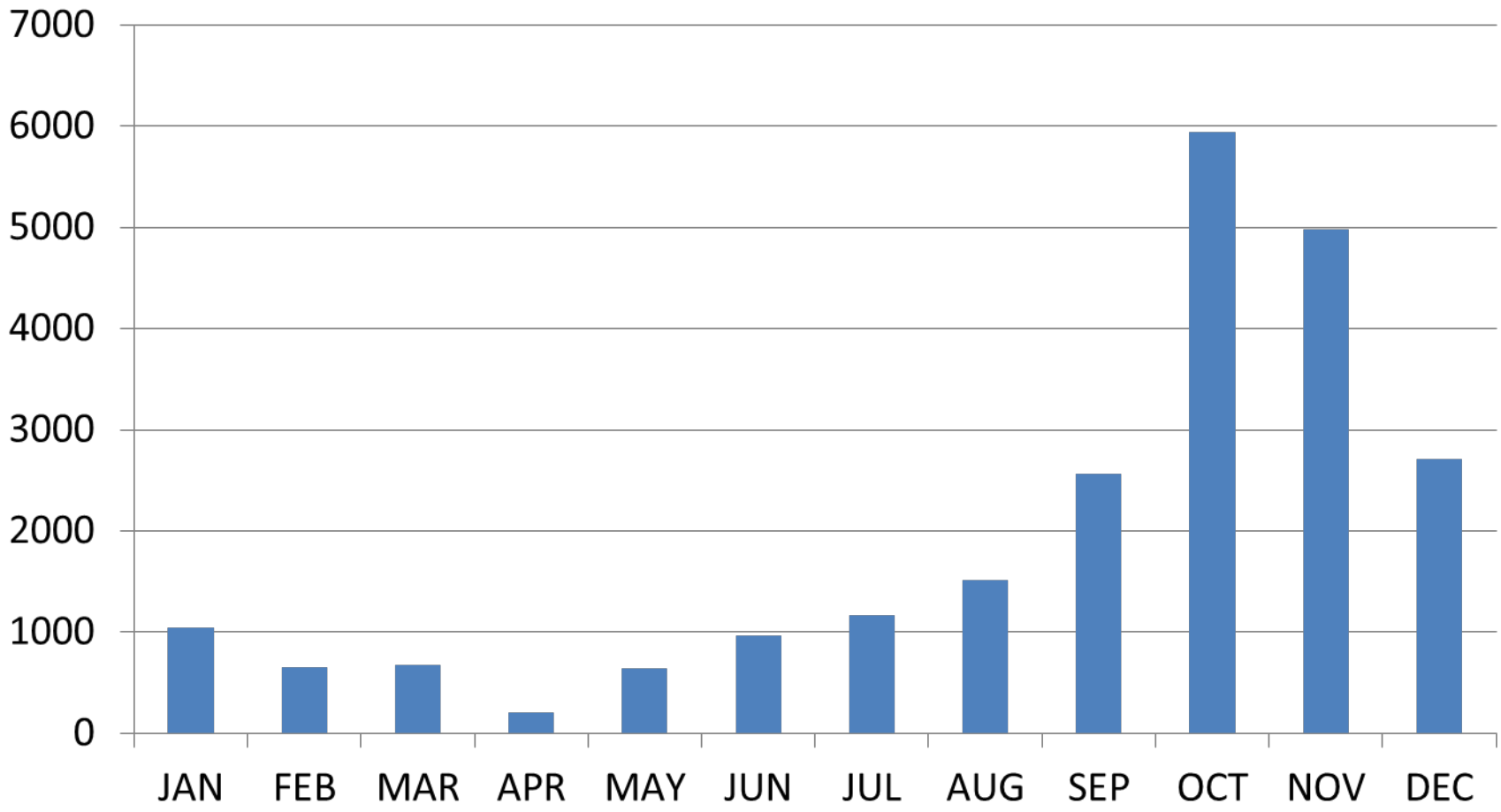
Month of Harvest



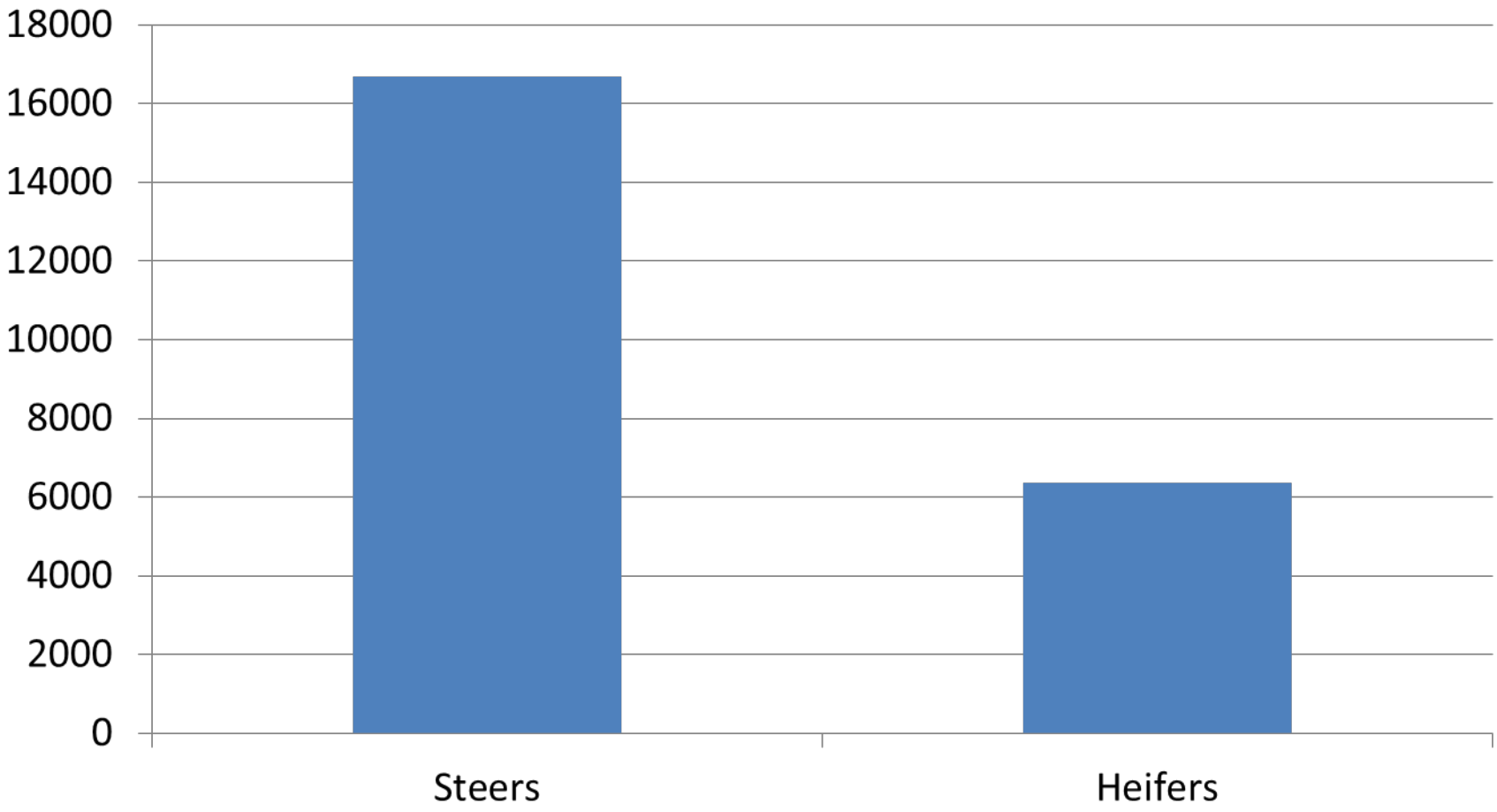
Year of Harvest



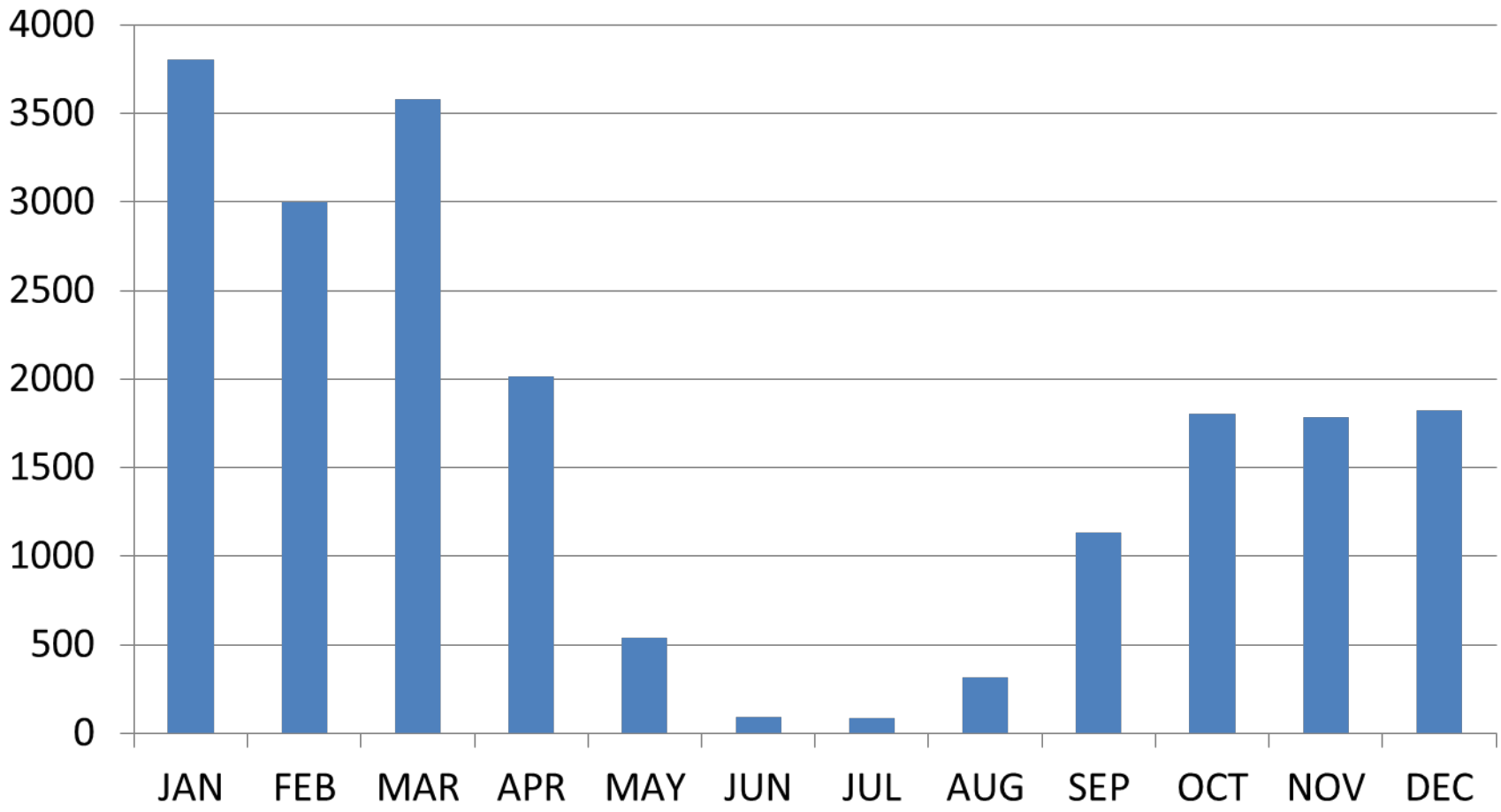
Month of Feedlot Arrival



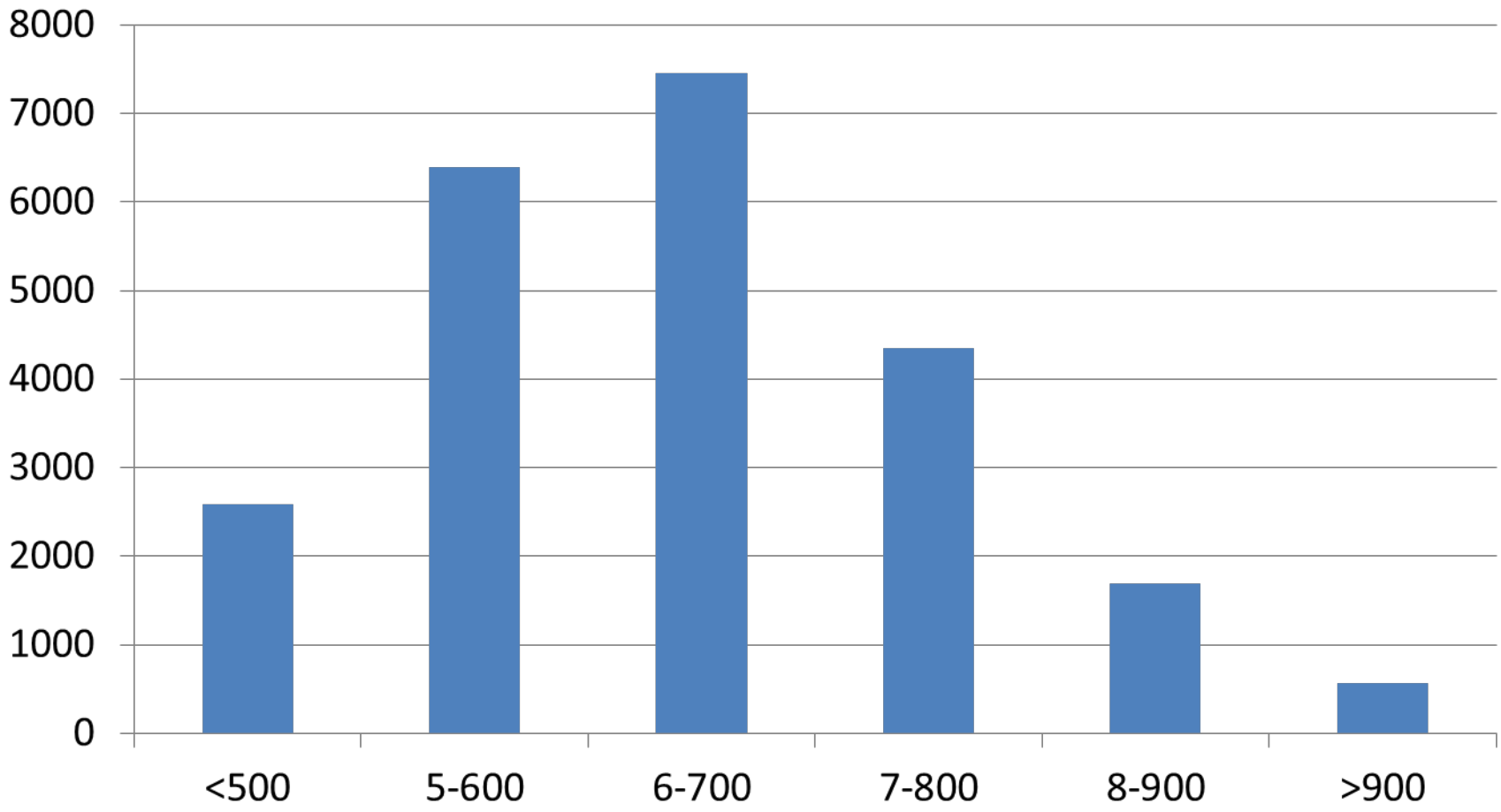
Sex Class


18000
16000
14000
12000
10000
8000
6000
4000
2000
0
Steers
Heifers

Month of Birth



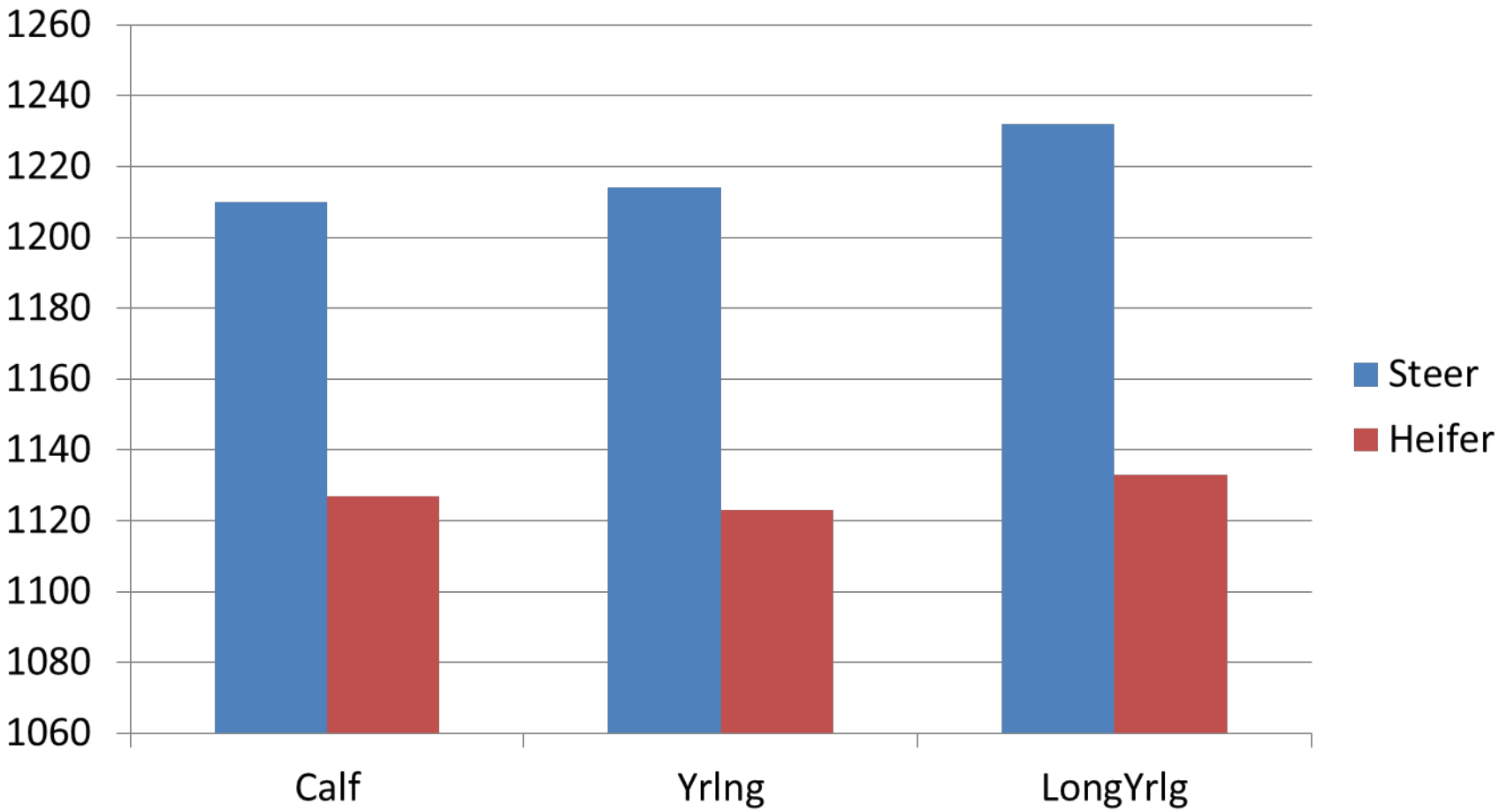
Arrival Weight



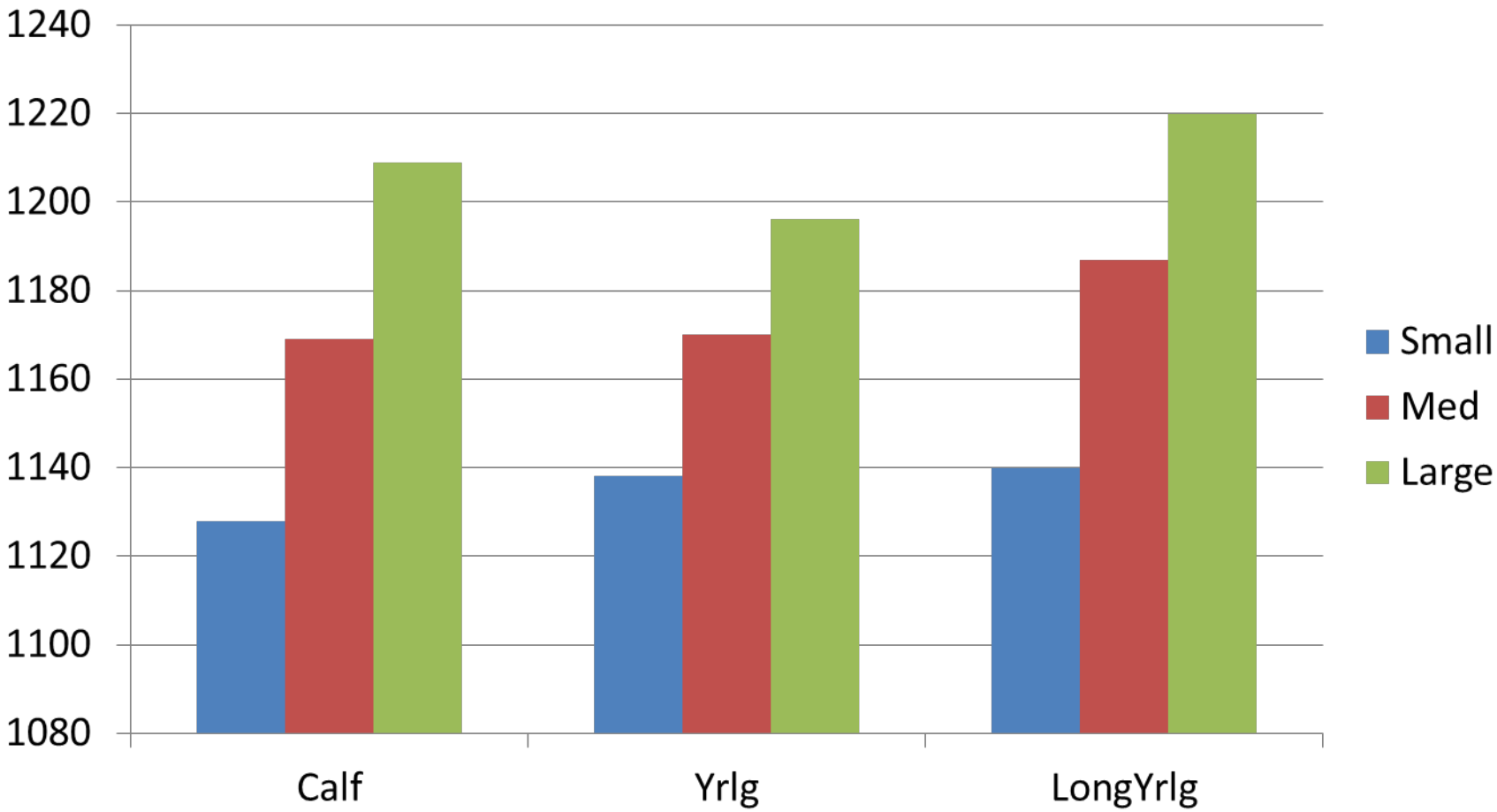
Summary of Analysis

- Performance and Carcass data
  - 23,057 head
- Analyzed with respect to effects of:
  - Frame Score
  - Muscle Score (adjusted)

Fat adj FinWt by Age x Sex

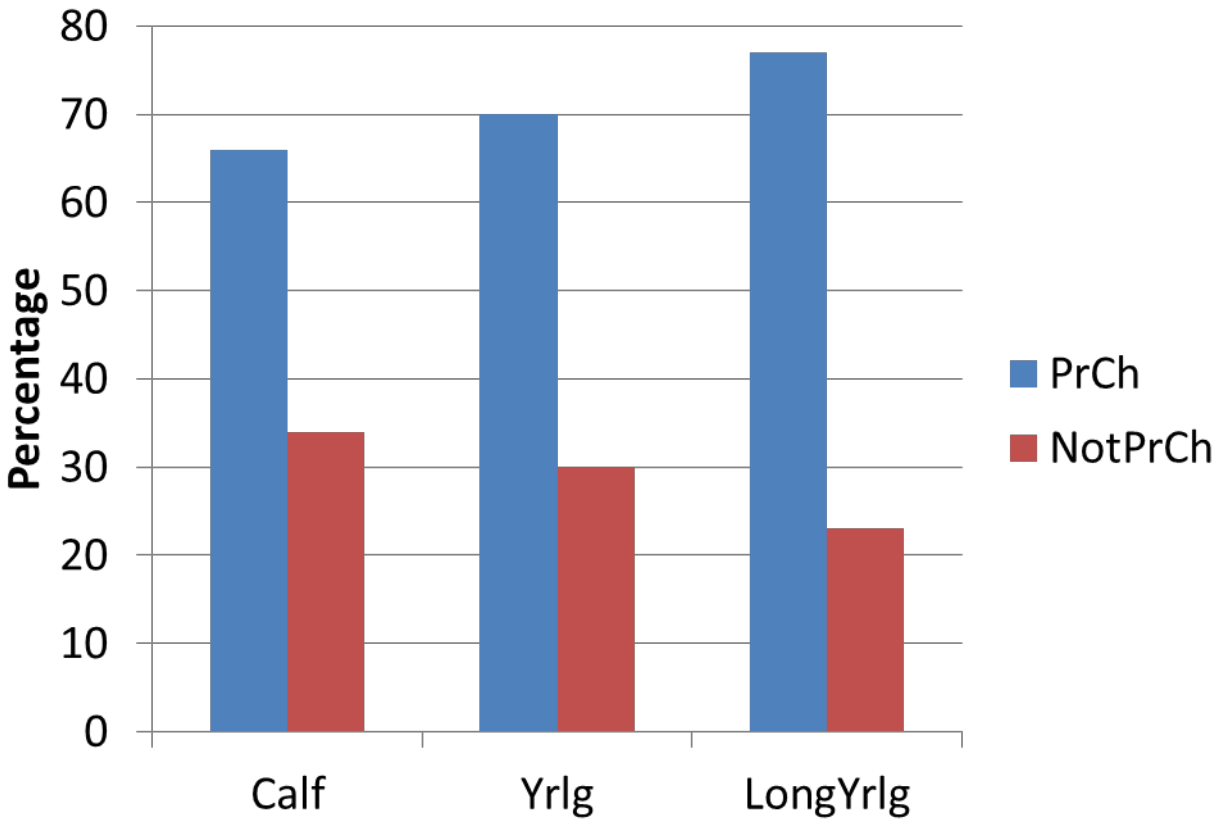


Fat adj FinWt by Age x Frame



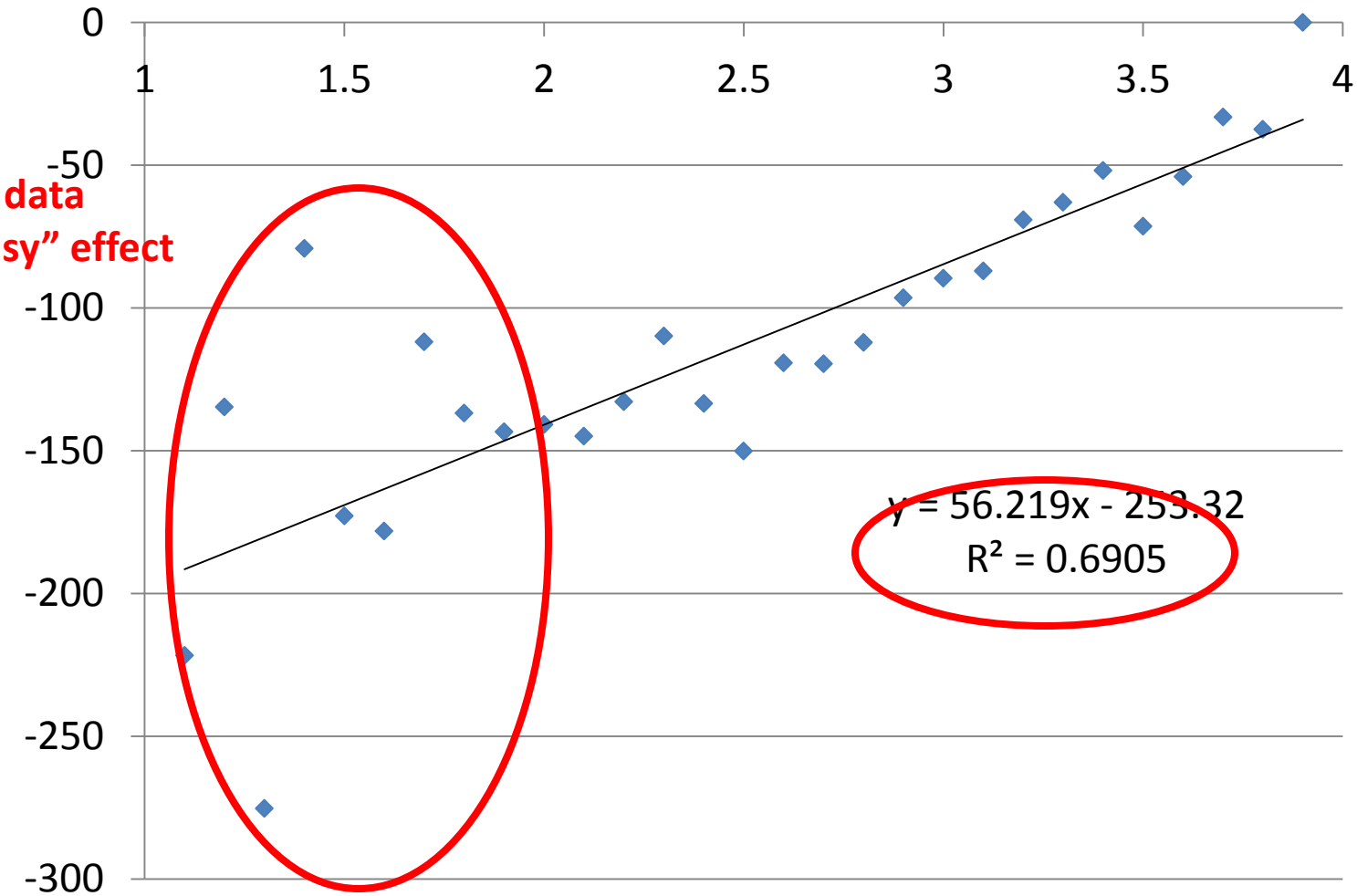
Age mattered in Small and Med, but not Large

PrCh by Age

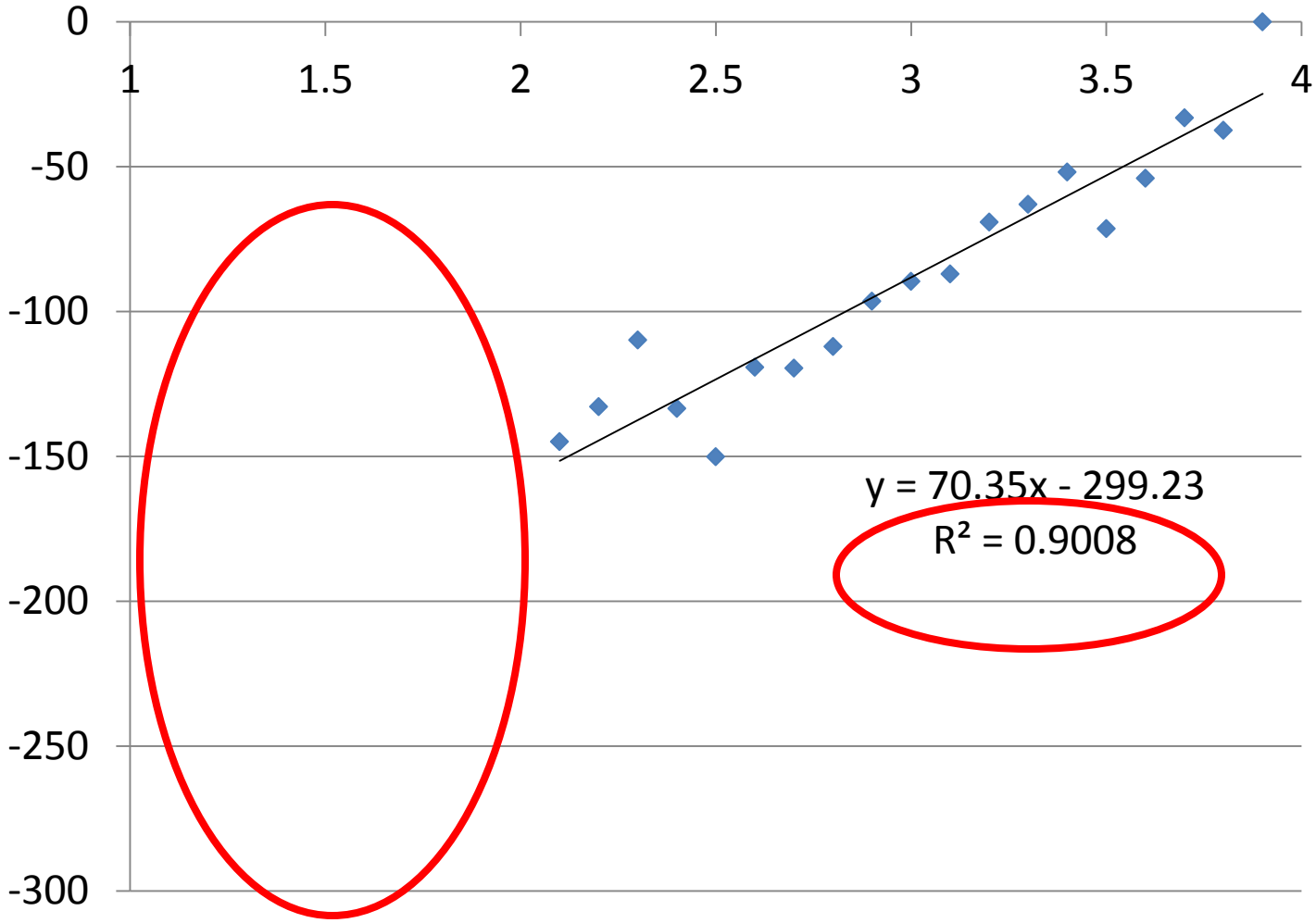

80
70
60
50
40
30
20
10
0
Percentage
Calf
Yrlg
LongYrlg
PrCh
NotPrCh

FINAL WT BY FRAME – ALL DATA

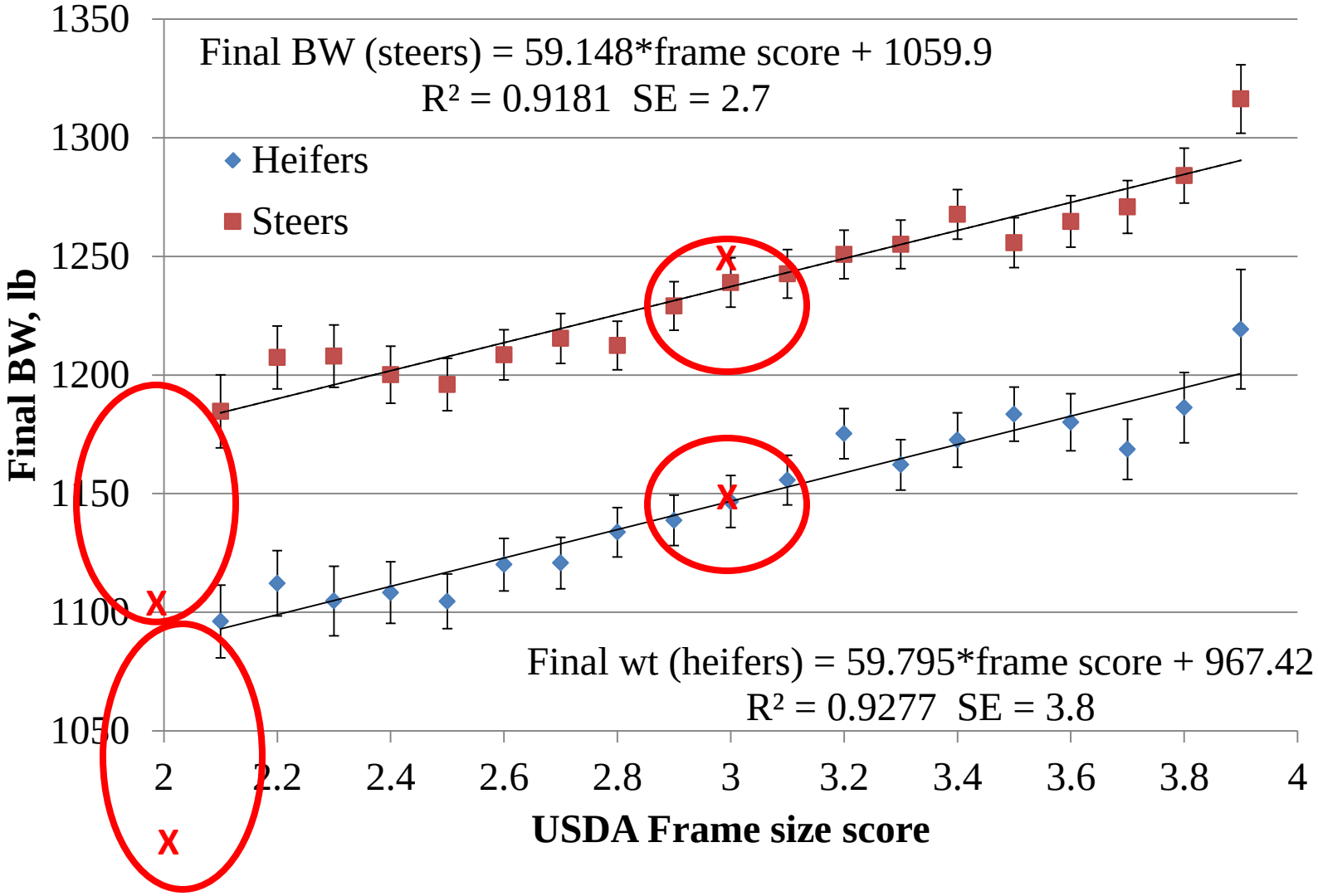
- **Few data**
- **"Noisy" effect**



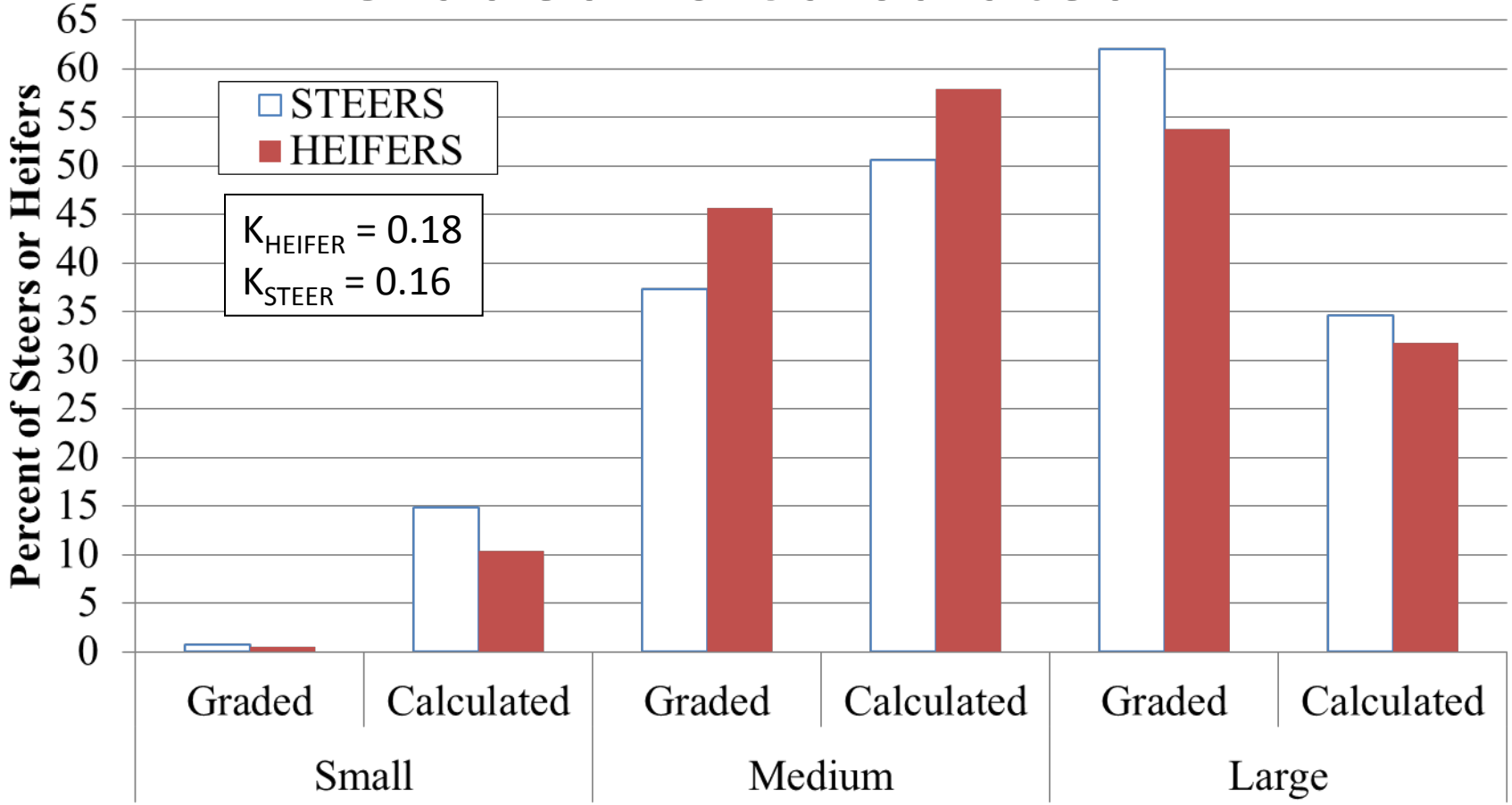
FINAL WT BY FRAME – TRIMMED DATA

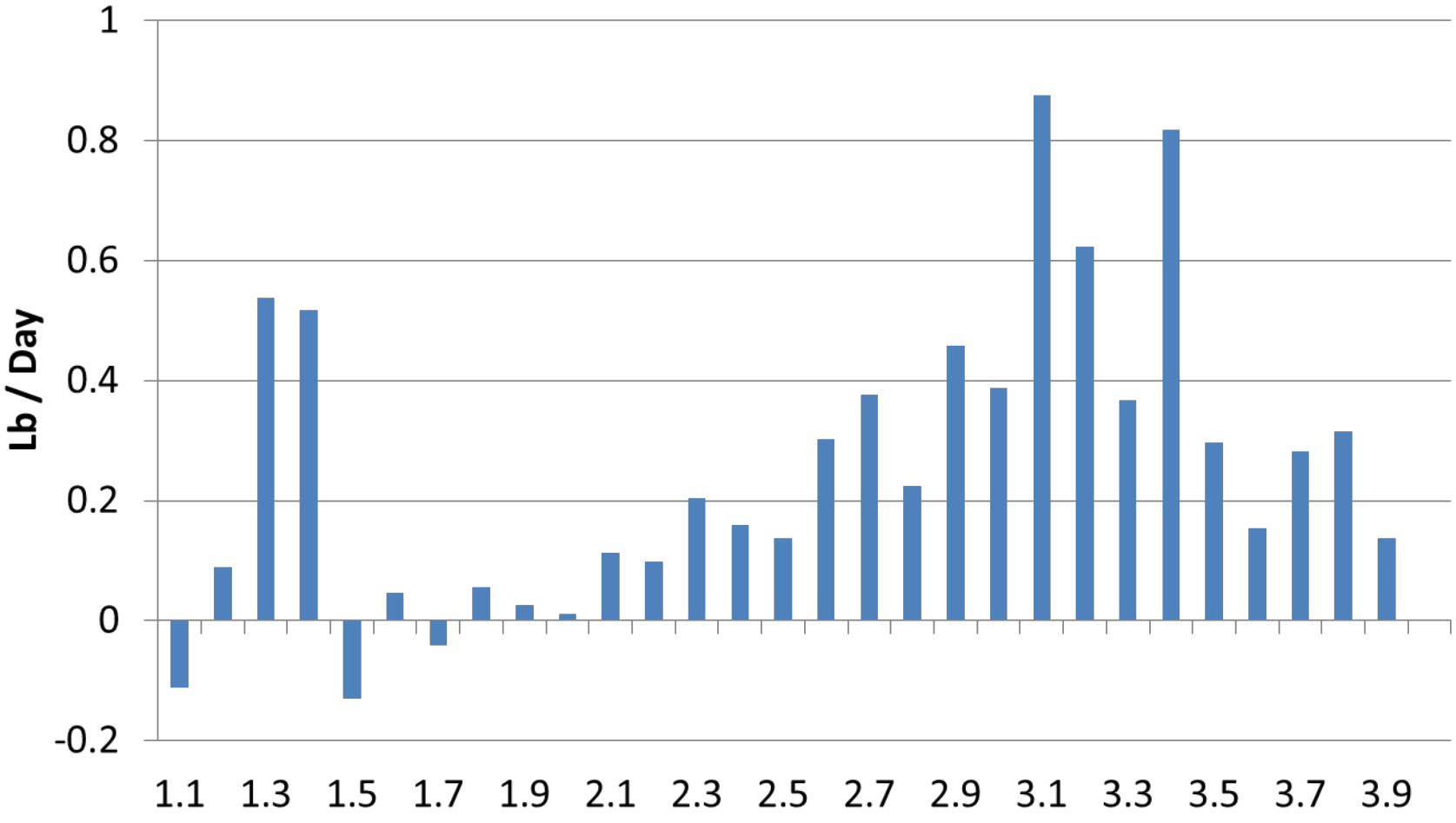


Final BW vs Frame: Adj to 0.50” BF



Small, Med, Large Frame: Graded vs Calculated



Kappa:
0.01–0.20 Slight agreement; 0.21– 0.40 Fair agreement; 0.41–0.60 Moderate agreement; 0.61–0.80 Substantial agreement; 0.81–0.99 Almost perfect agreement

ADG by MS