# Genetic improvement strategies and successes by Australian Angus breeders

Peter Parnell
Chief Executive Officer
Angus Australia

ICAR 2012

Angus AUSTRALIA

# Outline

1. Angus Australia, background
2. Angus Breedplan, breed trends
3. Selection indexes, breed & herd trends
4. Sources of genetic trend
5. Management of recessive genes
6. Future needs

# Angus Australia

***Our Vision:***

**Leadership in the delivery of innovative programs that enhance and promote the value of Angus cattle and Angus beef products**

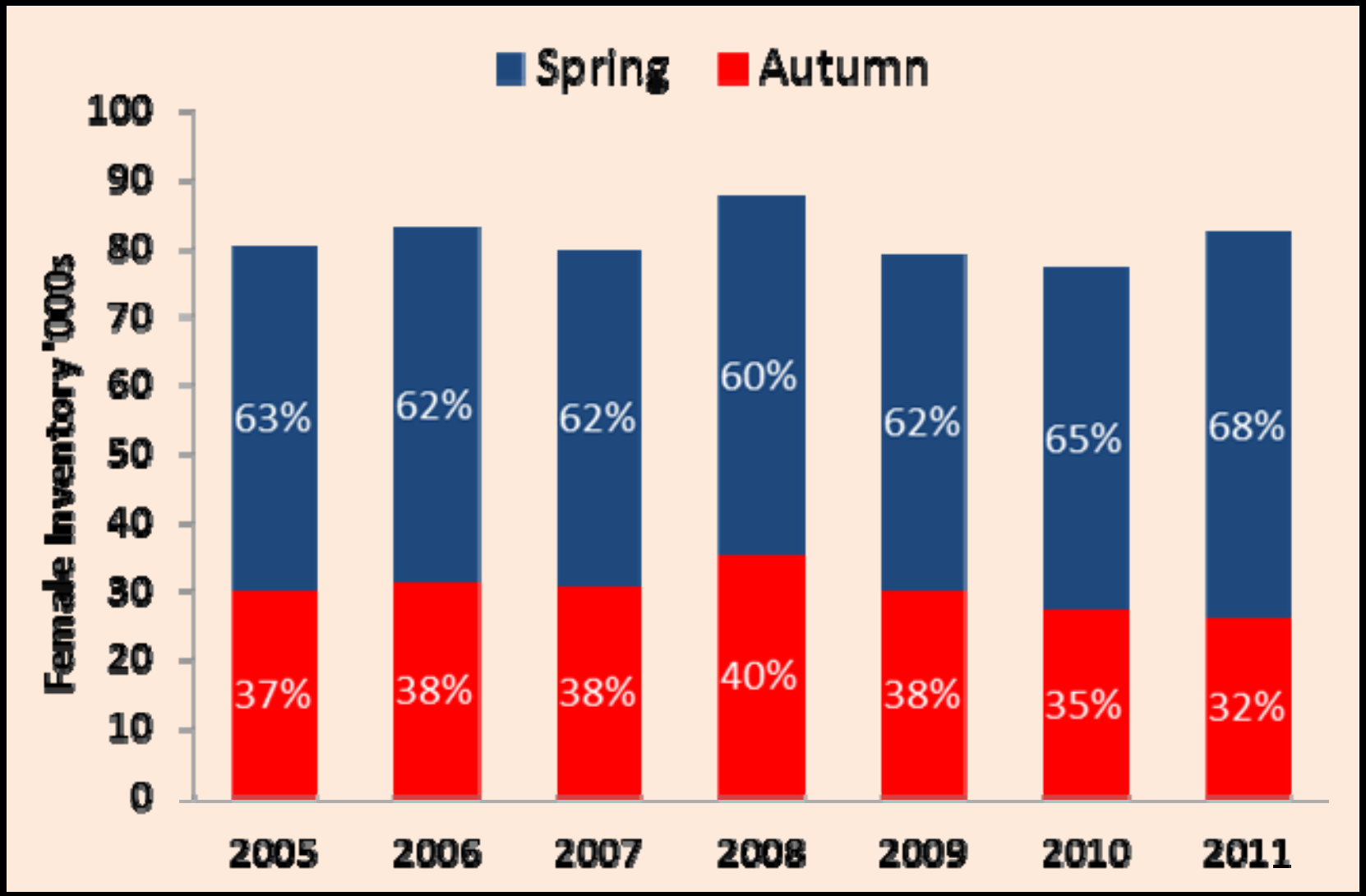
# *What we do ……*

- Breed registration & recording
- Breed development (R&D)
- Marketing
- Education
- Youth development

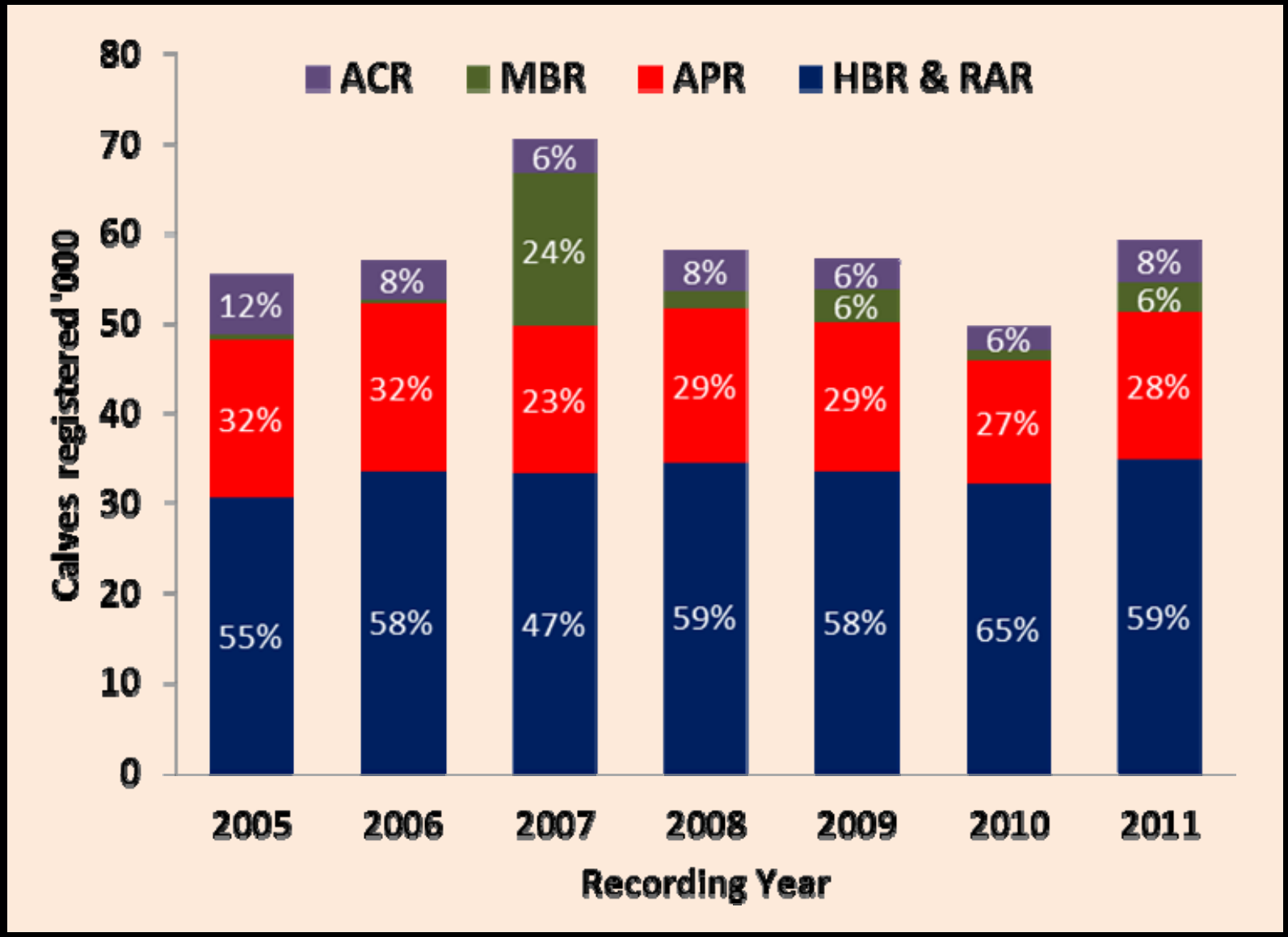

There are over 2.5 million cows in Australia joined to Angus bulls


Over 50% of Australia's feedlot cattle for export are Angus or Angus crossbred

# *Female Inventory:*



# *Calf registrations:*



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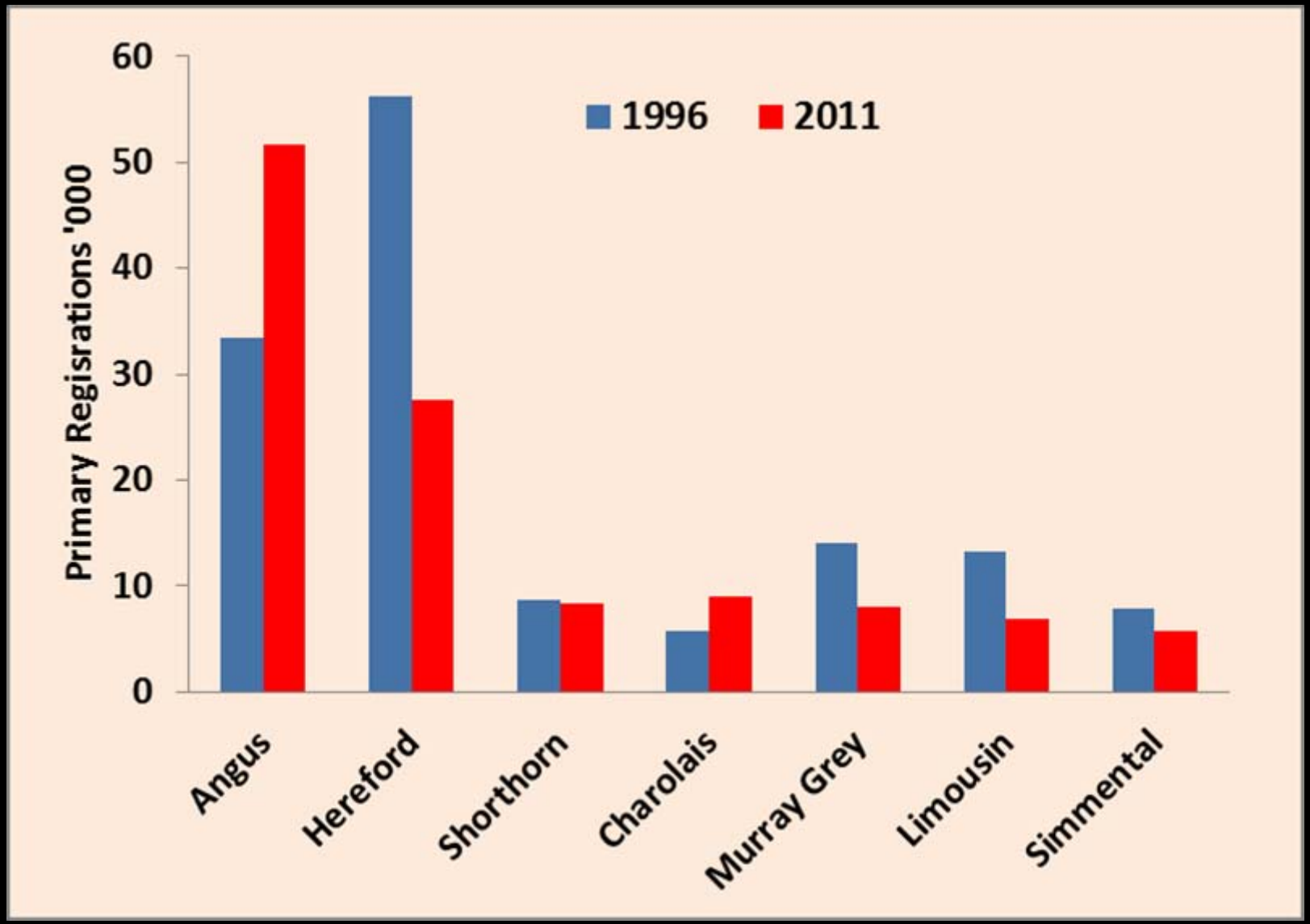
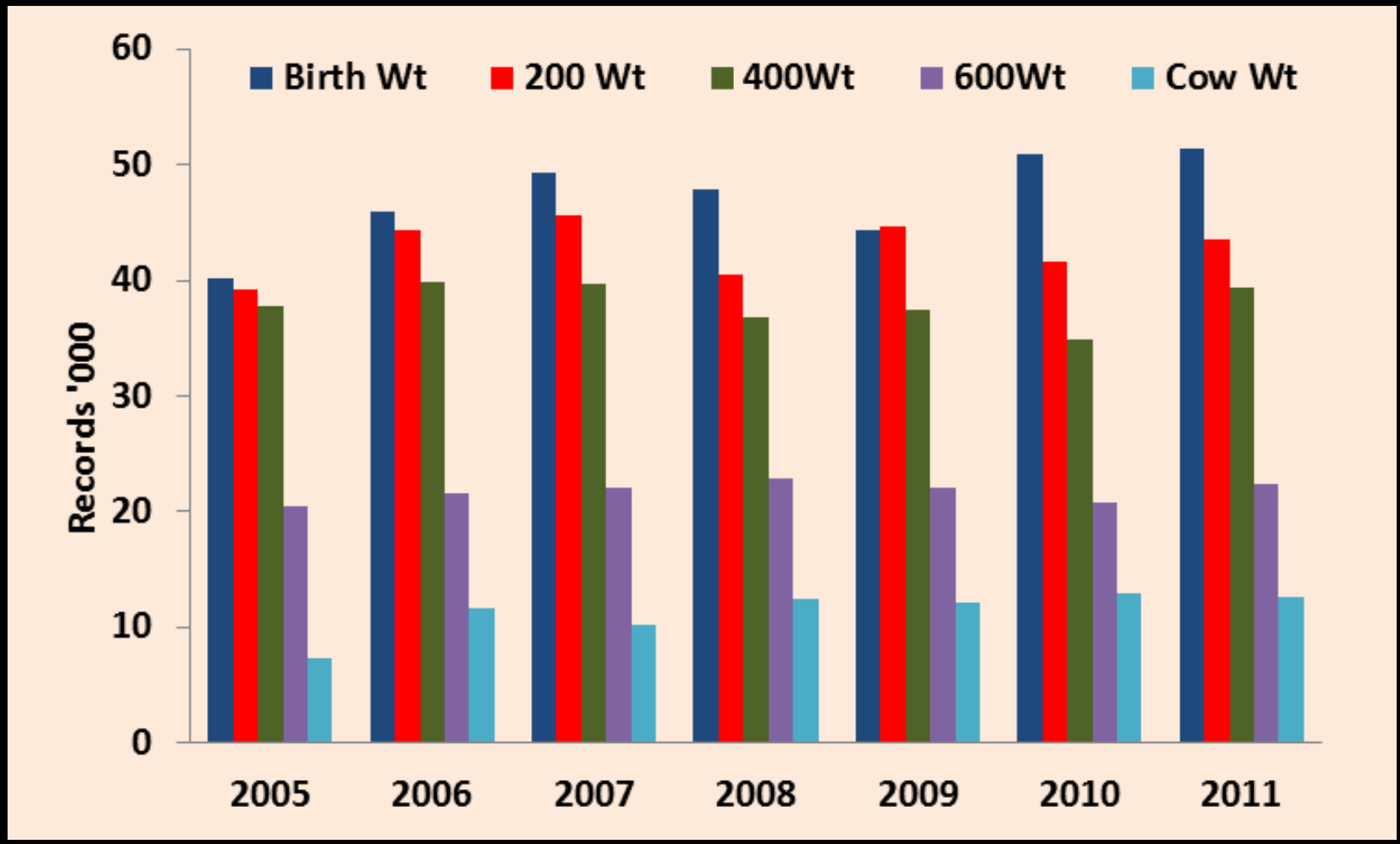


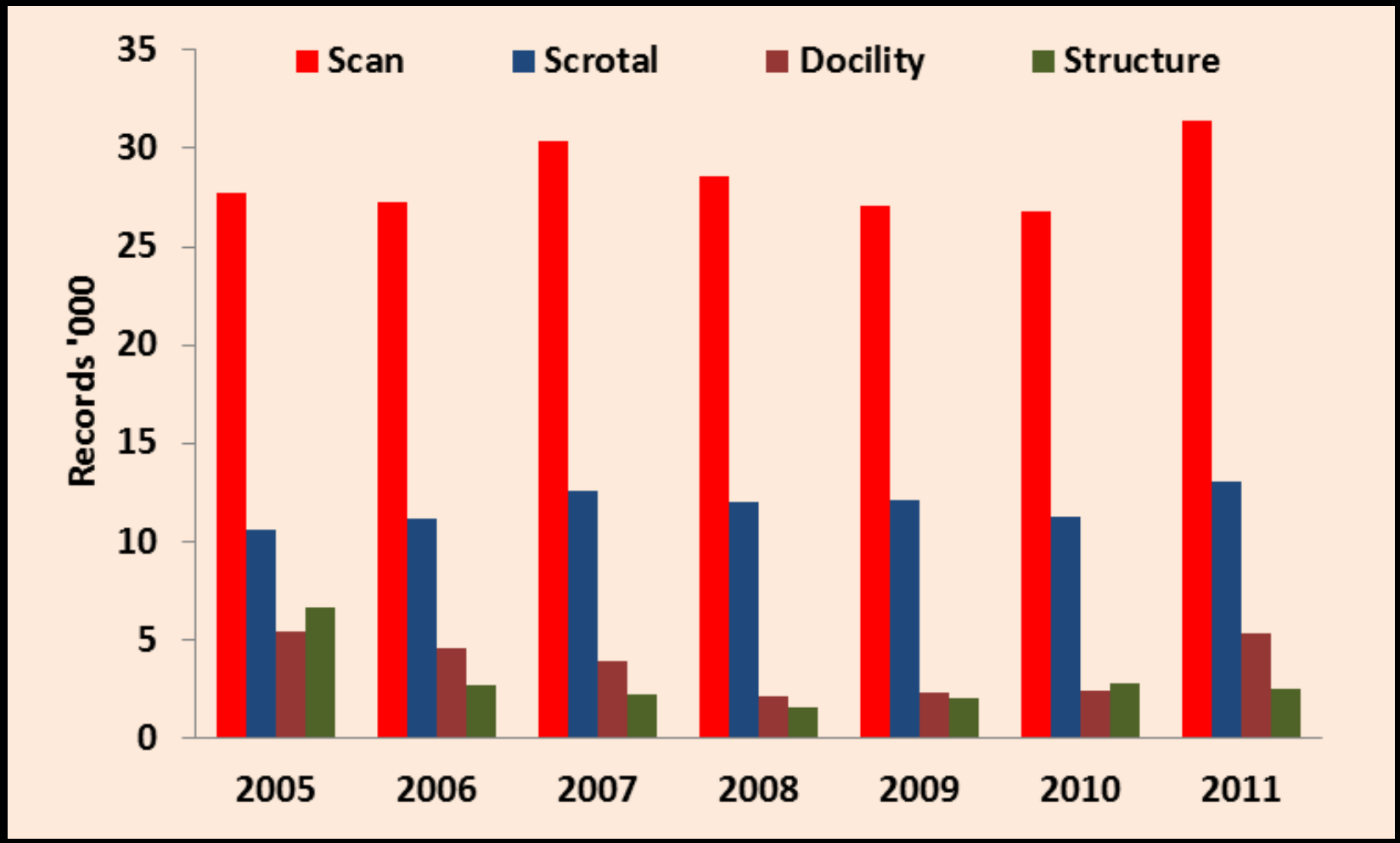

Compiled by Australian Registered Cattle Breeders Association (ARCBA)

# *Performance Recording:*




**>50% of all beef performance recording in Australia**

# *Performance Recording:*




**>60% of all carcase scan records collected in Australia**

# Estimated Breeding Values (EBVs)

**Growth**
*Birth Wt.*
*200-day Growth*
*400-day Wt.*
*600-Day Wt.*

**Reproduction**
*Days to Calving*
*Gestation Length*
*Calving Ease (Dir)*
*Calving Ease (Dtrs)*
*Scrotal Size*

**Carcase**
*Carcase Wt*
*EMA*
*Rib Fat*
*Rump Fat*
*RBY %*
*IMF%*

**Efficiency**
*Net Feed Intake*

**Maternal**
*Milk*
*Mature Cow Wt.*

**Other (trial)**
*Structural scores*
*Temperament*

# ARDROSSAN ADMIRAL A2 (AI) (ET)

**Birth Date:** 16/02/2005

**Register:** HBR

G A R PRECISION 1680 USA1680
C A FUTURE DIRECTION 5321 USA5321
C A MISS POWER FIX 308 USA12054694
**Sire: ARDROSSAN DIRECTION W109 (AI) (ET) NAQW109**
G T MAXIMUM USA88
ARDROSSAN WILCOOLA Q71 (AI) (ET) NAQQ71
ARDROSSAN WILCOOLA K31 (AI) (ET) NAQK31
**Animal: ARDROSSAN ADMIRAL A2 (AI) (ET) (REDF) NAQA2**
V D A R NEW TREND 315 USA315
B/R NEW DESIGN 036 USA036
B/R BLACKCAP EMPRESS 76 USA76
**Dam: KENNY'S CREEK ROSEBUD W171 (AI) (ET) NDIW171**
PAPA EQUATOR 2928 USA2928
IMRAN ROSEBUD U17 (AI) (ET) WFRU17
SOUTH CROSS L11 (AI) (ET) NSCL11

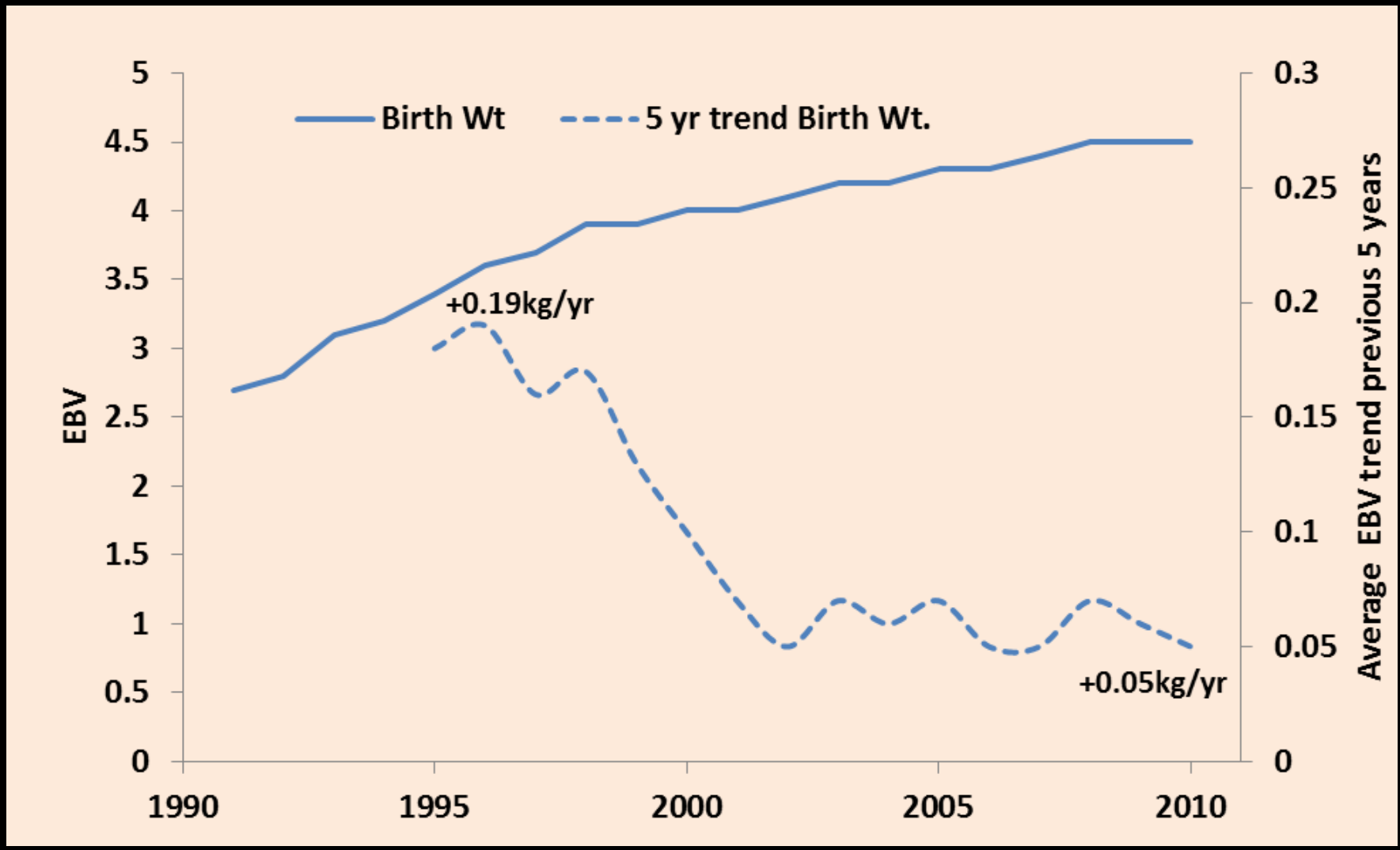
**April 2012 Angus Australia BREEDPLAN**

| | Calving Ease Dir (%) | Calving Ease Dtrs (%) | Gestation Length (days) | Birth Wt. (kg) | 200 Day Wt. (kg) | 400 Day Wt. (kg) | 600 Day Wt. (kg) | Mat. Cow Wt. (kg) | Milk (kg) | Scrotal Size (cm) | Days to Calving (days) | Carcase Wt. (kg) | Eye Muscle Area (sq.cm) | Rib Fat (mm) | Rump Fat (mm) | Retail Beef Yield (%) | IMF (%) | Docility (Trial) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| EBV | -4.6 | -8.4 | **-5.7** | +8.3 | **+58** | **+103** | **+133** | +128 | +17 | +1.2 | -4.5 | **+77** | **+10.2** | -1.8 | -1.7 | **+1.7** | **+2.8** | +35 |
| Acc | 95% | 91% | 99% | 99% | 99% | 99% | 99% | 98% | 97% | 99% | 86% | 96% | 92% | 95% | 95% | 92% | 91% | 86% |
| Breed Avg. EBVs for 2010 Born Calves Click for Percentiles | | | | | | | | | | | | | | | | | | |
| EBV | +0.0 | +0.3 | -2.9 | +4.5 | +38 | +71 | +90 | +83 | +12 | +1.4 | -3.0 | +50 | +3.5 | -0.1 | +0.0 | +0.3 | +1.0 | +0 |

**Traits Observed:** BWT,400WT,SS,FAT,EMA,IMF, HD 50K

**Statistics:** Number of Herds: **238**, Progeny Analysed: **4278**, Scan Progeny: **2424**, Carcase Progeny: **16**, Number of Dtrs: **646**

# Genetic trend:



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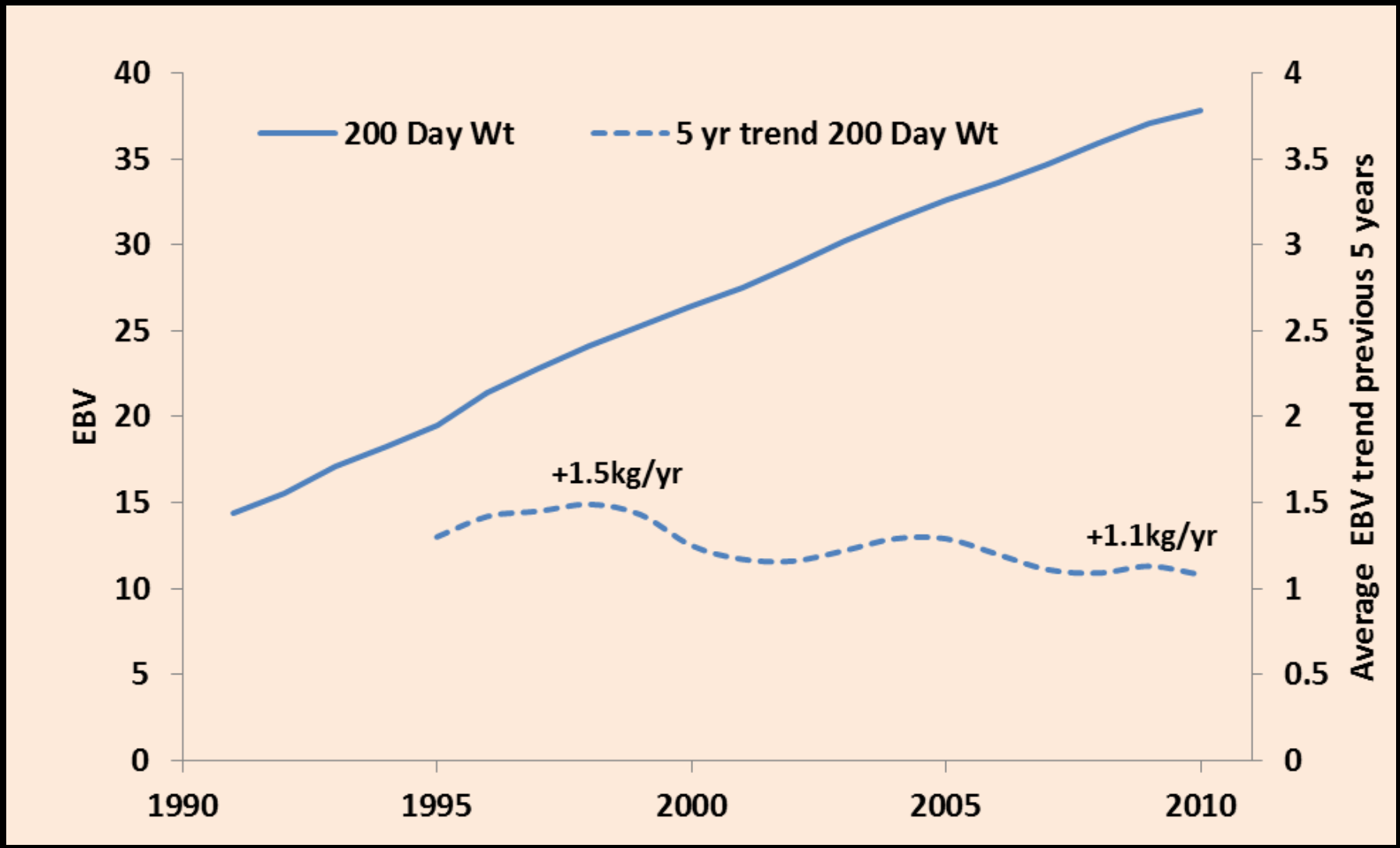

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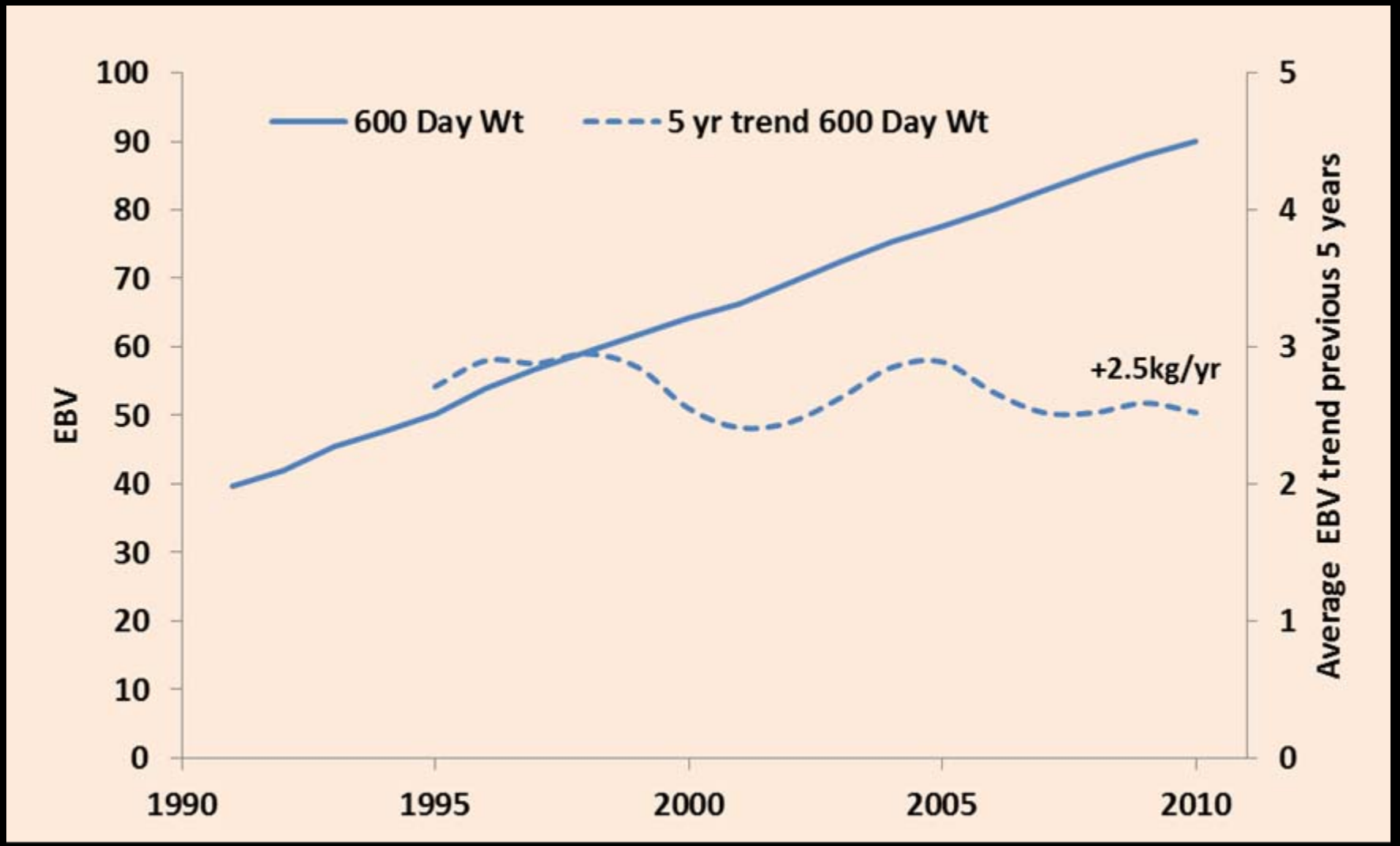

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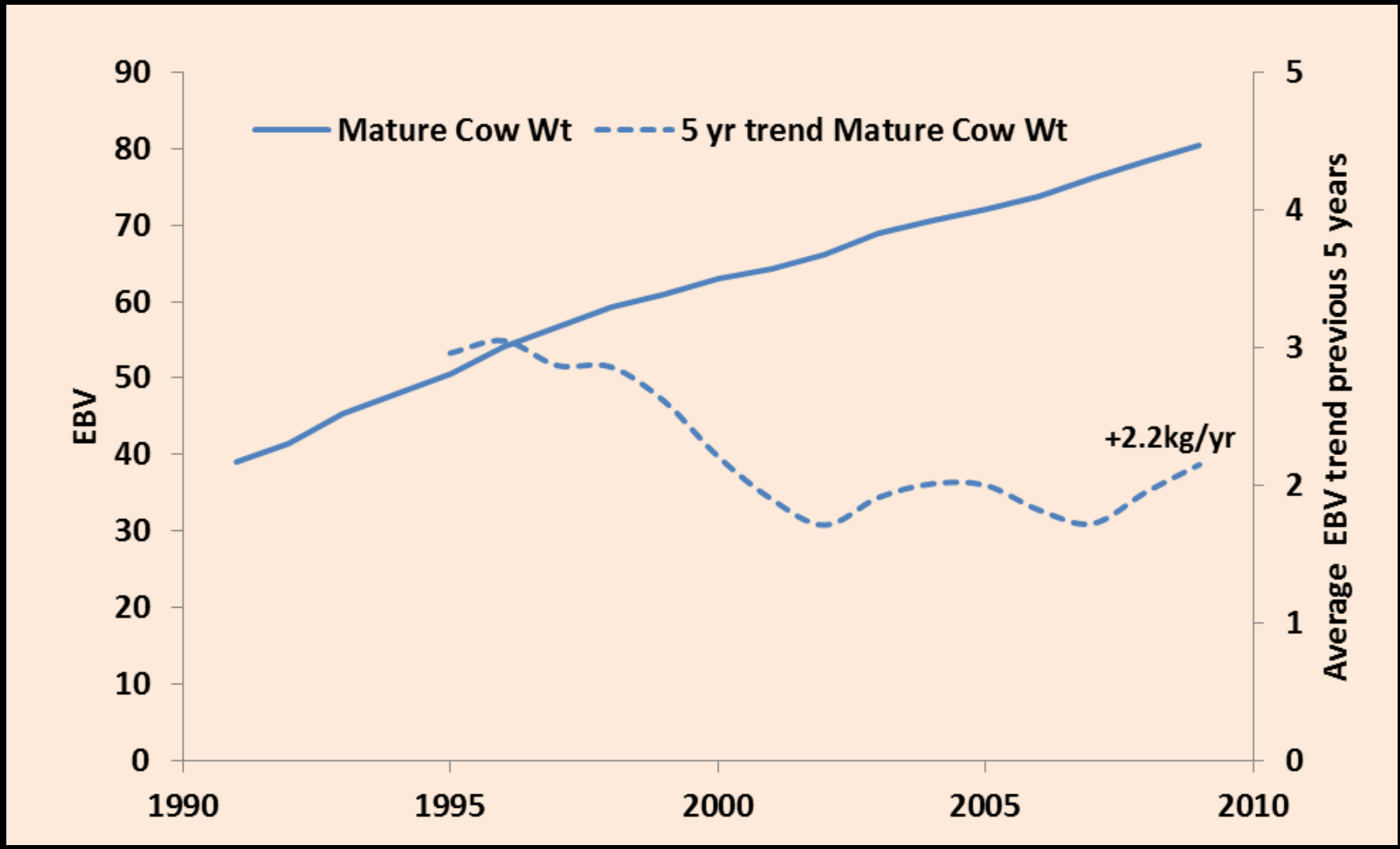

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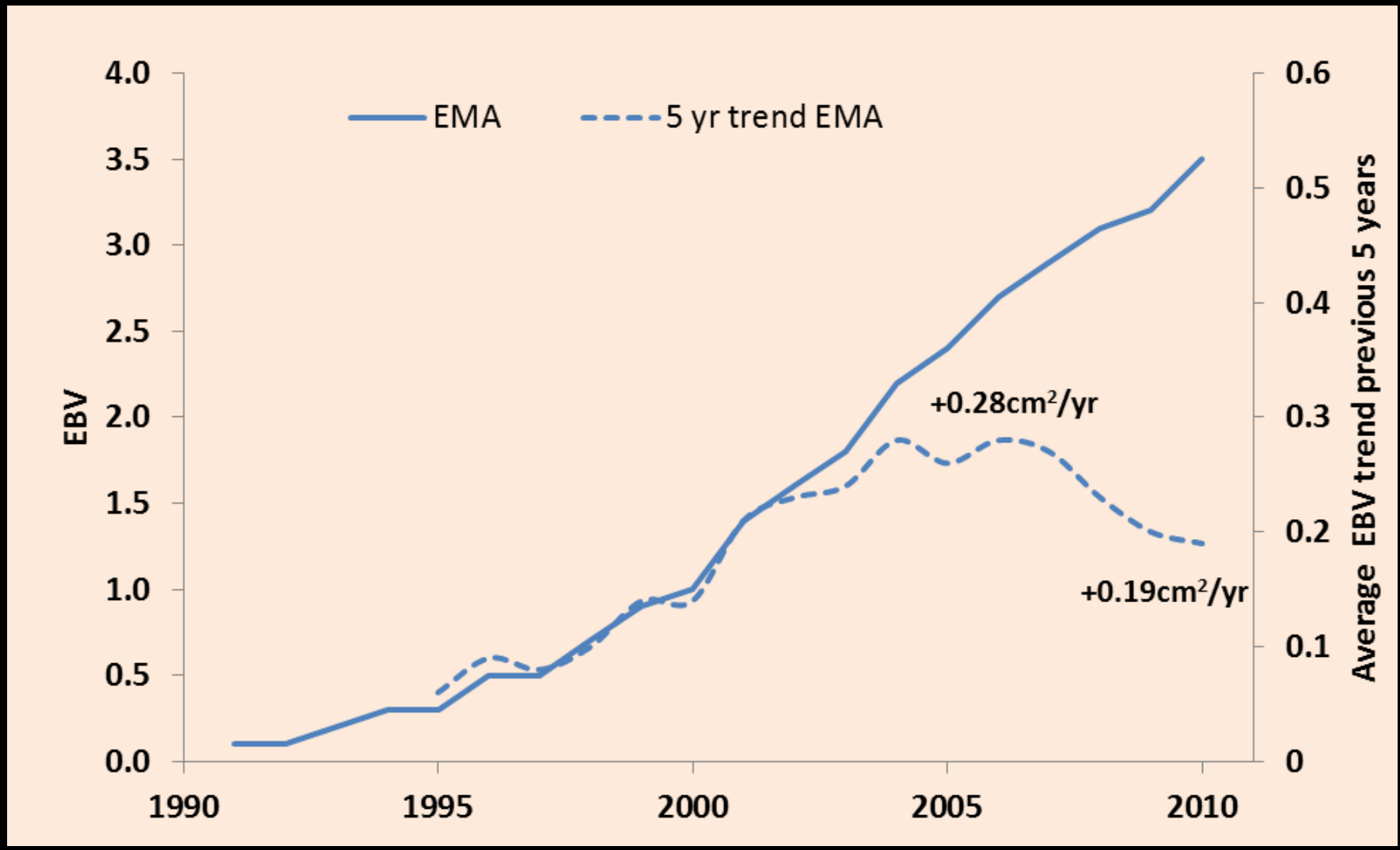

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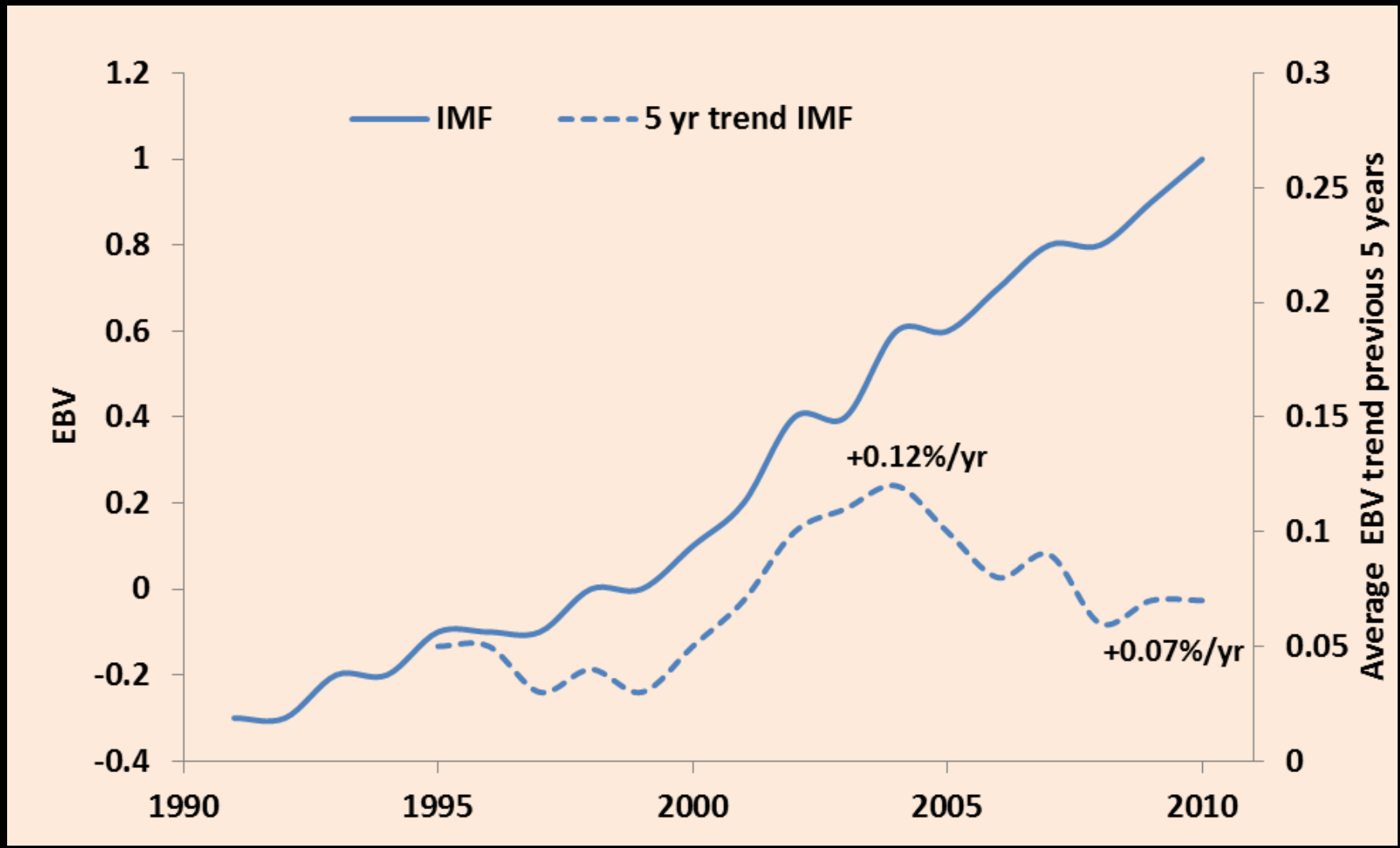

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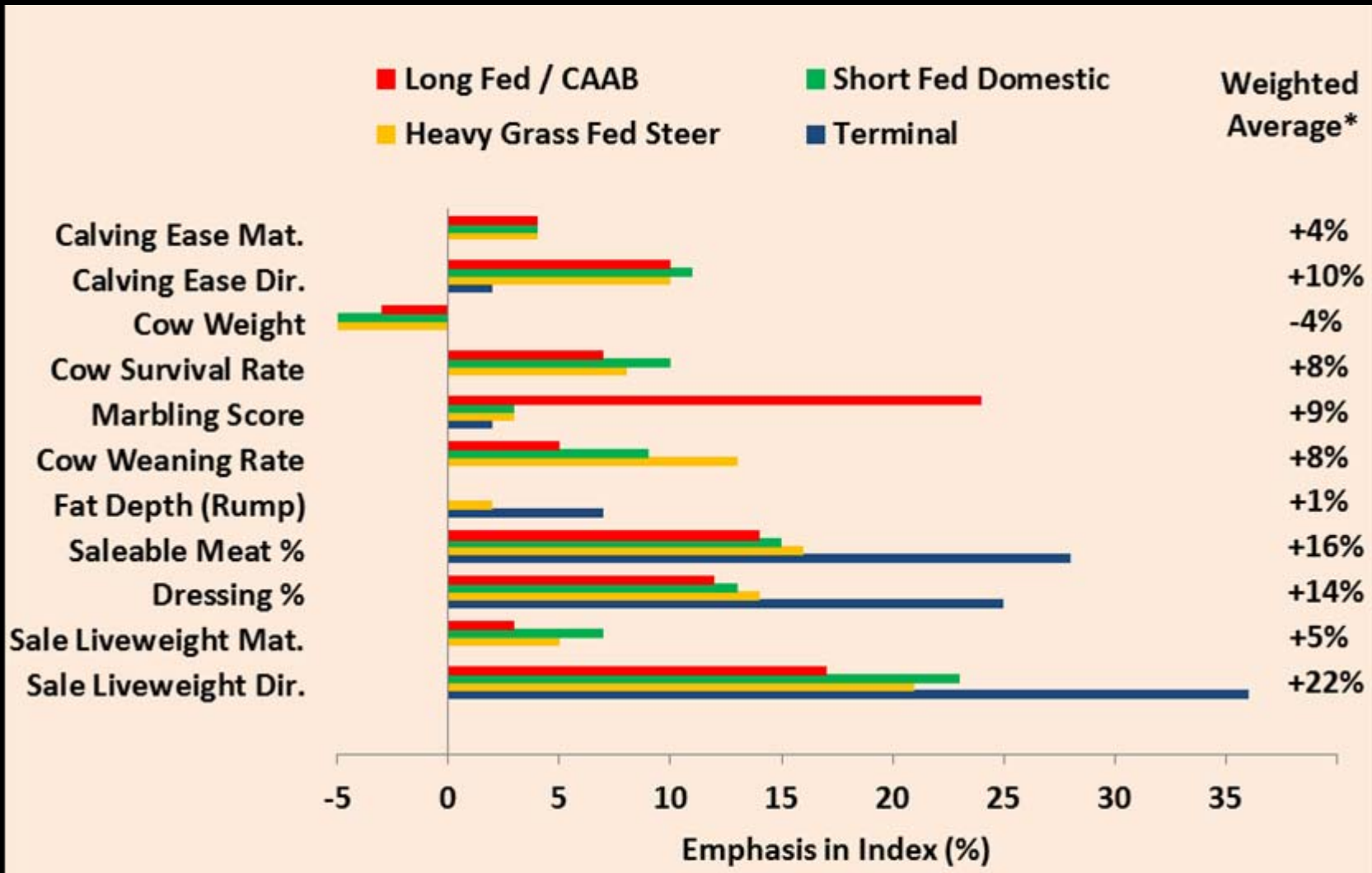
**SELECTION INDEX VALUES**

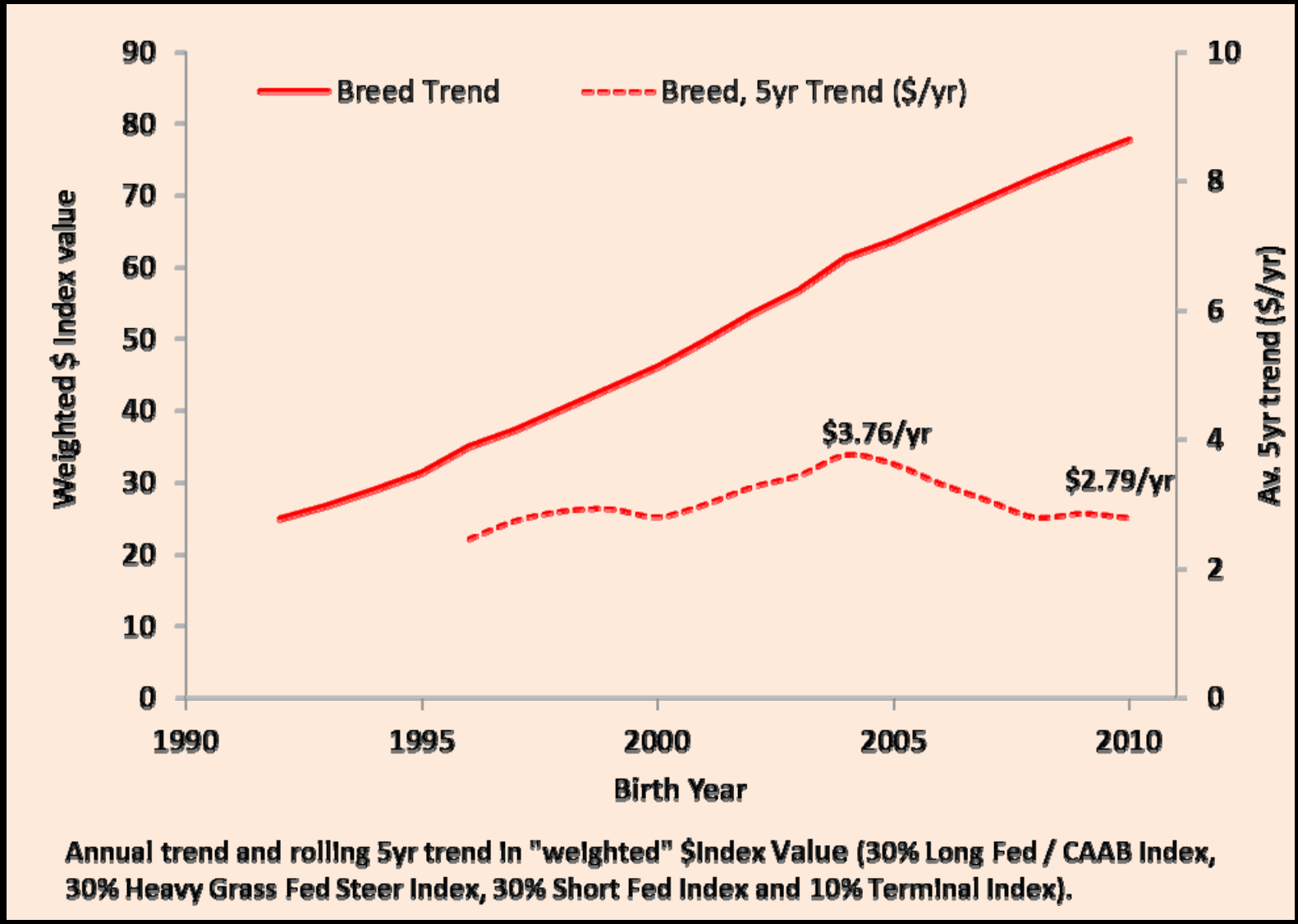
| Market Target | Index Value | Breed Average |
|---|---|---|
| Long Fed/CAAB Index | +$ 145 | +$ 94 |
| Heavy Grass Fed Steer Index | +$ 110 | +$ 77 |
| Short Fed Domestic Index | +$ 94 | +$ 68 |
| Terminal Index | +$ 107 | +$ 68 |

# Selection indexes:




Relative emphases in profit driver traits for different indexes published by Angus Australia (*Weighted Average includes 30% Long Fed/CAAB , 30% Heavy Grass Fed Steer, Steer, 30% Short Fed and 10% Terminal Index).

# Genetic trend:




Annual trend and rolling 5yr trend in "weighted" $Index Value (30% Long Fed / CAAB Index, 30% Heavy Grass Fed Steer Index, 30% Short Fed Index and 10% Terminal Index).

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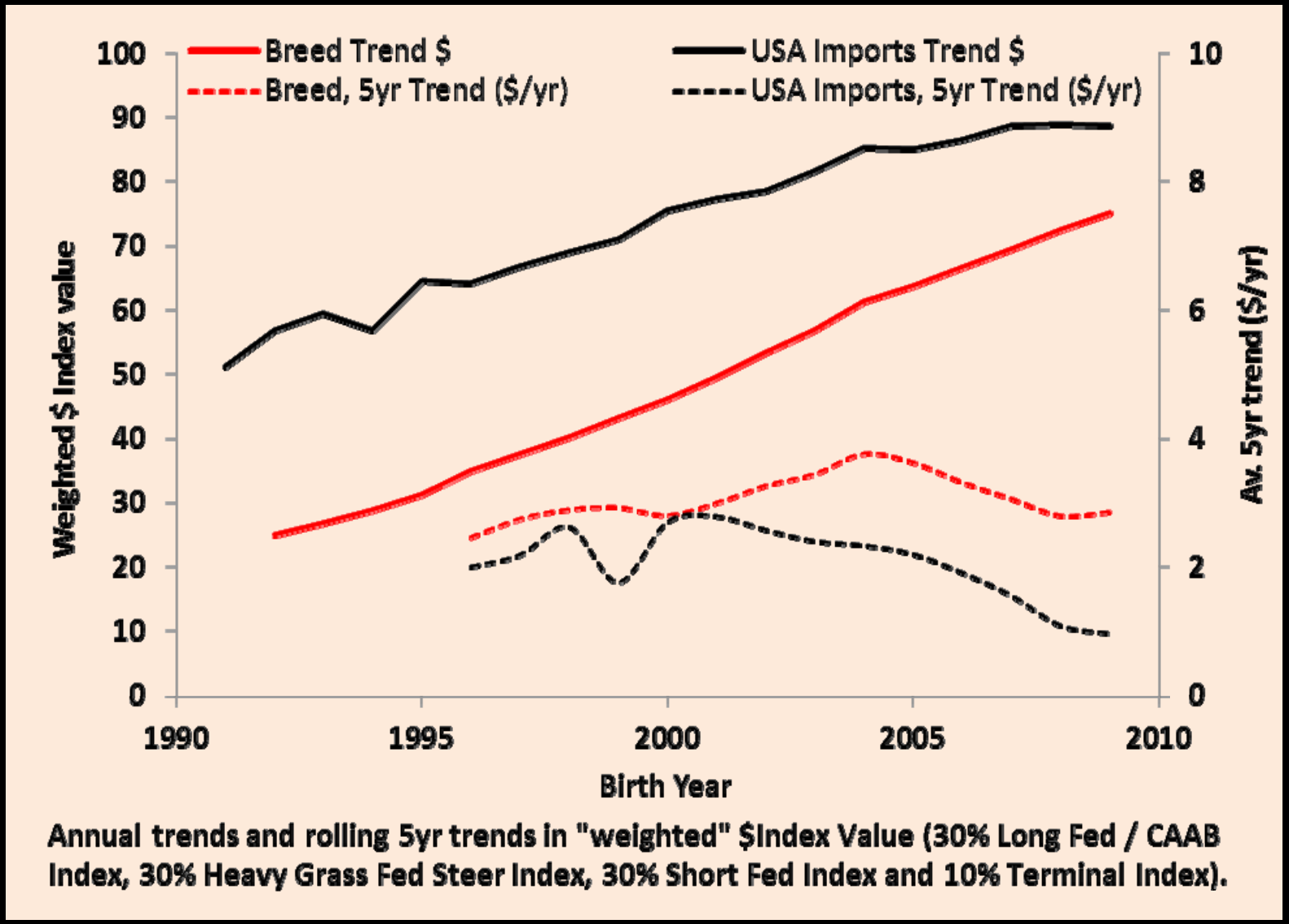


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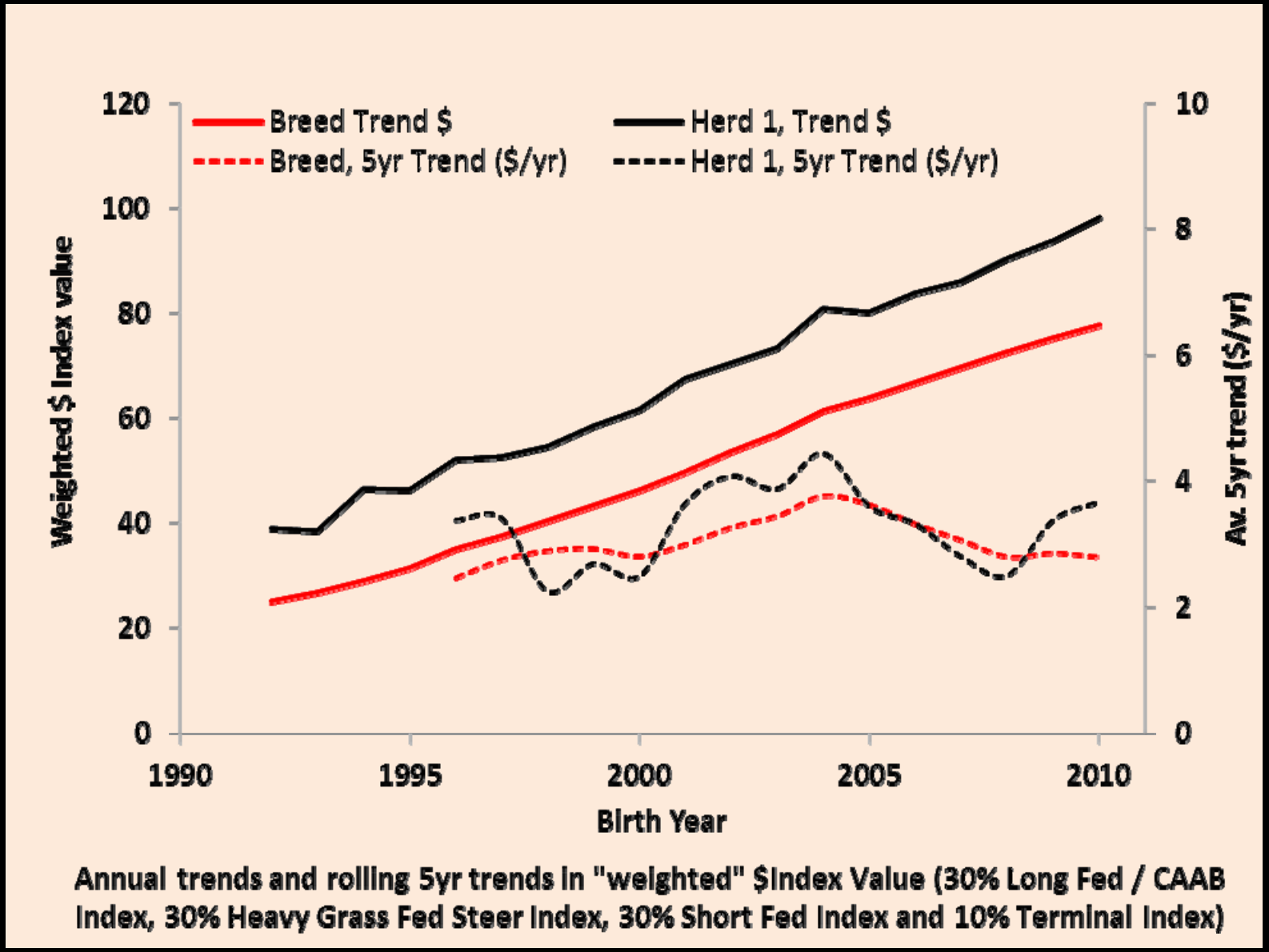


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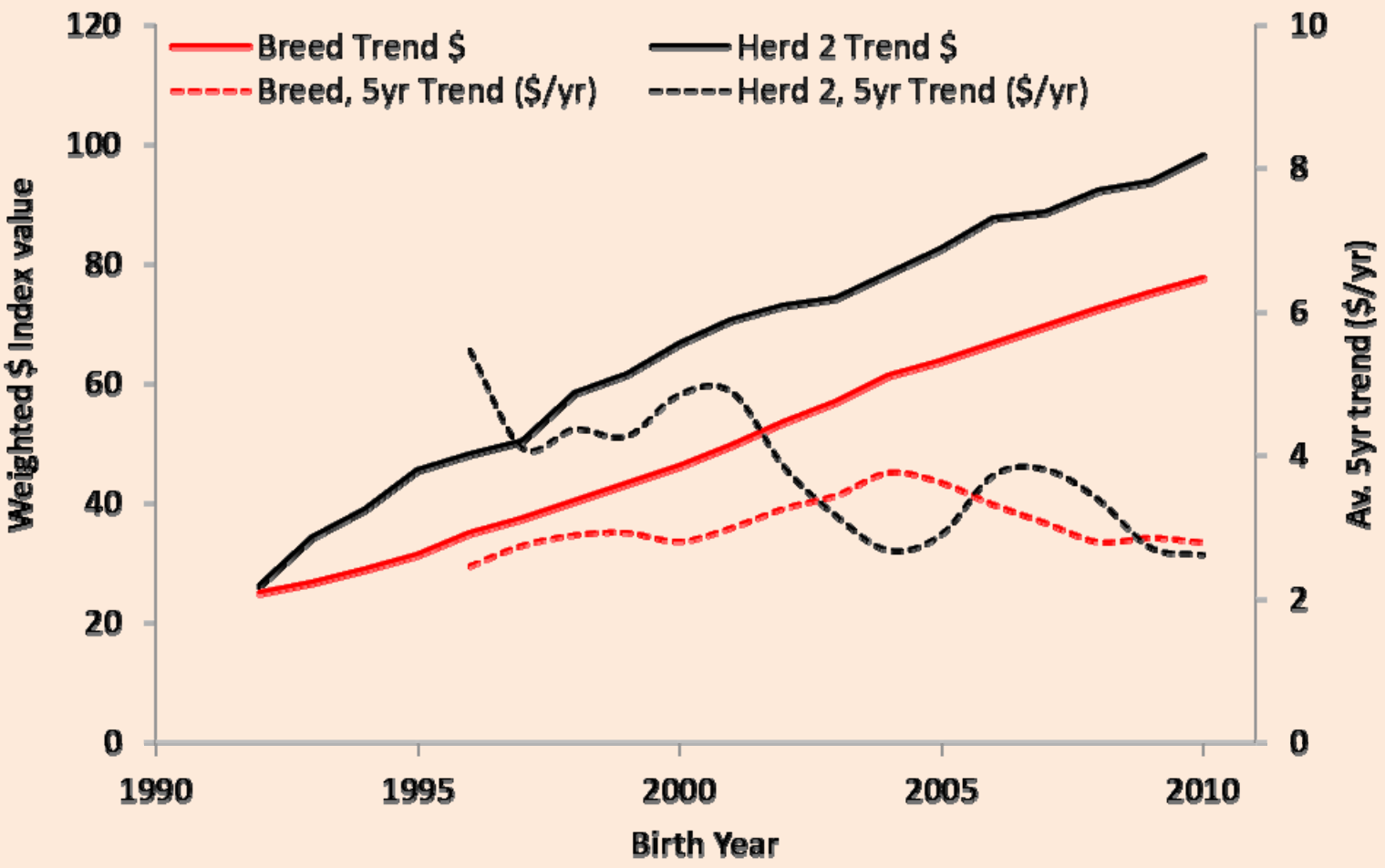


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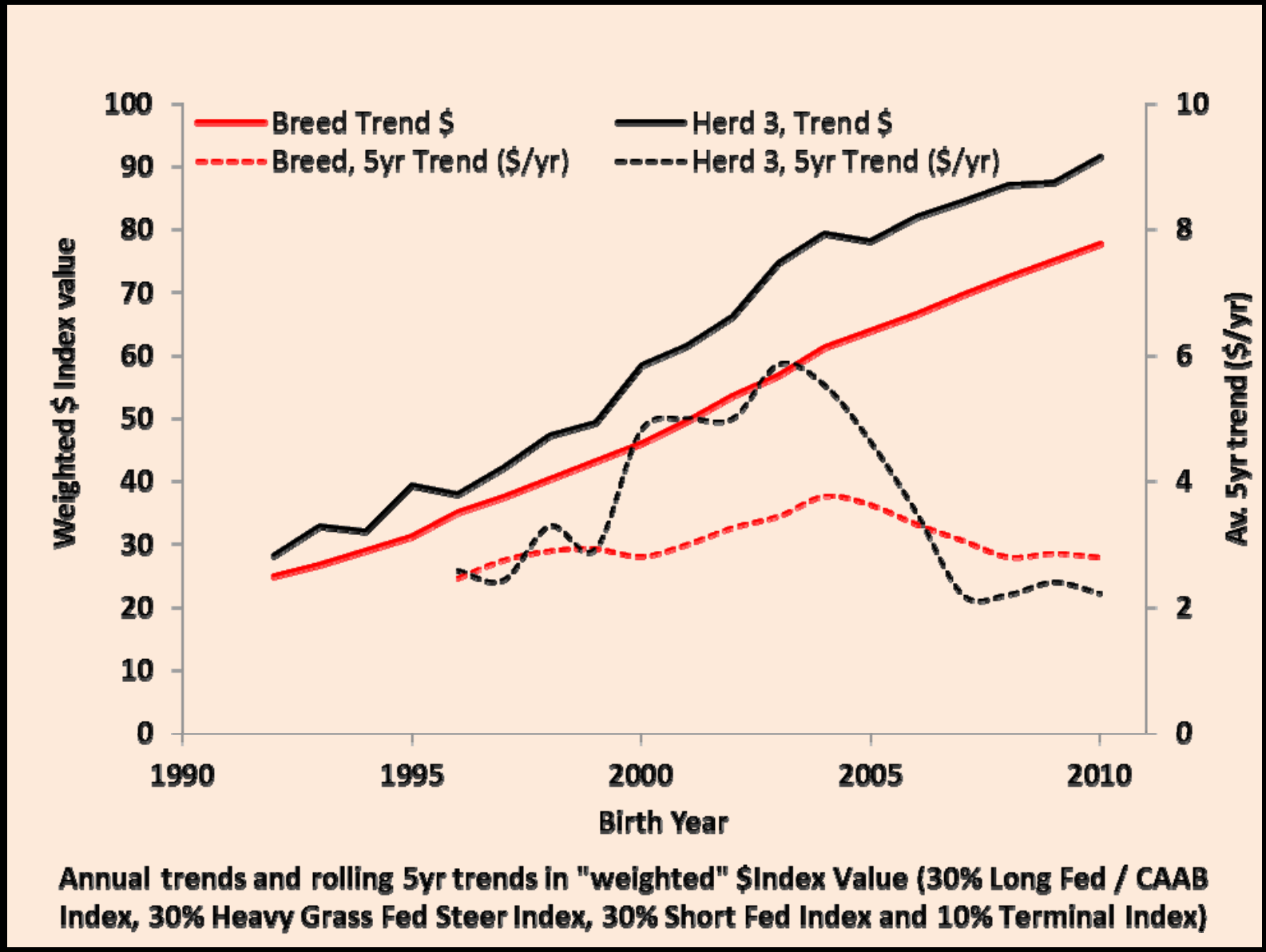


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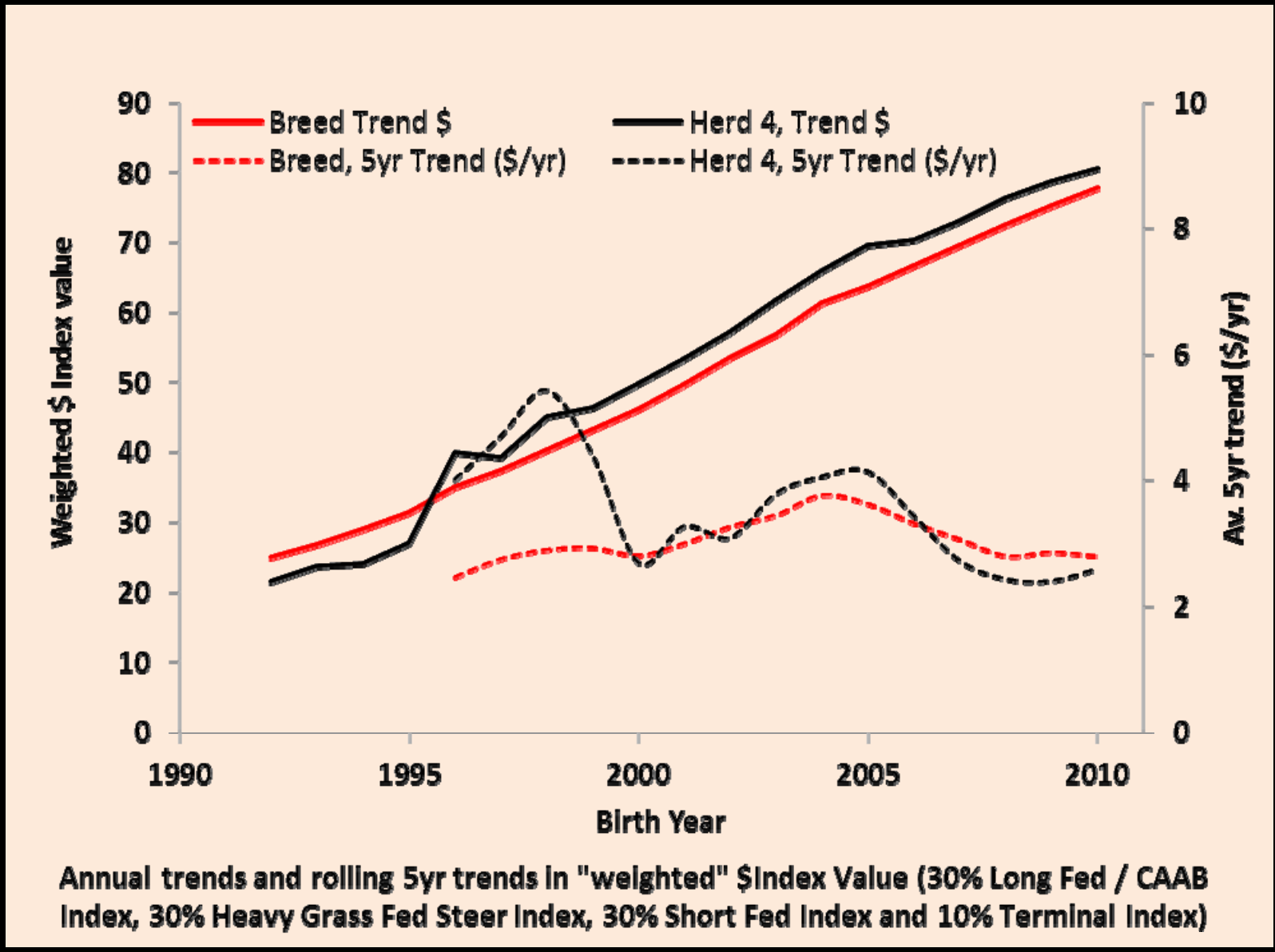


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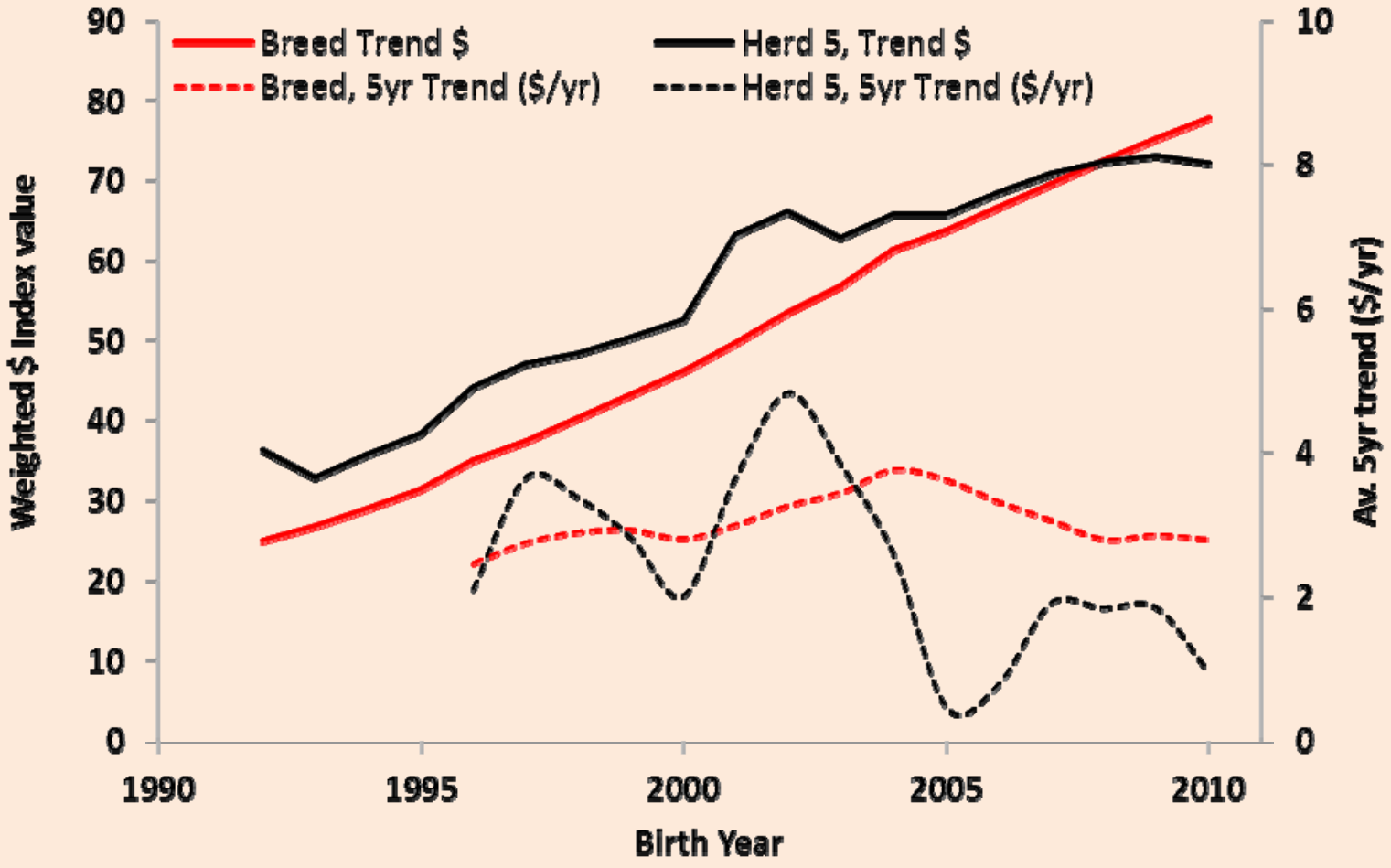
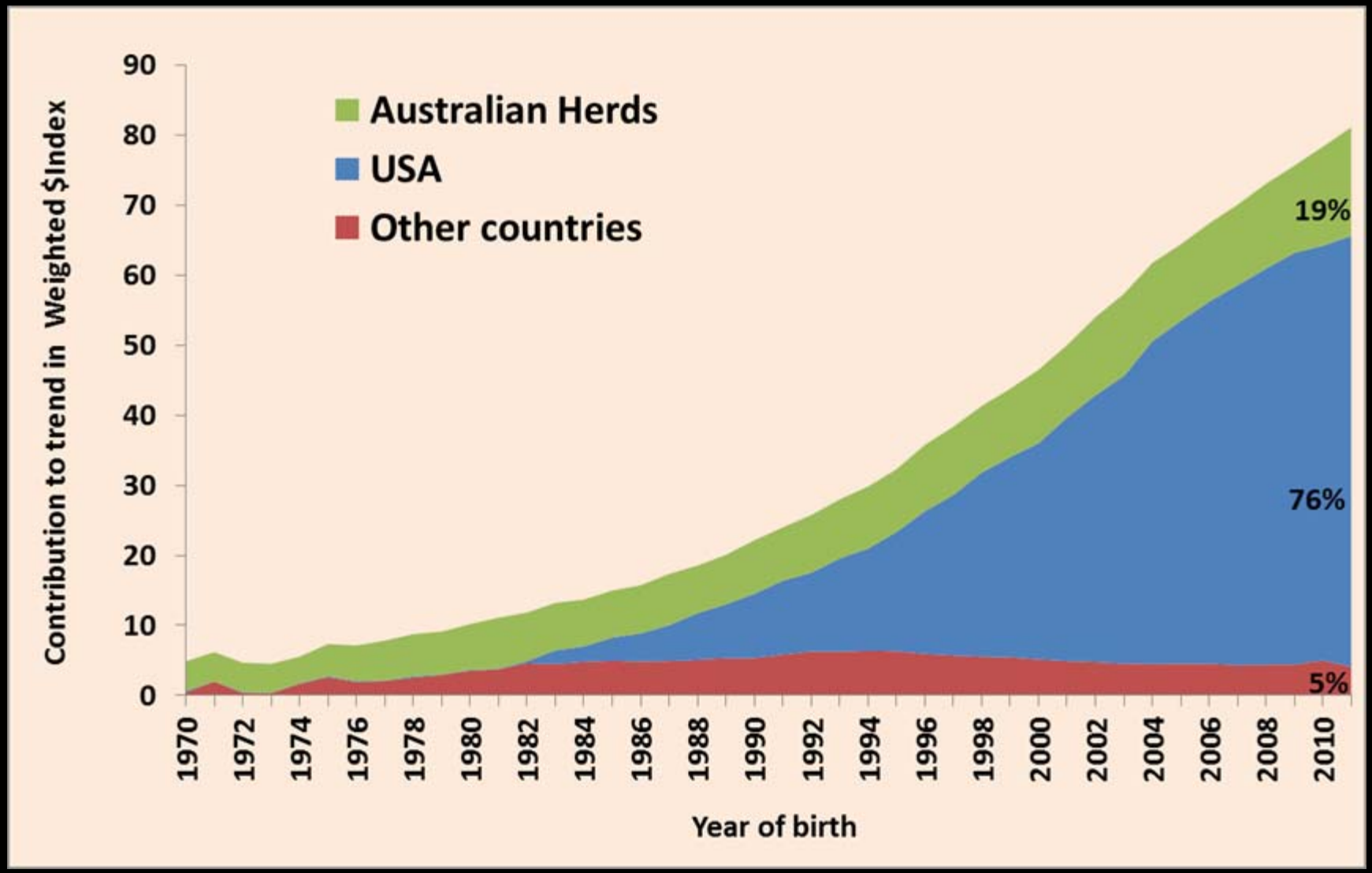


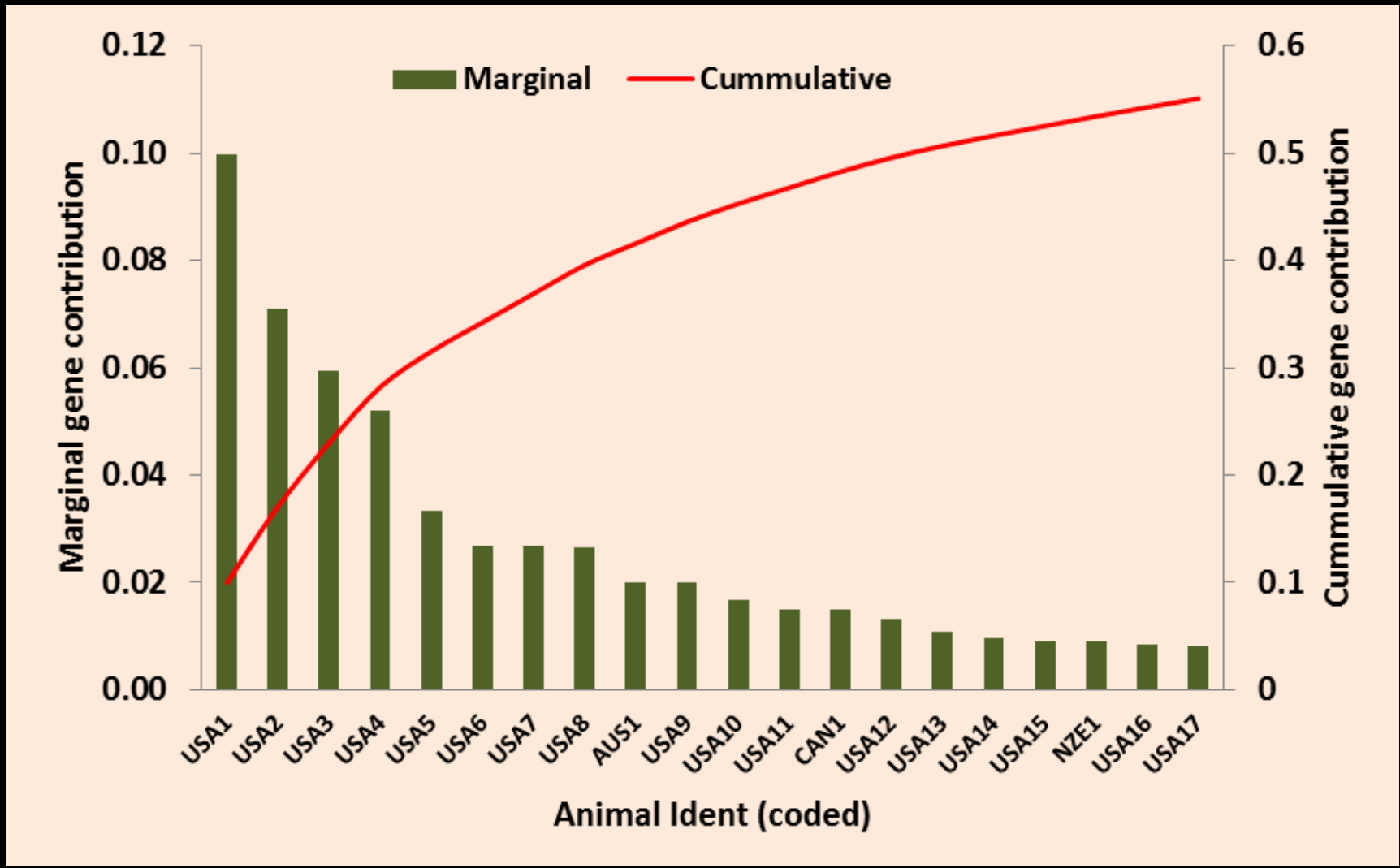

Annual trends and rolling 5yr trends in "weighted" $Index Value (30% Long Fed / CAAB Index, 30% Heavy Grass Fed Steer Index, 30% Short Fed Index and 10% Terminal Index)

# Contributions to genetic trend in the Australian Angus population




Amer, 2012 ( unpublished)

# *Gene contribution of key ancestors of the Australian Angus population:*



# Estimated Breeding Values (EBV)

**Own records**
- weights
- scans
- scores

**Pedigree**
- parents (sibs etc)
- progeny
  - carcass
  - daughters

**EBV**

**Correlated traits**
- other weights
- other scans
- other traits

**Genomic values**
- Pfizer Molecular Value Predictions

AGBU

# Inclusion of Pfizer 50K SNP data into Angus Breedplan

**Step 1. Discovery** (Pfizer, Angus Australia)

1,031 sires genotyped with Illumina SNP50 to develop "prediction equations" to estimate Molecular Value Predictions (MVPs) based on correlations with EBVs

1) DISCOVERY

2) CALIBRATION

INTO EBVs

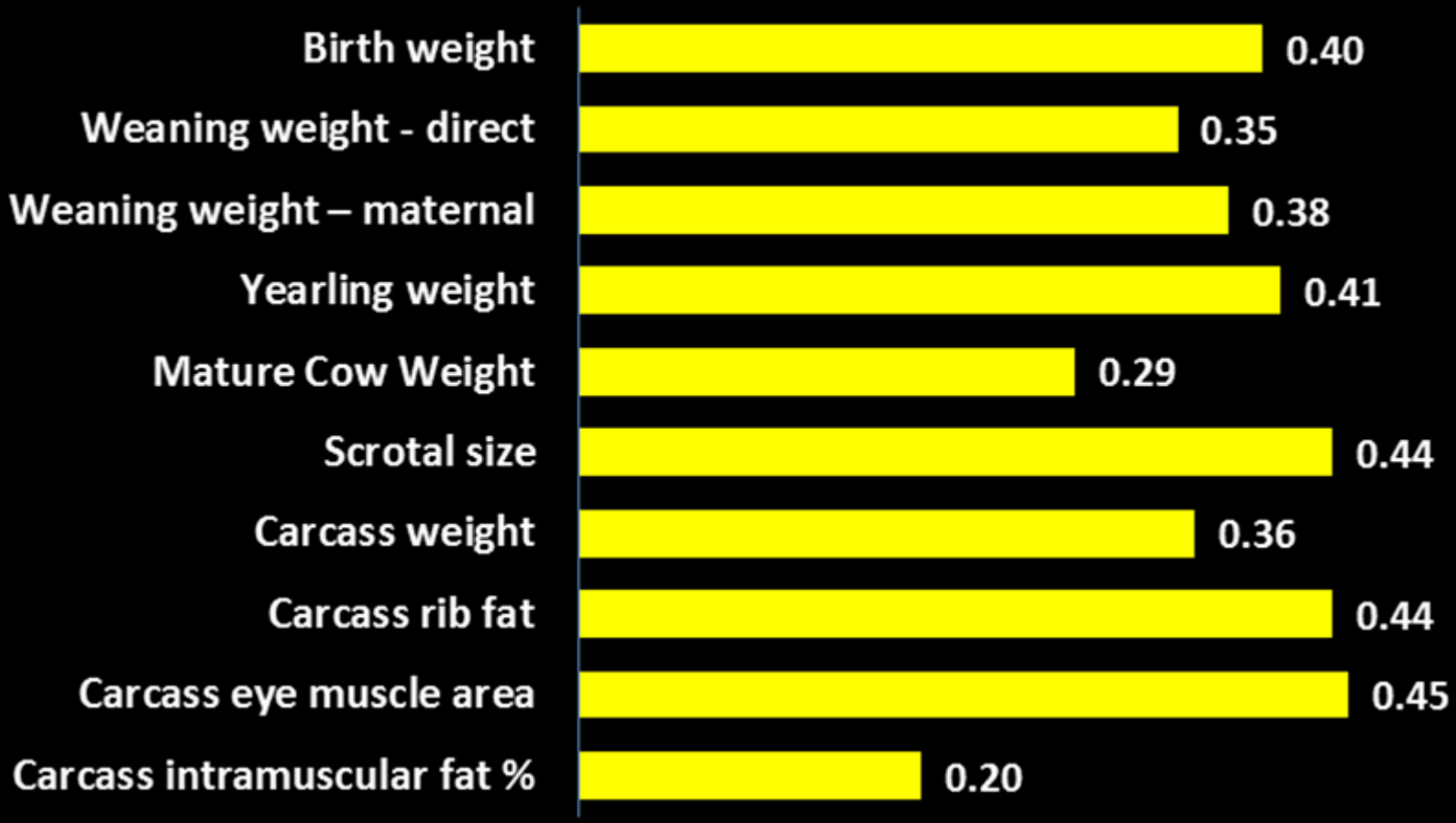
**Step 2. Calibration** (AGBU)

Correlations of MVPs with grand- progeny phenotypes

AGBU

3) IMPLEMENTATION

# Calibration of Pfizer 50K SNP panel




- explain 4 - 20% genetic variation

AGBU

# Inclusion of Pfizer 50k SNP panel into Angus Breedplan

**Step 1. Discovery** (Pfizer, Angus Australia)

1,031 sires genotyped with Illumina SNP50 to develop "prediction equations" to estimate Molecular Value Predictions (MVPs) based on correlations with EBVs

1) DISCOVERY 2) CALIBRATION INTO EBVs

**Step 2. Calibration** (AGBU)

Correlations of MVPs with grand- progeny phenotypes

**Step 3. Implementation** (AGBU, ABRI, Angus Australia)

"Blending" of MVP results with EBVs

3) IMPLEMENTATION

# Inclusion of MVPs

| May 2011 Angus GROUP BREEDPLAN | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | Calving Ease Dir (%) | Calving Ease Dtrs (%) | Gestation Length (days) | Birth Wt. (kg) | 200 Day Wt. (kg) | 400 Day Wt. (kg) | 600 Day Wt. (kg) | Mat. Cow Wt. (kg) | Milk (kg) | Scrotal Size (cm) | Days to Calving (days) | Carcase Wt. (kg) | Eye Muscle Area (sq.cm) | Rib Fat (mm) | Rump Fat (mm) | Retail Beef Yield (%) | IMF (%) | Docility (Trial) |
| EBV | -4.2 | -7.2 | **-5.5** | +8.1 | **+59** | **+103** | **+134** | +135 | **+17** | +1.2 | -4.3 | **+81** | **+7.6** | -1.4 | -1.3 | +1.1 | **+2.3** | +25.2 |
| Acc | 93% | 87% | 98% | 99% | 99% | 99% | 99% | 96% | 96% | 98% | 79% | 94% | 88% | 93% | 93% | 87% | 86% | 83% |
| Breed Avg. EBVs for 2009 Born Calves Click for Percentiles | | | | | | | | | | | | | | | | | | |
| EBV | +0.0 | +0.4 | -2.6 | +4.5 | +37 | +69 | +89 | +81 | +12 | +1.3 | -2.7 | +49 | +3.1 | -0.1 | +0.0 | +0.3 | +0.9 | +2.3 |

HD 50K

**Traits Observed:** BWT,400WT,SS,FAT,EMA,IMF,

**Statistics:** Number of Herds: **221**, Progeny Analysed: **3875**, Scan Progeny: **2010**, Carcase Progeny: **14**, Number of Dtrs: **379**

Show Index Values

Animal has genomic information included in EBVs

# Accuracy (%) for 2,241 Angus animals with MVPs blended (April, 2012)

| Trait | CED | BW | WW | YW | MCW | CEM | MILK |
|---|---|---|---|---|---|---|---|
| Before | 52.4 | 79.8 | 75.2 | 75.2 | 69.2 | 45.3 | 61.5 |
| After | 57.2 | 80.8 | 76.9 | 77.3 | 70.5 | 50.1 | 66.6 |
| Change | +4.8 | +1.0 | +1.7 | +2.1 | +1.3 | +4.8 | +5.1 |

| Trait | SCROTAL | CARC-WT | CARC-EMA | CARC-RUMPFAT | CARC-RIBFAT | CARC-IMF |
|---|---|---|---|---|---|---|
| Before | 64.4 | 67.9 | 59.9 | 67.0 | 66.1 | 57.9 |
| After | 69.2 | 70.5 | 64.3 | 69.2 | 70.4 | 59.0 |
| Change | +4.8 | +2.6 | +4.5 | +2.1 | +4.3 | +1.1 |

Overall impact on $Index accuracy: ⬆ 1 - 3%

# AngusSire™ Benchmarking Program

**2010:** 35 bulls joined by AI to 1,640 cows to produce 906 calves

**2011:** 47 bulls joined by AI to 2,325 cows

**2012:** Target > 50 bulls

mla MEAT & LIVESTOCK AUSTRALIA

Angus AUSTRALIA

AngusSire™ Benchmarking Program


**Cohort 1:**

NFI testing: Aug – Dec, 2012

Carcase data: Jun-Sept, 2013

**Cohort 2:**

NFI testing: Aug – Dec, 2013

Carcase data: Jun-Sept, 2014

**Cohort 3:**

NFI testing: Aug – Dec, 2014

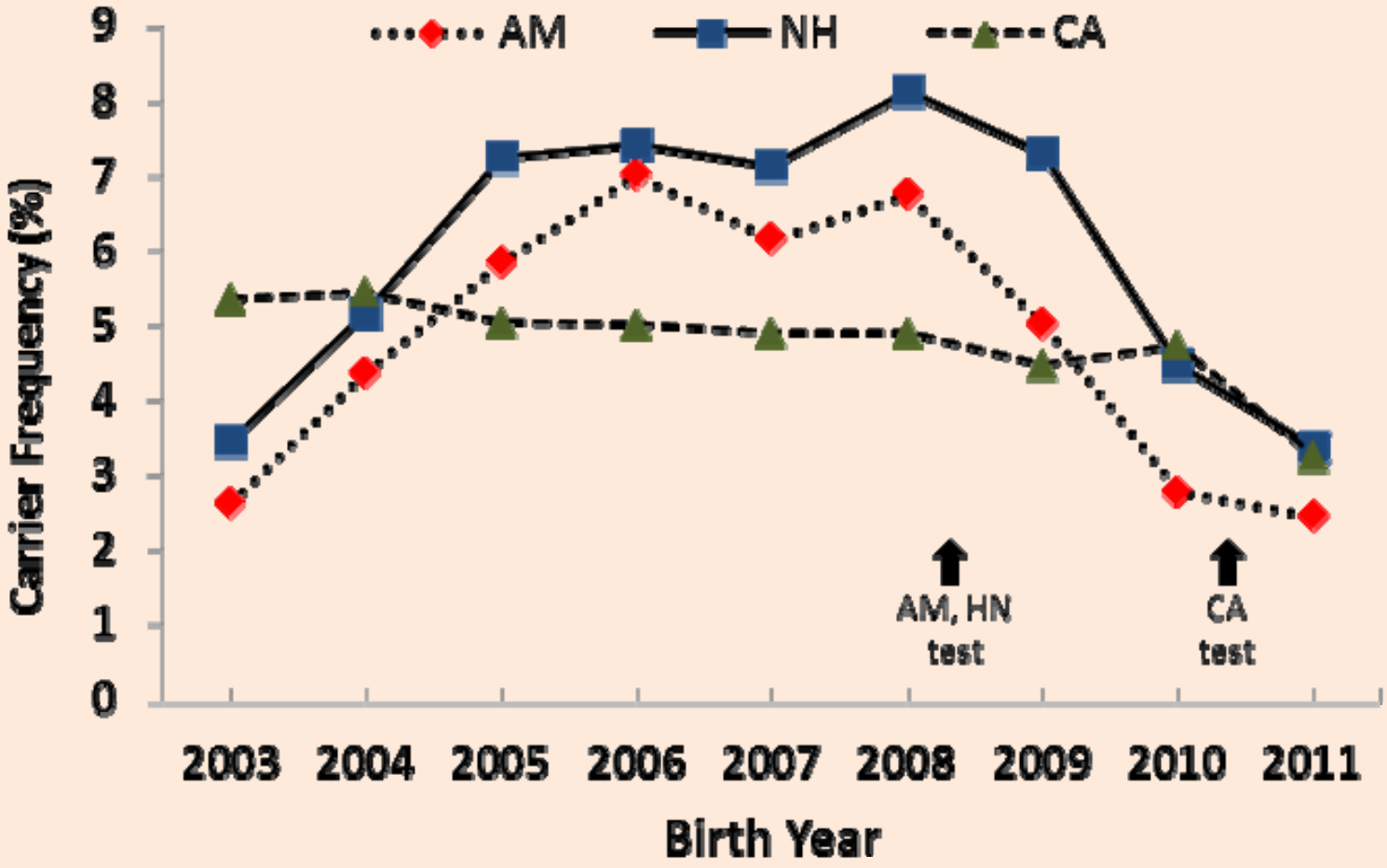
Carcase data: Jun-Sept, 2015

mla MEAT & LIVESTOCK AUSTRALIA

GrowSafe SYSTEMS

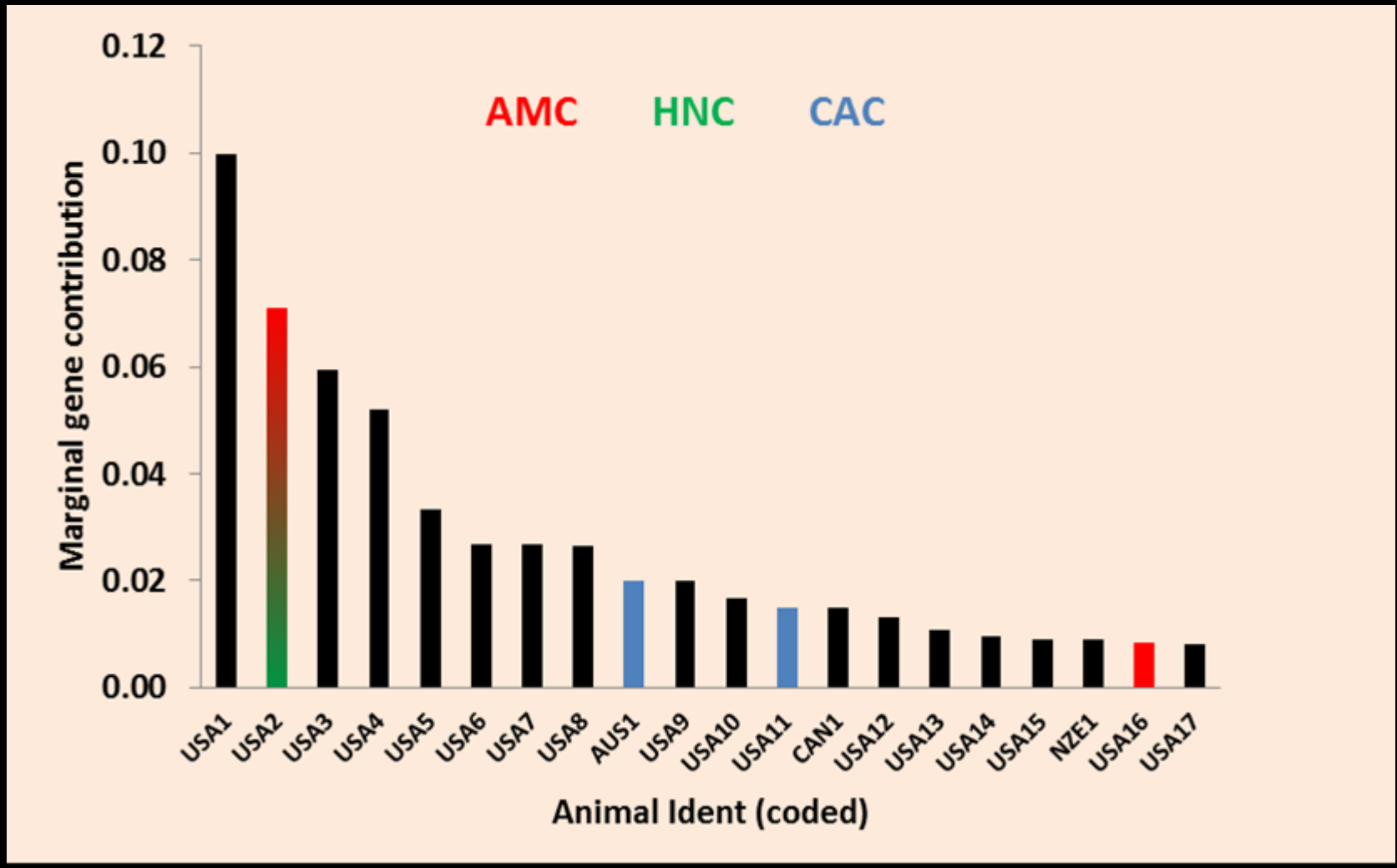
Angus AUSTRALIA

# *Recessive genetic conditions:*




**Impact of DNA tests on frequency of Arthrogryposis Multiplex (AM) and Neuropathic Hydrocephalus (NH) and Contractural Arachnodactyly (CA) in registered Australian Angus**

# *Recessive gene status of key ancestors of the Australian Angus population*



# Key messages:

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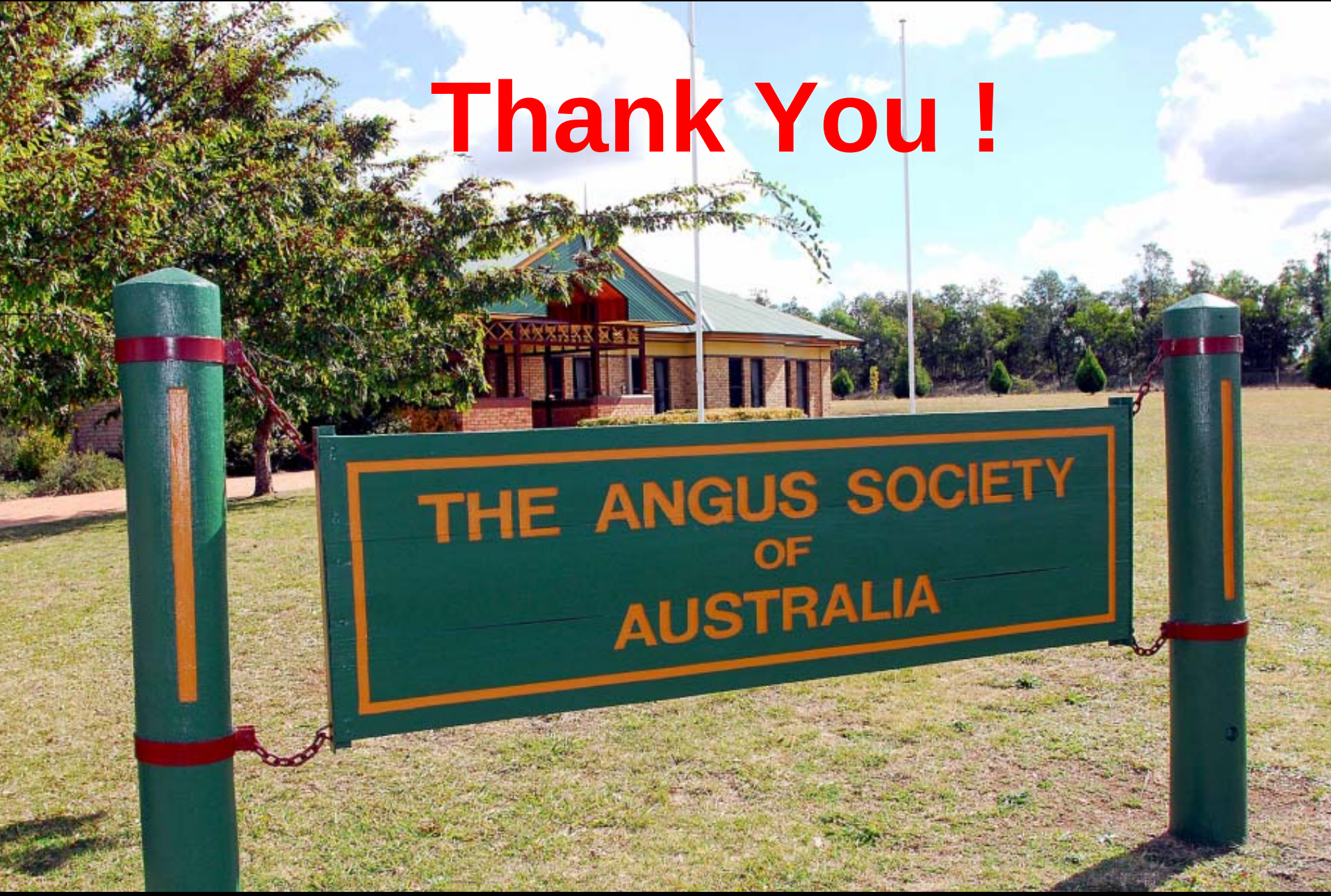
1. Angus breeders in Australia have achieved excellent genetic progress
2. Much of the genetic progress has been due to introductions from USA
3. Rates of genetic progress have declined in recent years
4. Recessive genetic conditions need to be rapidly identified and managed

# Key messages:

5. Need for strategic investment in collecting phenotypes necessary to exploit genomics opportunities
6. Greater global co-operation in genetic evaluation may enable better utilisation of breed genetic diversity




peter@angusaustralia.com.au