Using DNA paternity testing to evaluate commercial bull performance

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Outline

- Overview of CA commercial ranch project
- Prolificacy of commercial sires
- Selection for prolificacy
- Calving pattern of prolific sires
- Selective genotyping for prolificacy

United States Department of Agriculture
National Institute of Food and Agriculture

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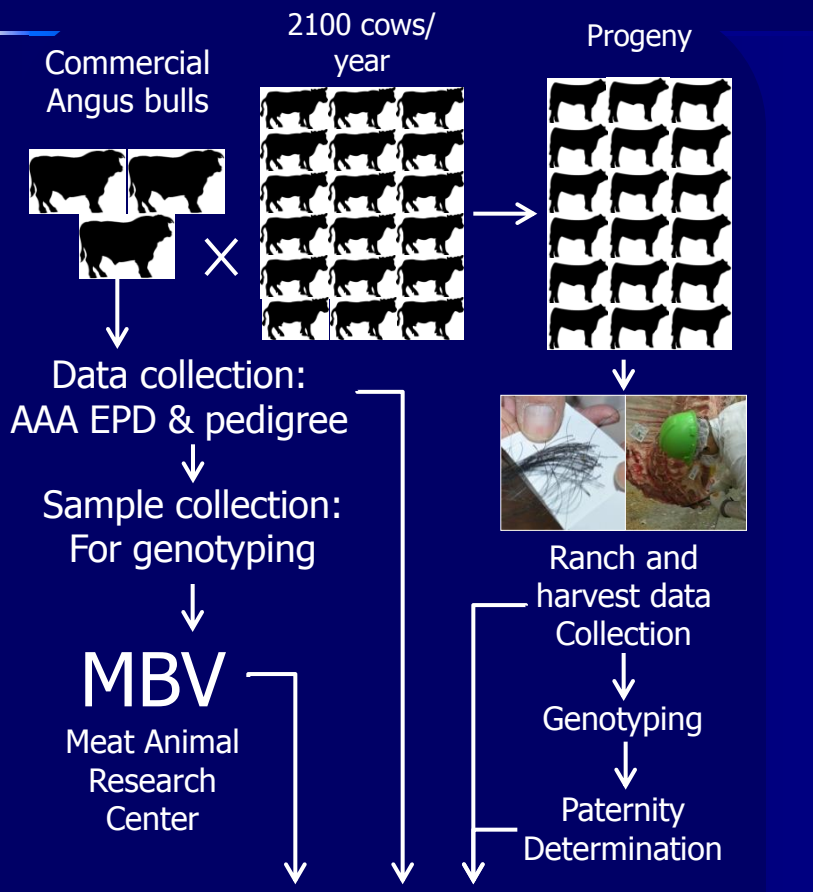
California Commercial Ranch Project



Three ranches:

- Ranch A (900 cows)
- Ranch B (500 cows)
- Ranch C (700 cows)

Approximately 120 Angus bulls, 15 "other" breed bulls and 6000 calves were enrolled on the project

Objective: *Evaluate bull performance in multi-sire breeding pastures*

Materials and Methods

- Hair samples were collected on calves from natural service multi-sire breeding pastures from 3 commercial ranches in northern CA representing **15** calf crops over 3 years
- Samples were genotyped using the SeekSire parentage panel (Geneseek, a Neogen Co., Lincoln, NE), including between 96-99 SNP
- A sire was assigned a calf if it was the only bull with none or one opposite homozygous genotype (i.e. mismatches) with the calf genotype.
- Single sire matches were called on 5,052 calves (~98% of the samples genotyped from these 3 ranches)

Cowley Ranch

~20 bulls/season


Kuck Ranch
~10 bulls/season

Mole-Richardson Farms

~30 bulls


agrident
TEKLOGIX
WORKABOUT PRO


DELL
DYMO
LabWriter 400 Turbo


212
8400030048835 80
10/21/2008

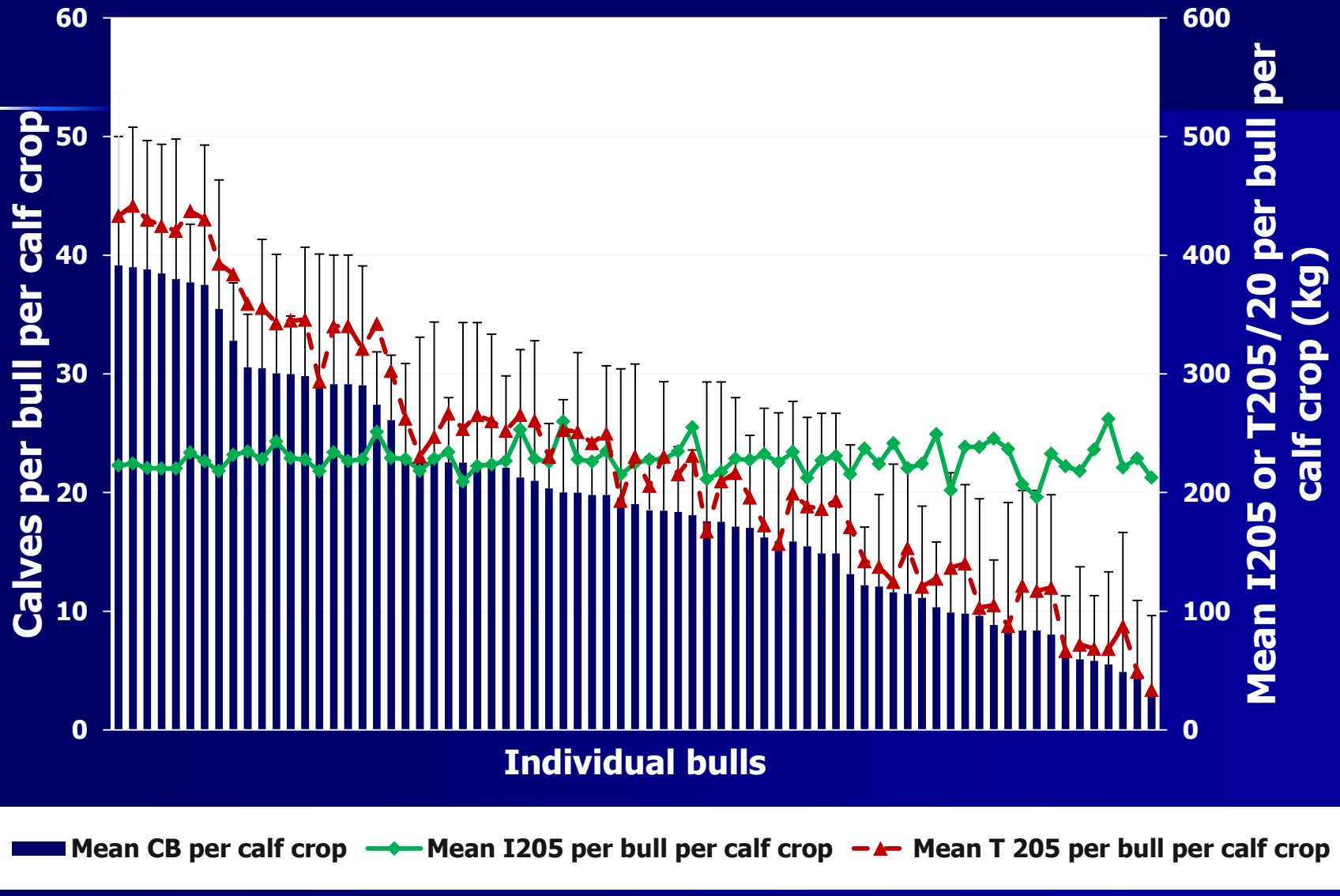
Natural service bull reproductive performance on 3 California commercial beef ranches (A, B and C) in multi-sire breeding pastures

						Per bull		
Ranch	Year	Calf crop	# of sires	Mean bull age±SEM	Total # of calves	Min # calves	Max # calves	Mean # calves±SEM
A	2009	Spring	18	4.3±0.3	353	3	47	19.9±3.8
A		Fall	19	3.5±1.4	346	1	47	19.6±18.2
A	2010	Spring	22	4.3±0.9	435	3	45	19.8±3.8
A		Fall	19	3.9±1.2	328	1	48	18.4±22.1
A	2011	Spring	17	4.7±1.2	402	4	53	24.2±4.7
A		Fall	19	4.2±1.8	286	1	33	16.8±14.5
B	2009	Spring	8	4.3±0.3	141	1	45	16.7±10.0
B		Fall	10	4.3±0.3	214	10	50	21.8±9.3
B	2010	Spring	8	3.0±1.1	142	3	30	16.5±7.4
B		Fall	12	4.3±0.3	247	4	44	20.2±12.9
B	2011	Spring	4	4.3±1.4	110	18	42	26.5±14.4
B		Fall	12	4.6±1.6	266	3	51	22.8±6.2
C	2009	Fall	30	4.3±1.2	642	2	54	20.3±3.0
C	2010	Fall	27	4.6±1.7	567	1	52	19.9±3.8
C	2011	Fall	38	5.5±0.9	573	1	64	14.4±5.7
A	2009-2011		114	4.1±0.7	2150	1	53	18.6±6.0
B	2009-2011		54	4.8±0.5	1120	1	51	19.9±3.8
C	2009-2011		95	3.9±1.6	1782	1	64	21.1±13.2
A,B,C	2009-2011		263	4.4±1.7	5052	1	64	18.9±13.1

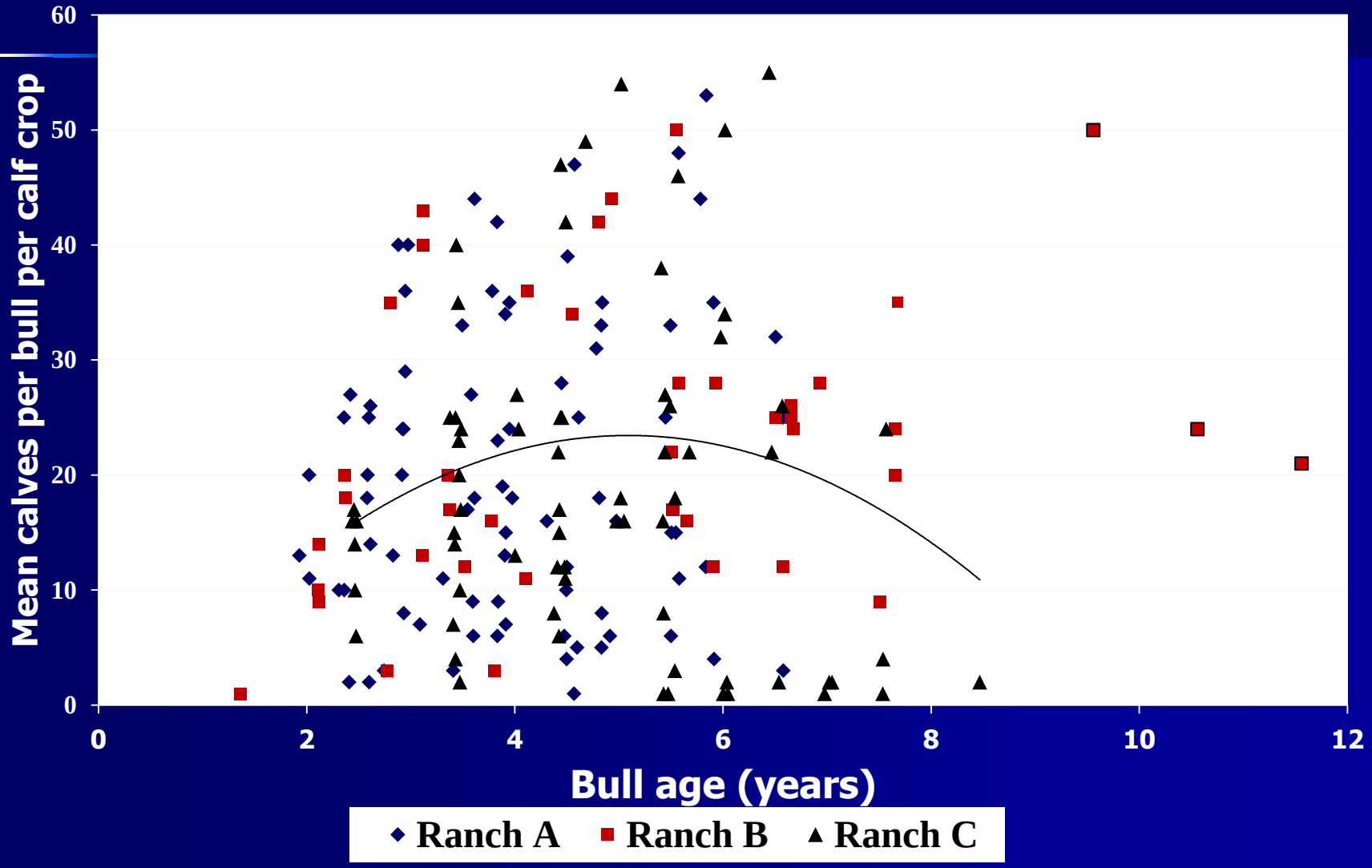
Number of calves per bull (CB)

- Reproductive failure, i.e. no calves produced, occurred in 4.4% of the bulls (12/275 bull breeding season opportunities)
- The overall mean number of calves per bull (CB) was 18.9±13.1, with little variation between ranches
- Calf crop mean CB showed little variation (P=.51) ranging from 14.4±5.7 to 26.5±14.4
- Similarly differences between years (19.9±3.8, 20.1±1.9 and 19.7±7.7, P=.96), and season (spring 20.5±12.2, fall 19.2±5.0, P=.94) for CB were small.
- However, mean CB per bull varied widely (P<.01) ranging from means of 3.3±6.3 to 39.1±10.9 CB.
- Total adjusted 205d weight differed significantly between bulls ranging from **676 – 8,838** kg per bull per calf crop (P<.01)

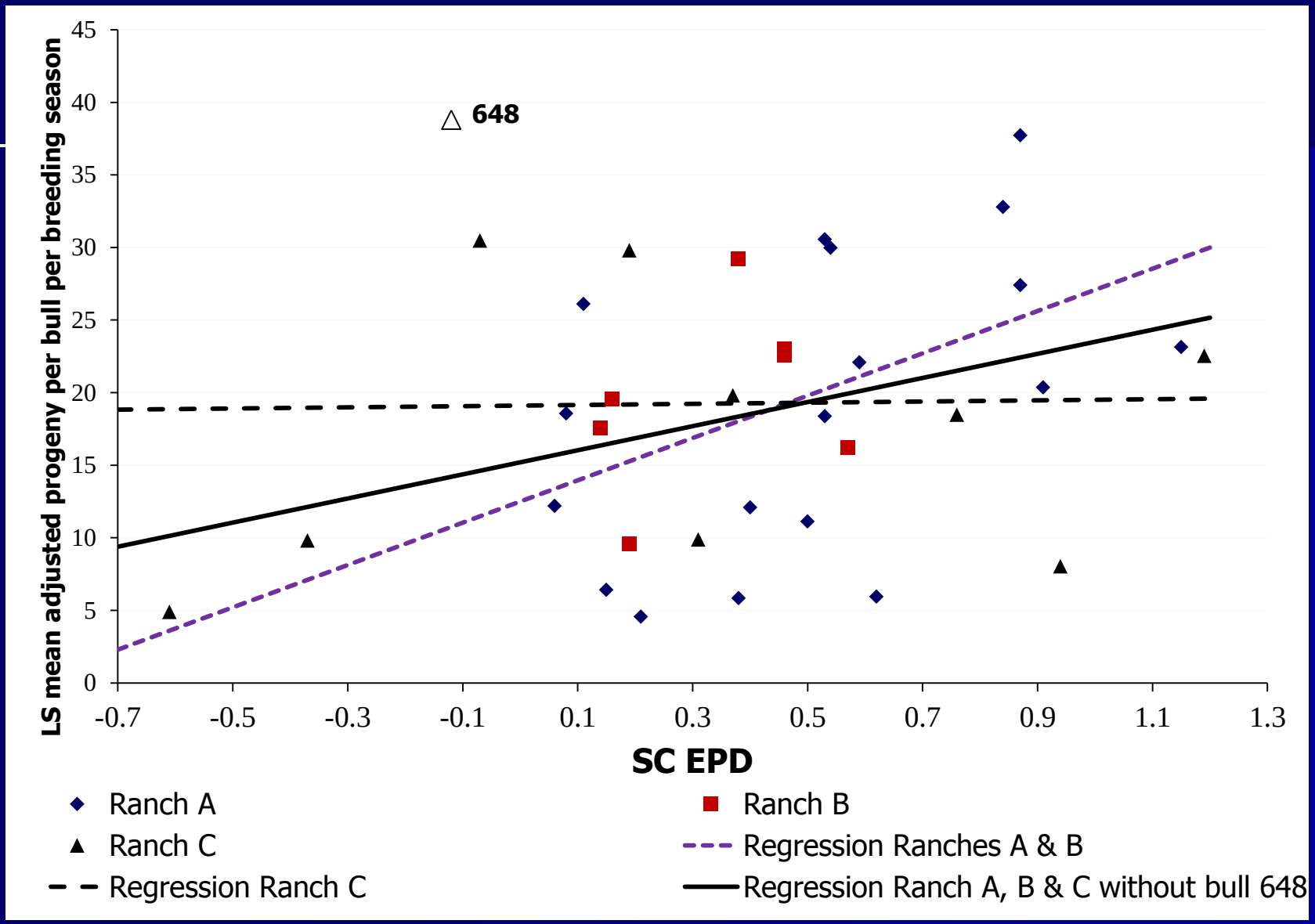
The mean number of calves per bull (CB) per calf crop varied widely (P<.01). Average Individual 205d sex adjusted wt (I205) or Total 205d sex adjusted weight (T205) also differed (P<.01) between bulls.



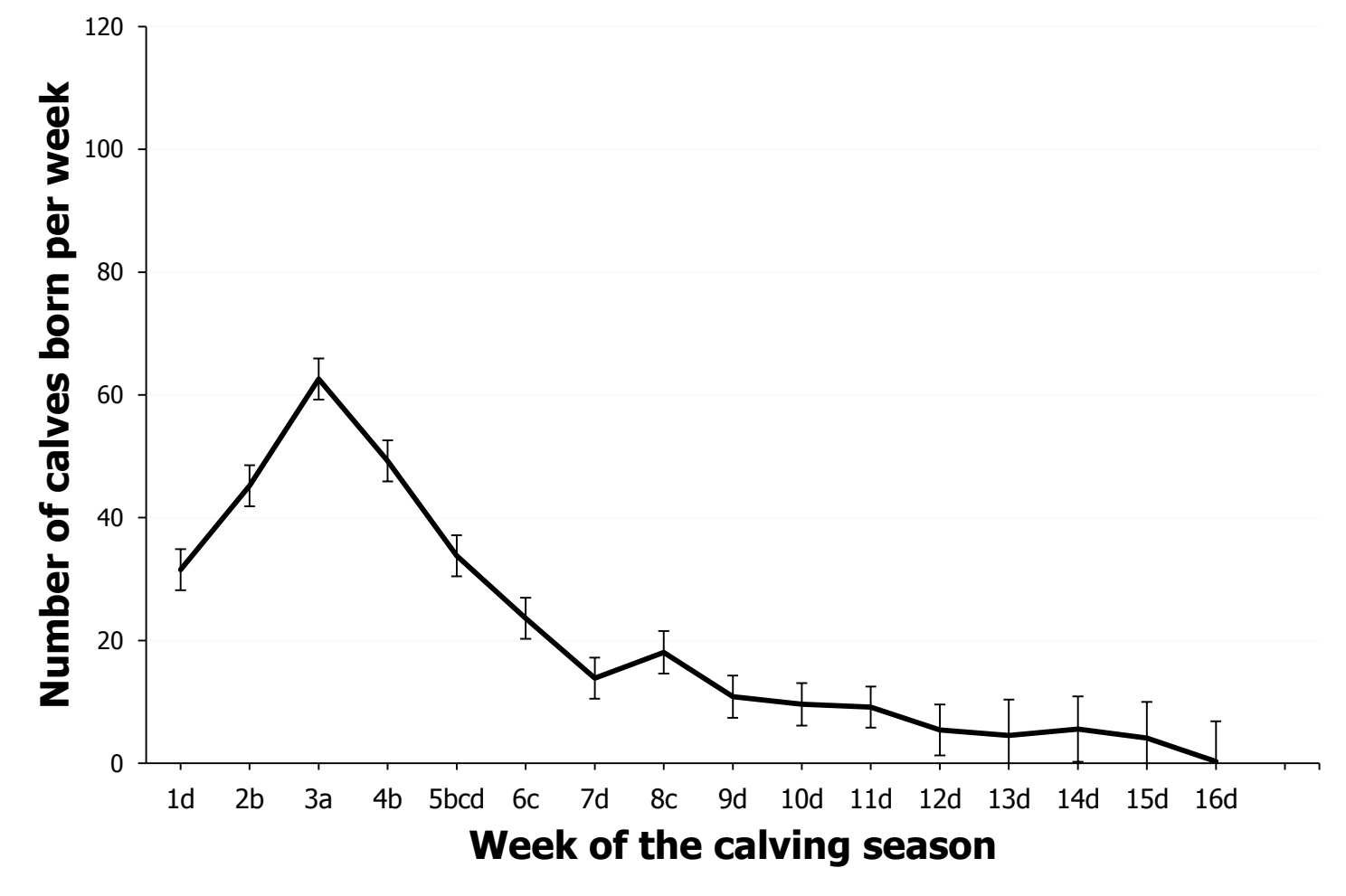
Prolificacy was curvilinear for bull age (P=.03) with the peak CB at about 5 years of age for bulls from 2 to 11 years of age.



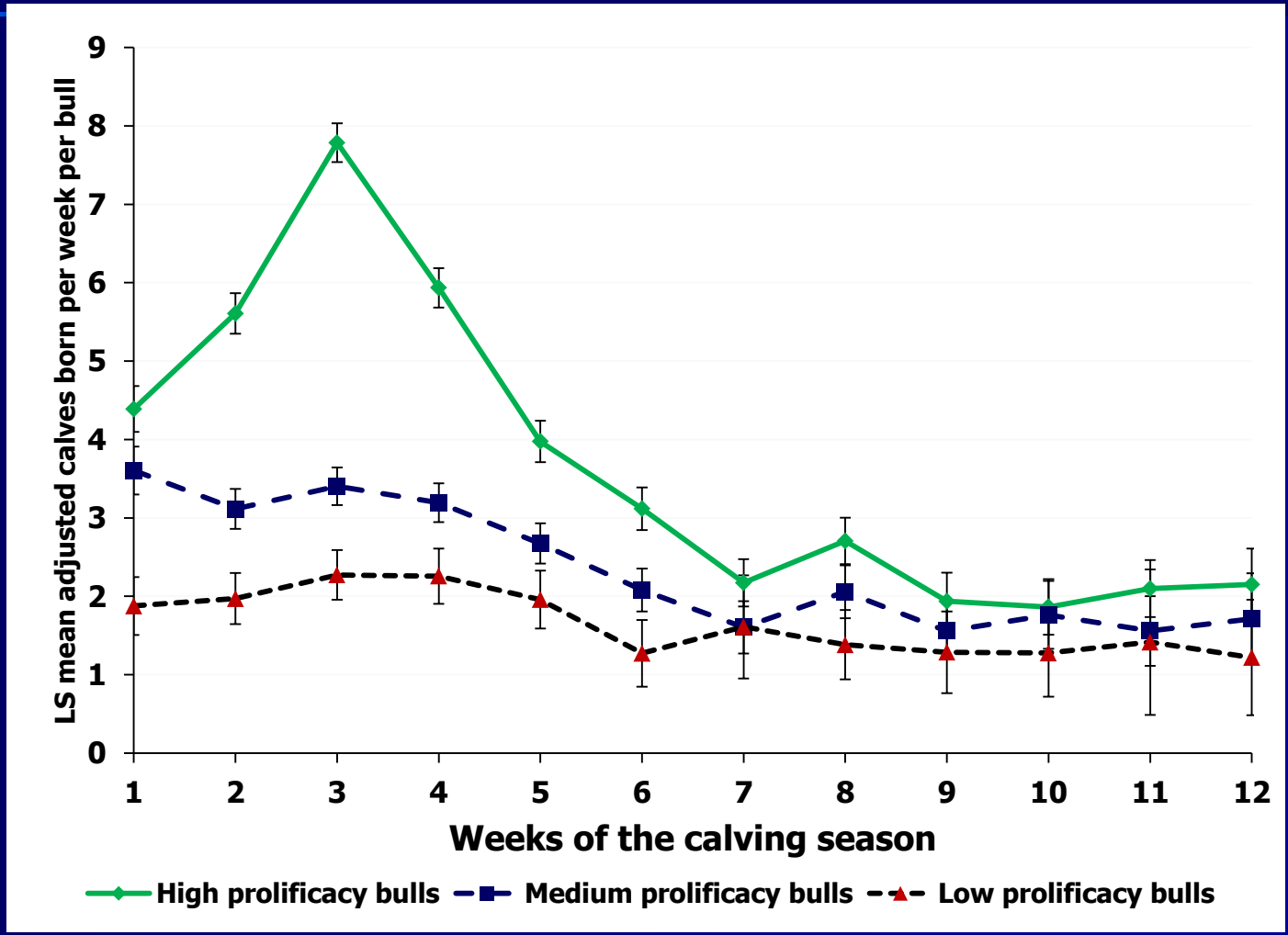
About 12 % of the variation in prolificacy (R^2=.12) was explained by SC EPD



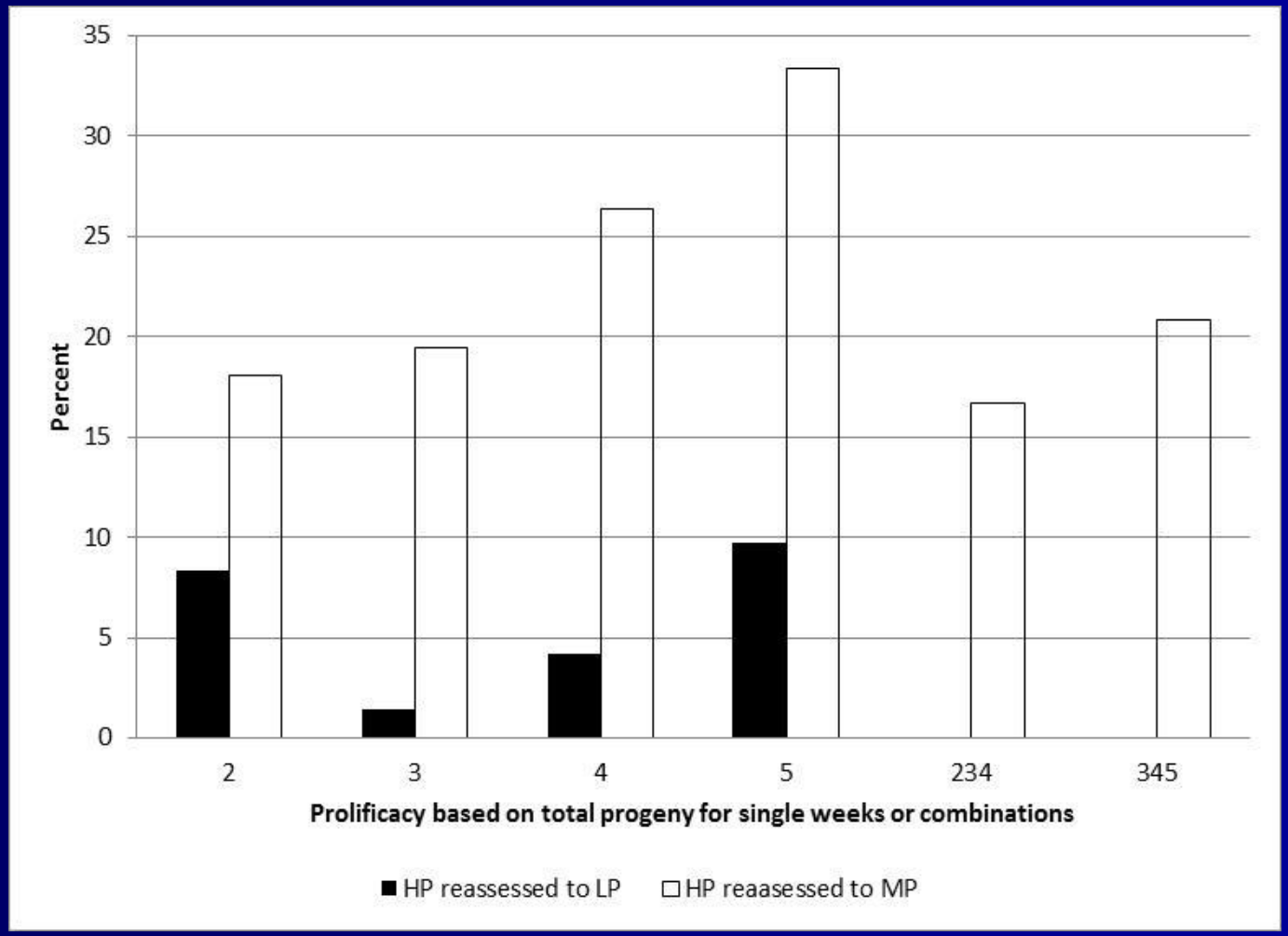
LS mean adjusted calves born per week of the calving season across all calf crops Means with different letters P<.05.



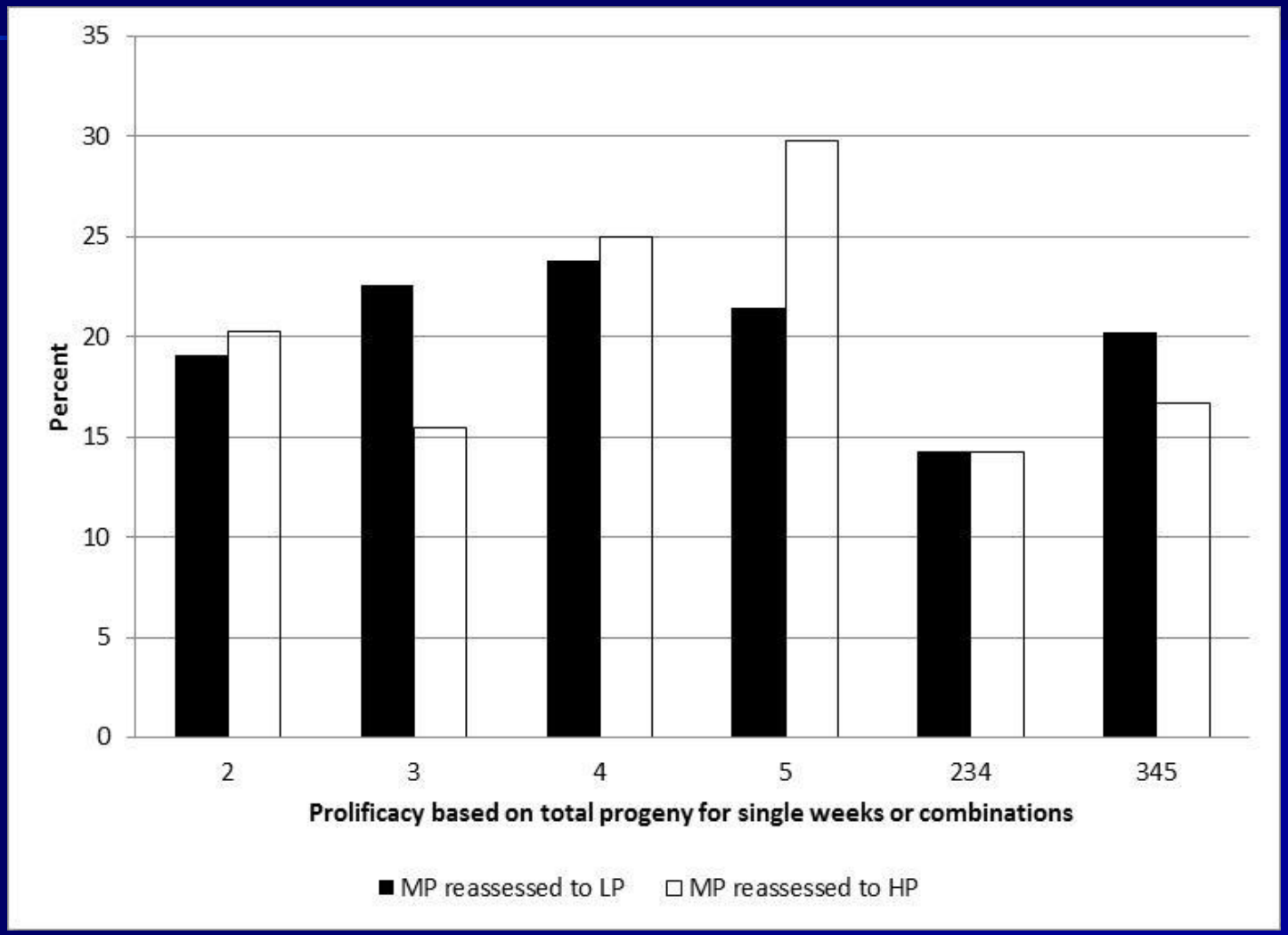
Bulls categorized into equal groups based on their number of progeny for a calf crop had different calving distributions.



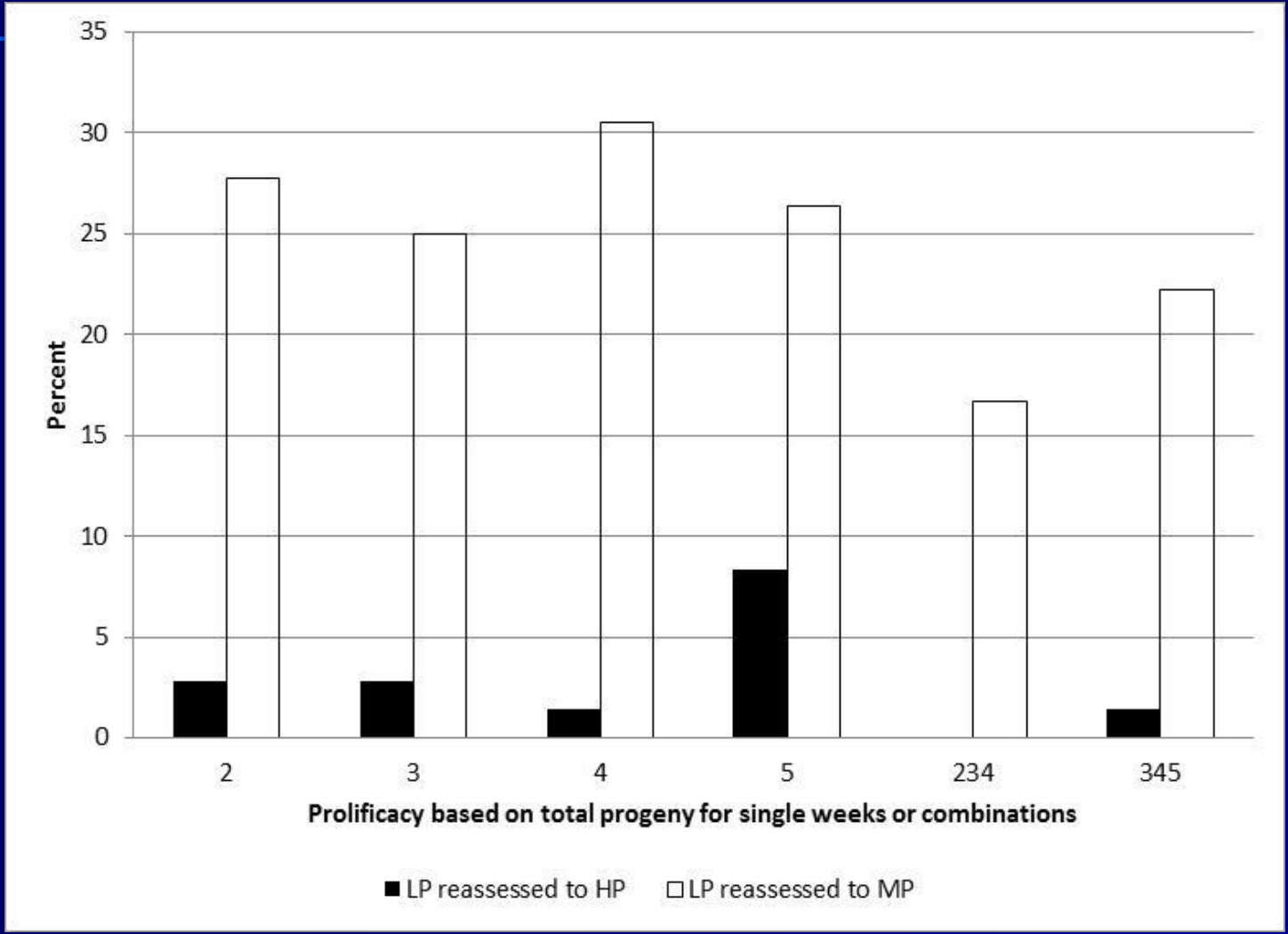
High Prolificacy: Bulls misassigned if using various reduced sampling strategies



Medium Prolificacy: Bulls misassigned if using various reduced sampling strategies



Low Prolificacy: Bulls misassigned if using various reduced sampling strategies



Recap

- Bulls produced on average about 20 calves per calf crop
- Prolificacy varied from 0 (~4.4%) - 64 calves per season
- No single factored completely predicted bull prolificacy
  - tended to increase up to about 5 years of age and then declined.
  - Bulls with larger SC EPDs tended to be more prolific
- Bull contribution to total ranch income (total saleable weaning 205d weight) was very highly correlated to prolificacy and only a small amount to average 205d weaning weight
- Repeatability of DNA paternity determined prolificacy was 0.33 – 0.37 over 3 years under our intensive conditions
- Prolificacy assessments from testing only week 3 calves were closely related to prolificacy assessments based on the total calf crop

Happy California Cow

Questions?

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