

## CHAPTER 7

### Genetic Selection for Cow Efficiency: What is Next Step?

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# Genetic Selection for Cow Efficiency: What is the Next Step?



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# Economically Relevant Trait

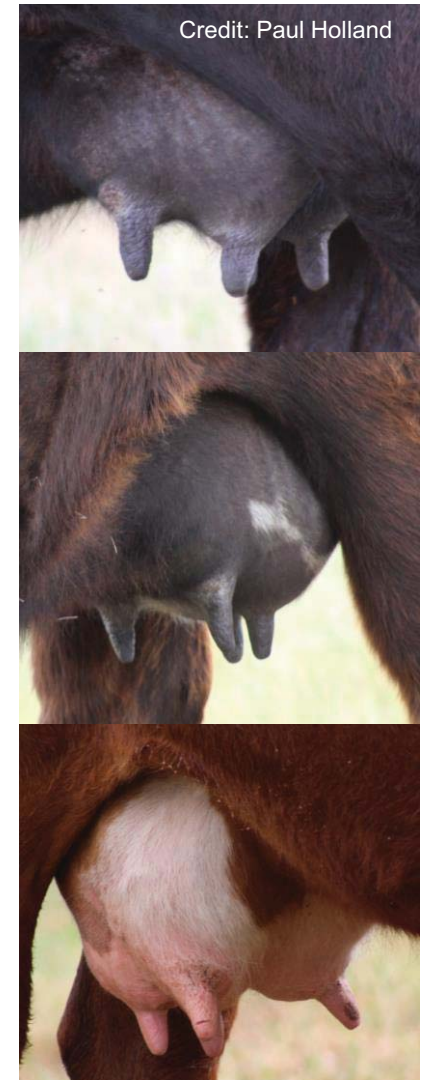
Credit: Paul Holland

- ERT is a trait that directly impacts cost or revenue.
  - Cow Maintenance Feed Requirement
  - Longevity or Stayability
- Incomplete observations or cost prohibitive traits make it challenging to select on



# Indicator Trait

- An indicator trait does not have a direct effect on cost or revenue, but is related to an ERT.
- Example:
  - Cow Maintenance Feed Requirement: Mature Cow Weight, Cow Body Condition Score, Milk Production, Gut Weight, Liver Weight
  - Longevity and Stability: Calving Records, Days to Calving, Calving Interval, Milk Production



# Biological Efficiency

- “The capacity to convert physical inputs into marketable product under prevailing production conditions.” – D. Notter (2002 BIF Proceedings)
- Still... “Cow Efficiency” vs. “Growth Efficiency” differ in supporting biological traits.
- Individual-animal level vs. industry level



# Economic Efficiency

- Ratio of production cost per unit of animal product (Dickerson, 1976)
  - Avoids market fluctuations and stabilizes selection programs.
  - Need ERT



# Cow Efficiency

- # of calves weaned per cow exposed → biological
- Weight of weaned calves → economic
  - Still needs to be coupled with annual feed intake of the cow...
- Other effects?
  - Transmission of post weaning growth to progeny? Milk production based on production environment or threshold level? Optimum size?

# Selection?

- Reduce environmental variability as much possible
- Select to improve genetics, BUT:

$$P = G + E + (G * E?)$$

- Early indicators? Genotypes, Metabolic markers
- Focus is on bull selection, but should that be it?





Credit: Paul Holland

B4072 (LG, FS 8)

F:G at trial: 9.3 (lb:lb)

1<sup>st</sup> Calf % of BW: 7.5, 28

BW: 86, WW: 442 lb, Steer

2<sup>nd</sup> calf produced

B4197 (SM, FS 3)

F:G at trial: 16.7 (lb:lb)

1<sup>st</sup> Calf % of BW: 8.8, 41.9

BW: 50, WW: 356 lb, Heifer

2<sup>nd</sup> calf produced





Credit: Paul Holland

B4181 (ML, FS 6.5)  
F:G at trial: 10.4 (lb:lb)  
1<sup>st</sup> Calf % of BW: 7.7, 35.5  
BW: 62, WW: 417 lb, Heifer  
 2<sup>nd</sup> calf produced

B4152 (MS, FS 5)  
F:G at trial: 10.3 (lb:lb)  
1<sup>st</sup> Calf % of BW: 8.3, 39.6  
BW: 76, WW: 481 lb, Heifer  
 2<sup>nd</sup> calf produced

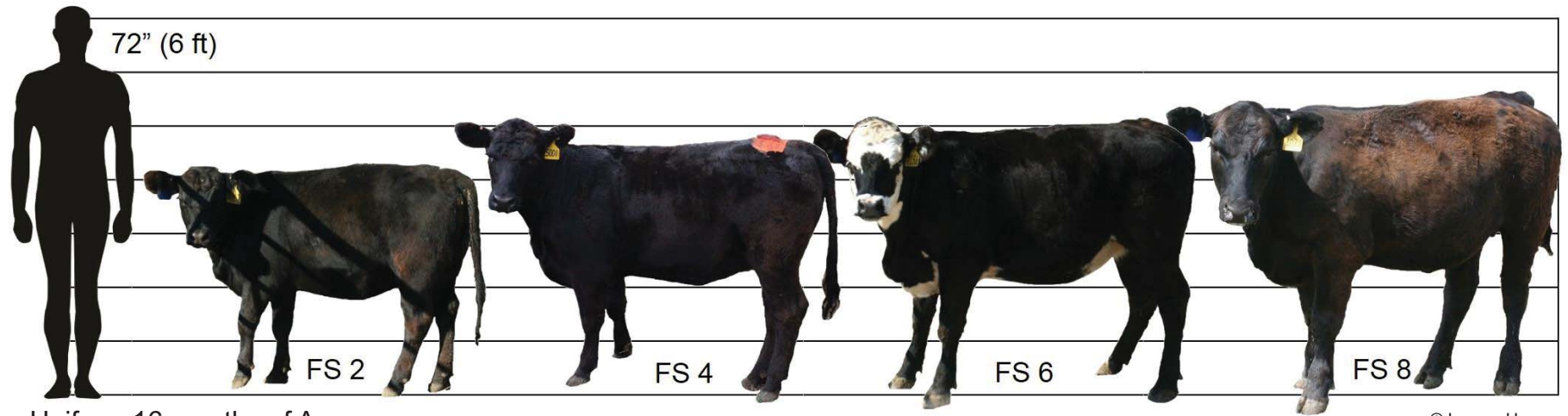


# Breeding Goals/Objectives

- Defining a set of traits to be improved or maintained in a given production system.
  - Typically focused on genetic basis of these.
- A selection index is an estimate of a breeding goal.

What does a “cow efficiency” index look like?

- \$ Cow?
- Calving Ease Index?
- Heifer Pregnancy?
- Stayability?
- Cow energy savings?
- None of the above?



Heifers, 16 months of Age

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Looking Forward: Impact of

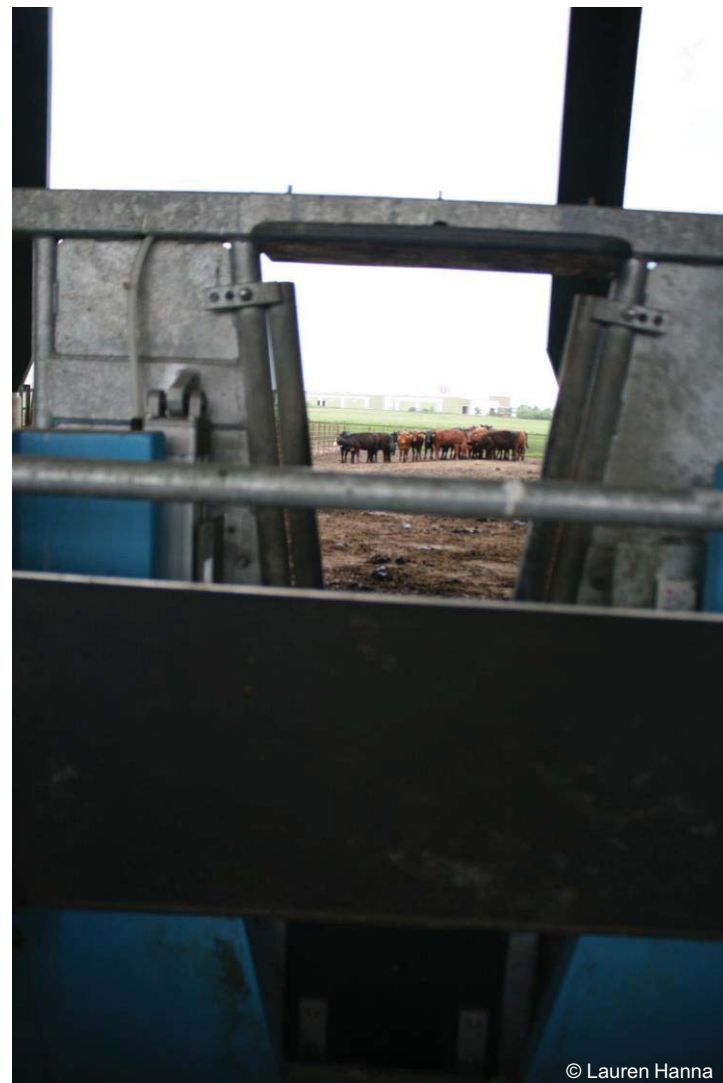
# FRAME SIZE, EFFICIENCY, AND LONGEVITY

in a commercial cow herd.

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# Project Objectives

- To identify measurable and practical criteria as preferred indicators of efficiency and longevity for potential use in genetic evaluation programs.
- To identify genomic regions contributing to efficiency, longevity, or both in beef cows.
- To determine relationship of the dam's longevity, efficiency, frame size, or a combination of these traits on progeny (steers and heifers) performance or value.



# Grouping Key

## Frame Size Category

- Based on calculated frame size using BIF guidelines (hip height and age at measurement)
- Category Levels:
  - SM is less than 4.00
  - MS is between 4.00 and 5.50
  - ML is between 5.51 and 6.50
  - LG is greater than 6.50

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## Gain:Feed Category

- Based on population's grouping into quarters, adjusted for year.
- Category Levels: 1, 2, 3, and 4
  - 4 is most efficient
  - 1 is least efficient

## Photo Symbol Key:



= Flagged (Lack of 2<sup>nd</sup> Calf)



= In Pen



= Sold (Lack of 1<sup>st</sup> Calf, typically)

# Current Status: By the Numbers

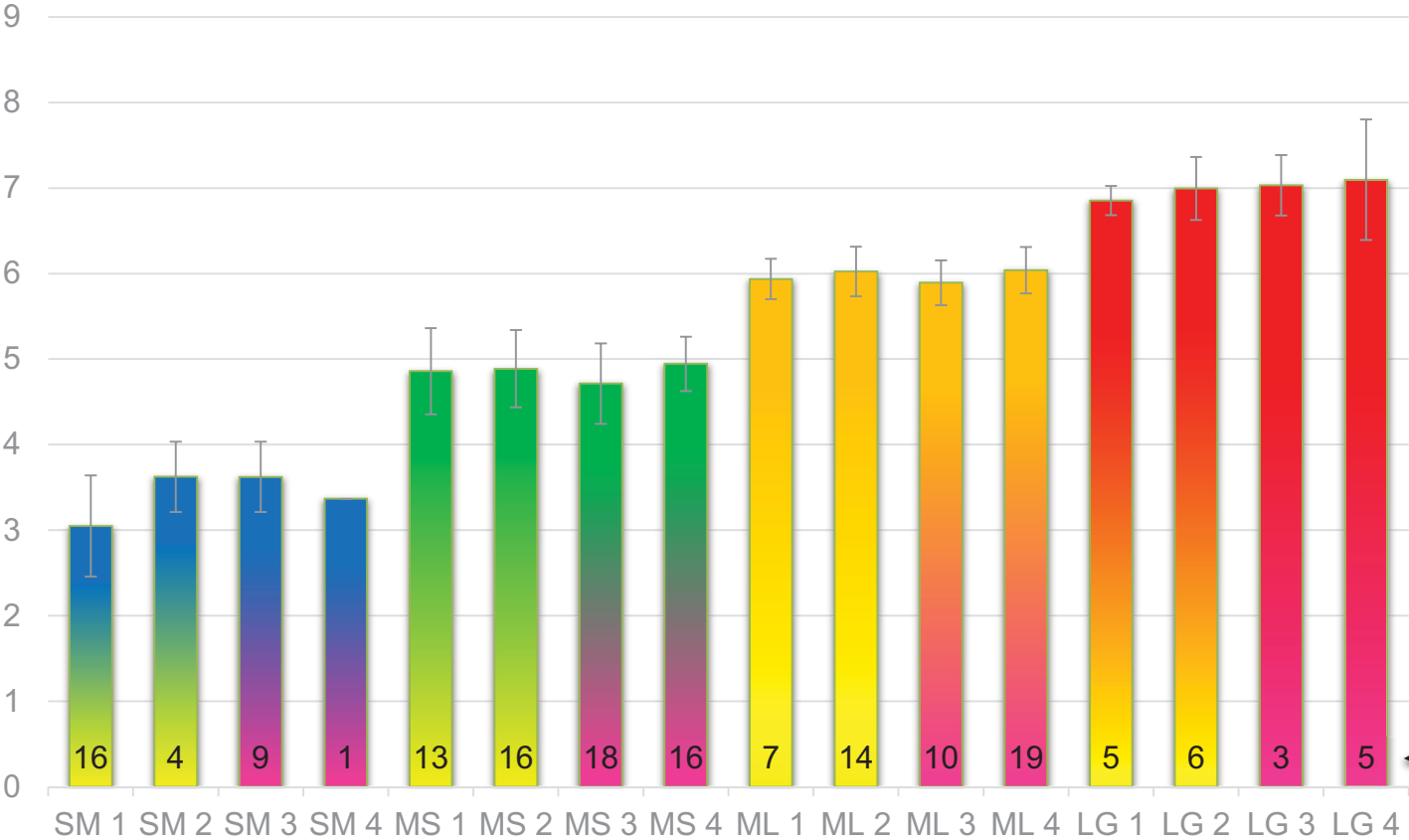
Heifer Status	2014 Born	2015 Born	2016 Born
No. to BCRC	99	81	62 (45)
No. Trained & Completed Feed Trial	89	73	55 (45)
No. Bred (Feed Trial)	83	66	?
No. Successfully Wean First Calf	<u>78</u>	<u>62?</u>	
No. Bred Back	72		
No. Successfully Weaned Second Calf	71?		

Group	Project	Daughters	Total
SM	3	11	14
MS	28	31	59
ML	21	3	24
LG	3	0	3



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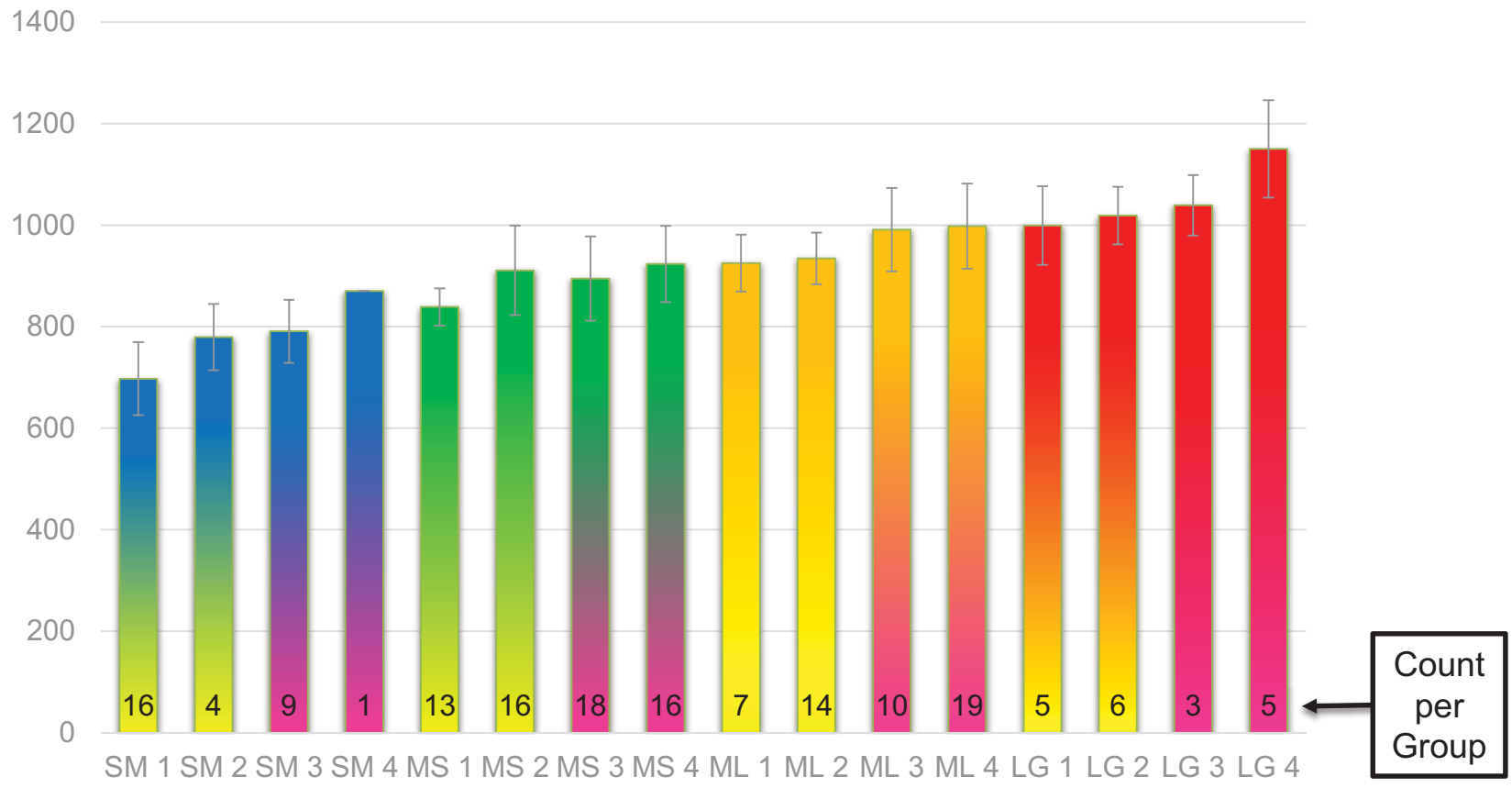
# Average Frame Score



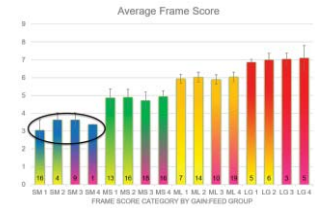
FRAME SCORE CATEGORY BY GAIN:FEED GROUP



# Average Trial Final Body Weight (lb)

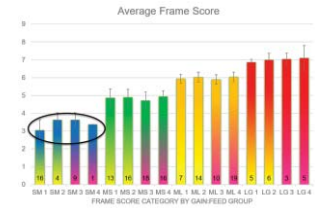


# Small (SM) – G:F Group 1



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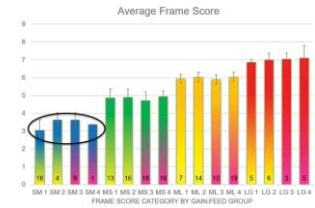
# Small (SM) – G:F Group 2



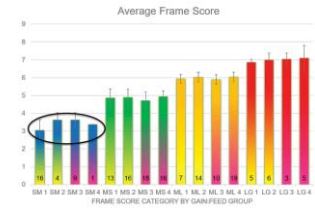
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# Small (SM) – G:F Group 3



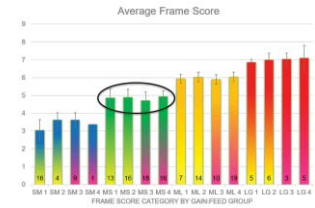
# Small (SM) – G:F Group 4



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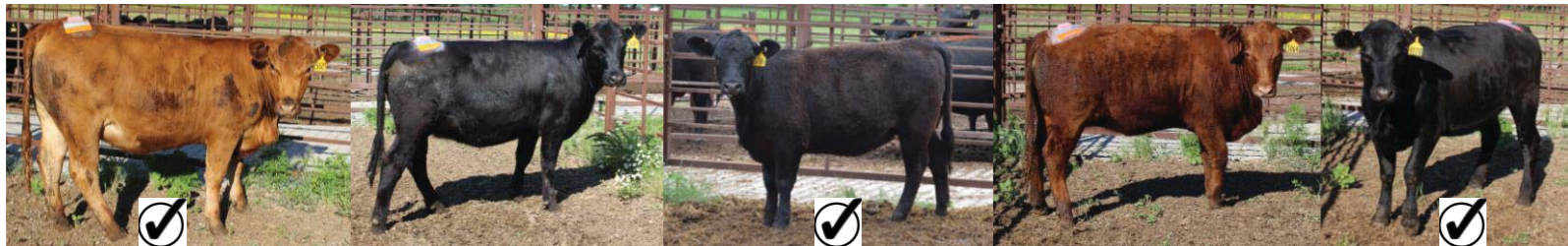
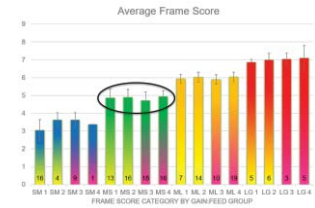
# Mod. Small (MS) – G:F Group 1



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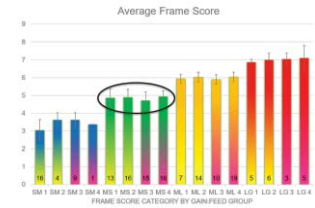
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# Mod. Small (MS) – G:F Group 2



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# Mod. Small (MS) – G:F Group 3

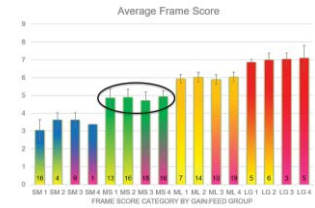


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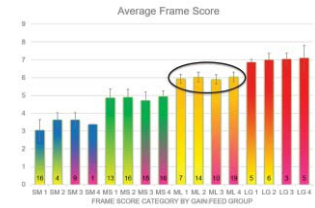


# Mod. Small (MS) – G:F Group 4



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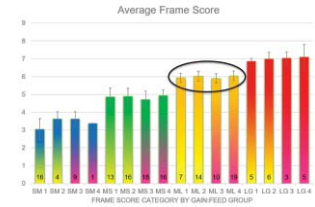
# Mod. Large (ML) – G:F Group 1



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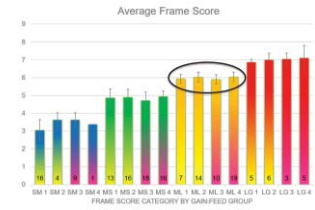
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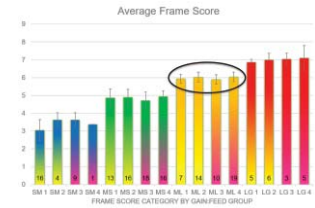
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# Mod. Large (ML) – G:F Group 3



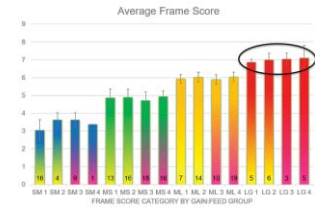
# Mod. Large (ML) – G:F Group 4



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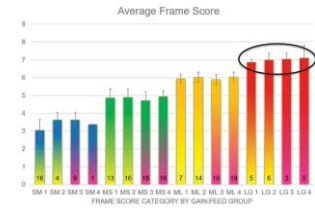
# Large (LG) – G:F Group 1



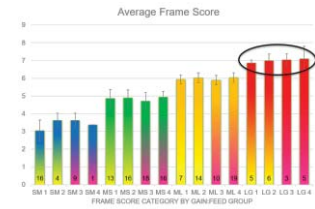
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# Large (LG) – G:F Group 2



# Large (LG) – G:F Group 3

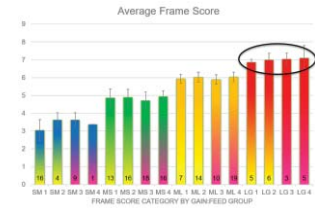


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# Large (LG) – G:F Group 4



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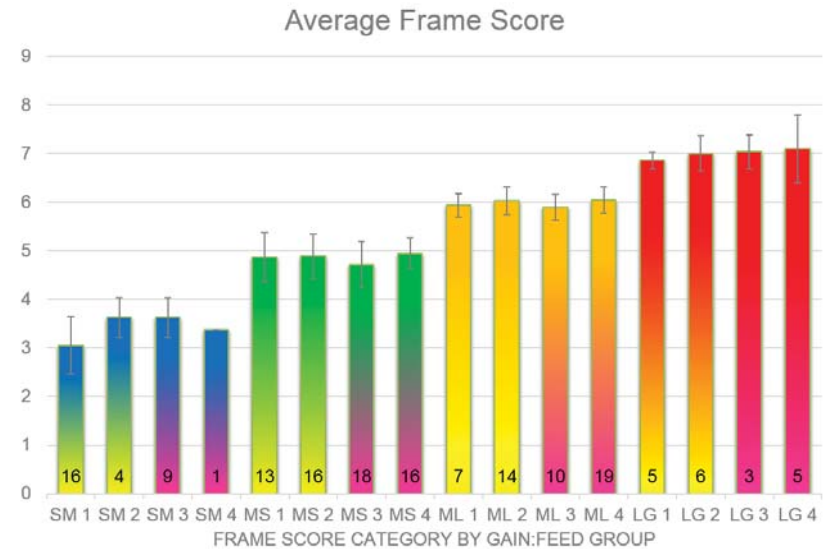
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# Breakdown of Heifers Lost

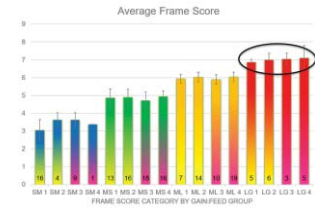
Size Group	First Year		Second Year	
	Sold	Total To Date	Flagged	Total To Date
SM	5 (16.7%)	30	0 (0.0%)	17
MS	4 (6.3%)	63	6 (17.6%)	34
ML	8 (16.0%)	50	0 (0.0%)	26
LG	1 (5.3%)	19	1 (7.1%)	14



Even with this loss, average frame sizes still follow



# Large (LG) – G:F Group 4



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# Next Steps?

- Creating or understanding a measure that accurately reflects “cow efficiency”
  - This is long-term, what about early indicators?
- Heritability, genomic control, and selection avenues?

# The Research Team

- Principle Investigators:
  - Dr. Lauren Hanna (animal breeding and genetics)
  - Dr. Kendall Swanson (ruminant nutrition)
- Collaborators:
  - Dr. Kim Vonnahme (reproductive physiology)
  - Dr. Carl Dahlen, Beef Cattle Extension Specialist
  - John Dhuyvetter, Area Livestock Extension Specialist
  - Dr. Rob Maddock (meat science)
  - Dr. Gerald Stokka, Livestock Stewardship Extension Specialist
- Contributors:
  - Dr. Kris Ringwall, Dickinson Research Extension Center Director

