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1. The power of the NZ gene pool, for NZ
2. Getting it right: Data recording in the U.S.
3. NZ into the future: Q&A session

Dorian Garrick

Institute of Veterinary, Animal & Biomedical Science, Massey University

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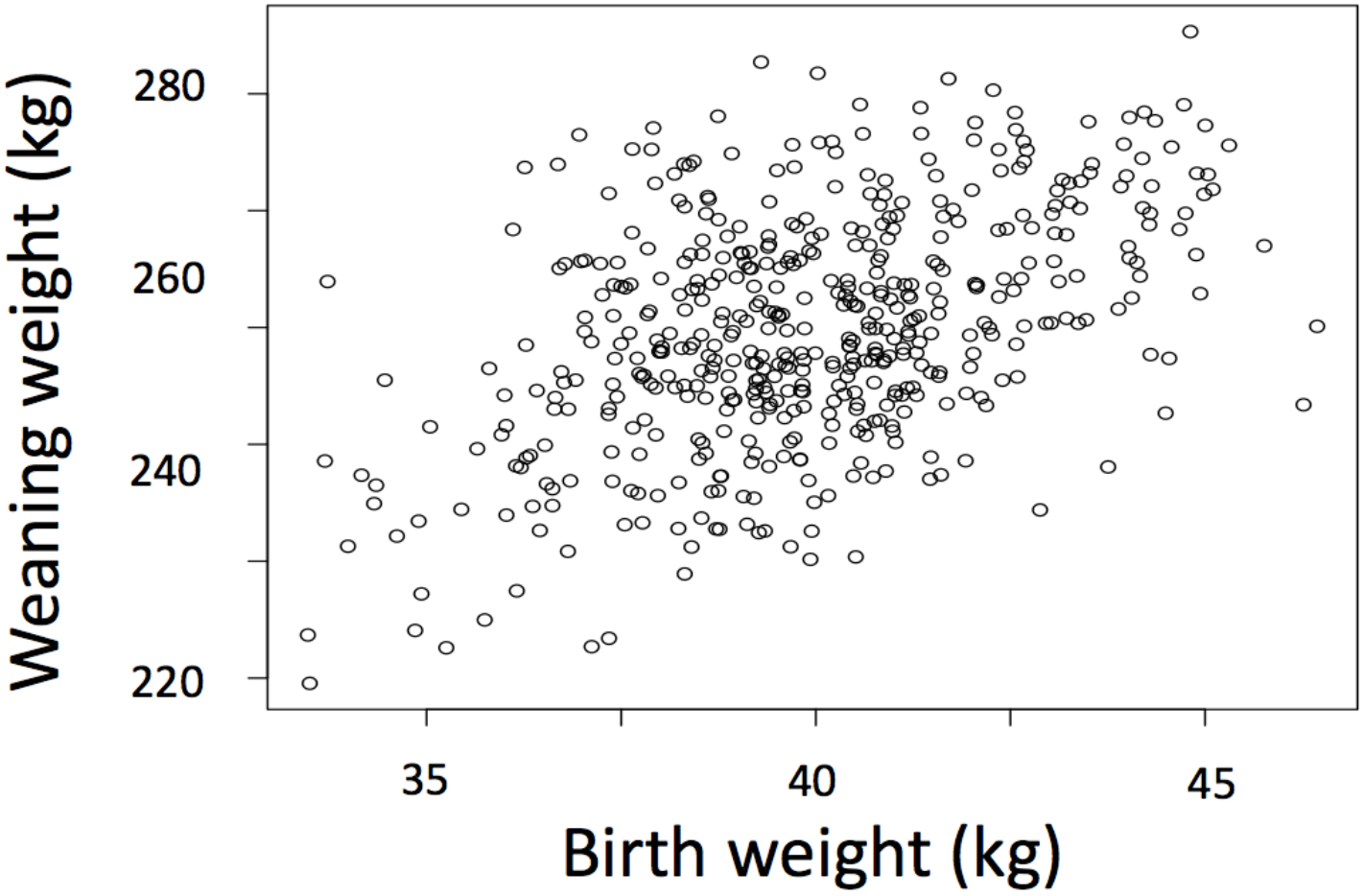
A Pool of Selection Candidates

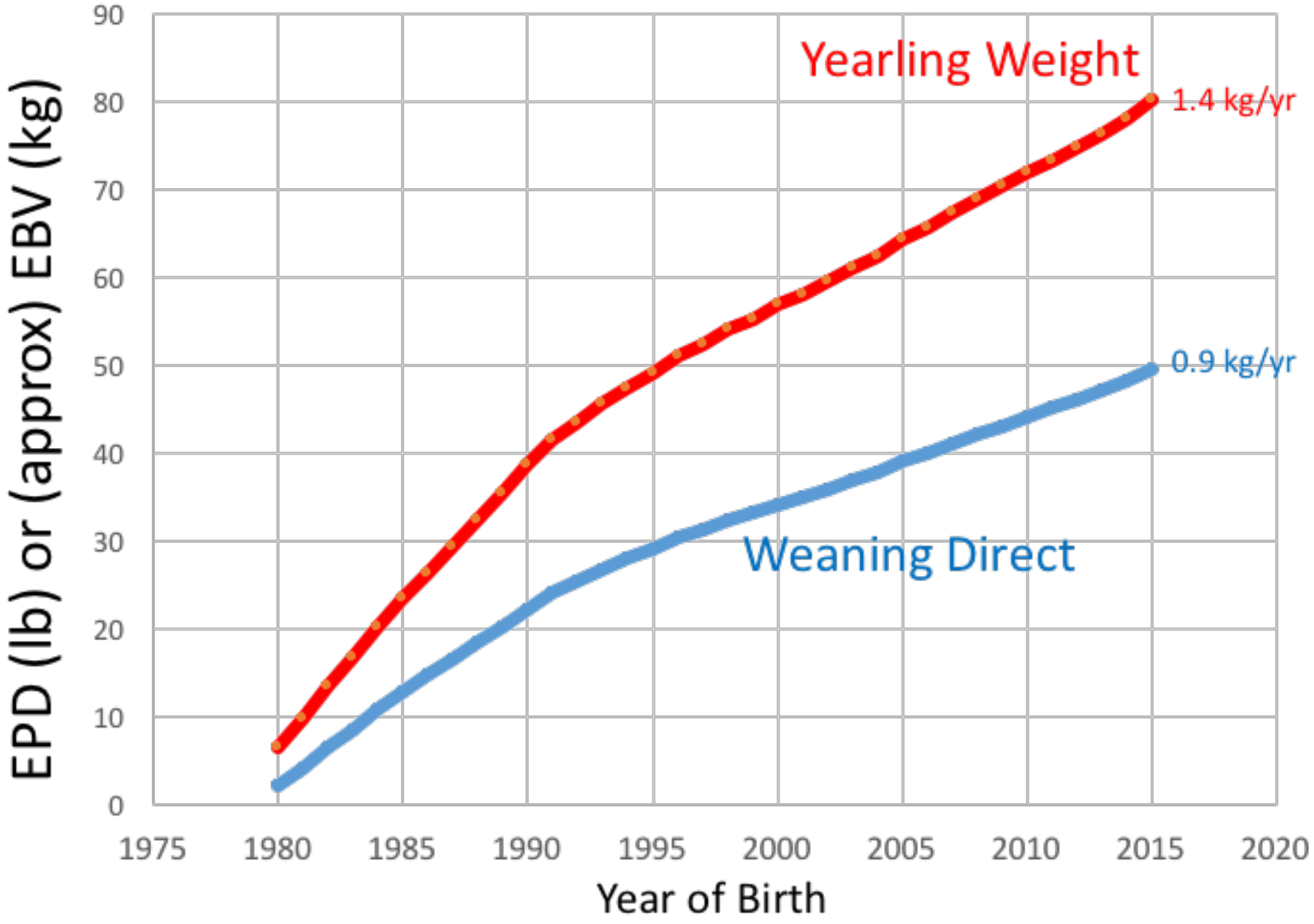


Genetic change in offspring performance only occurs if BVs of parents are not average

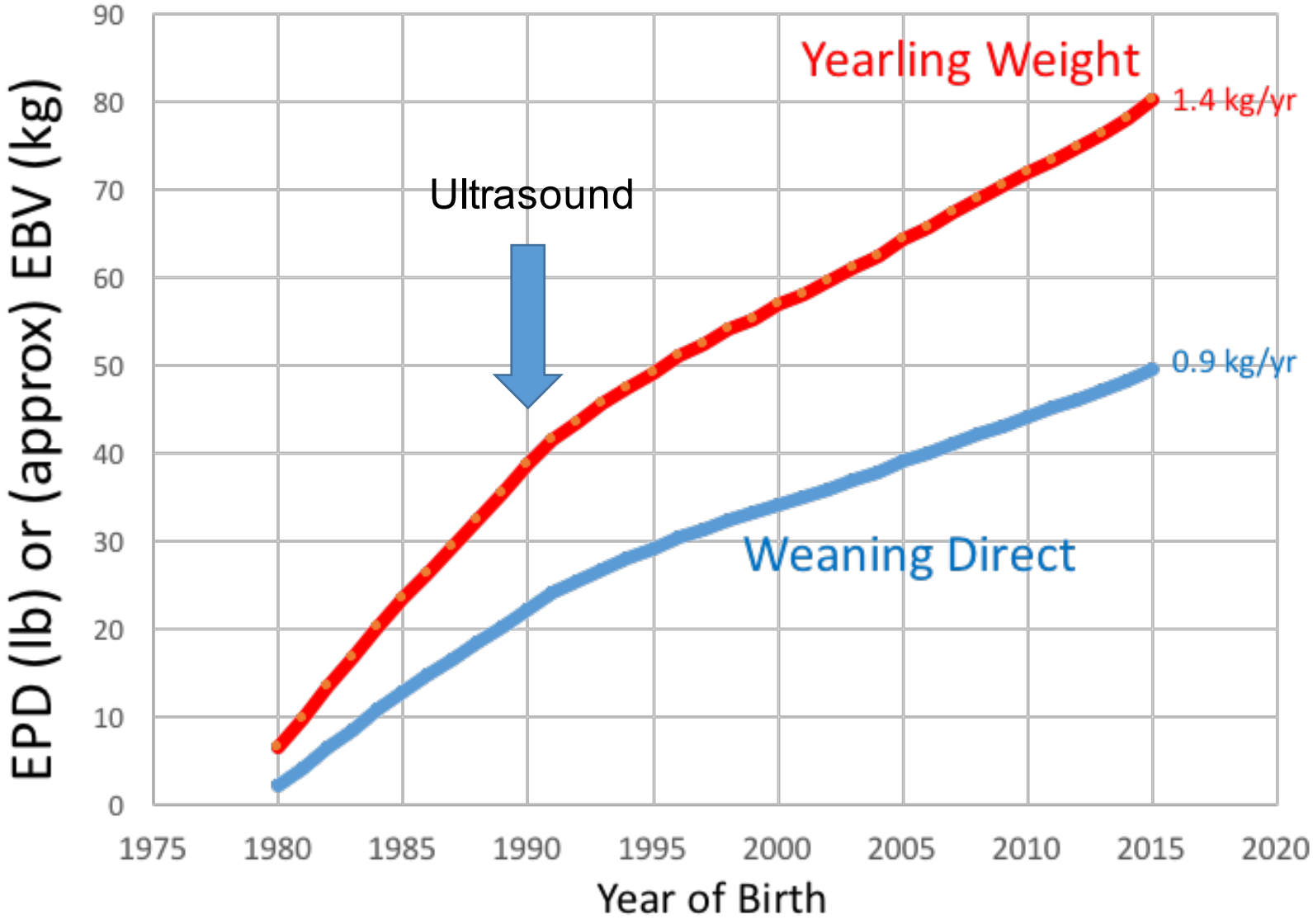
Breeding Values

- The “cloud” only moves if the breeding values of animals chosen to be parents differs from the average of their birth cohort
- This is true for natural or artificial selection, whether selection is based on eye appraisal, measured performance, EBVs, or any combination of these characteristics

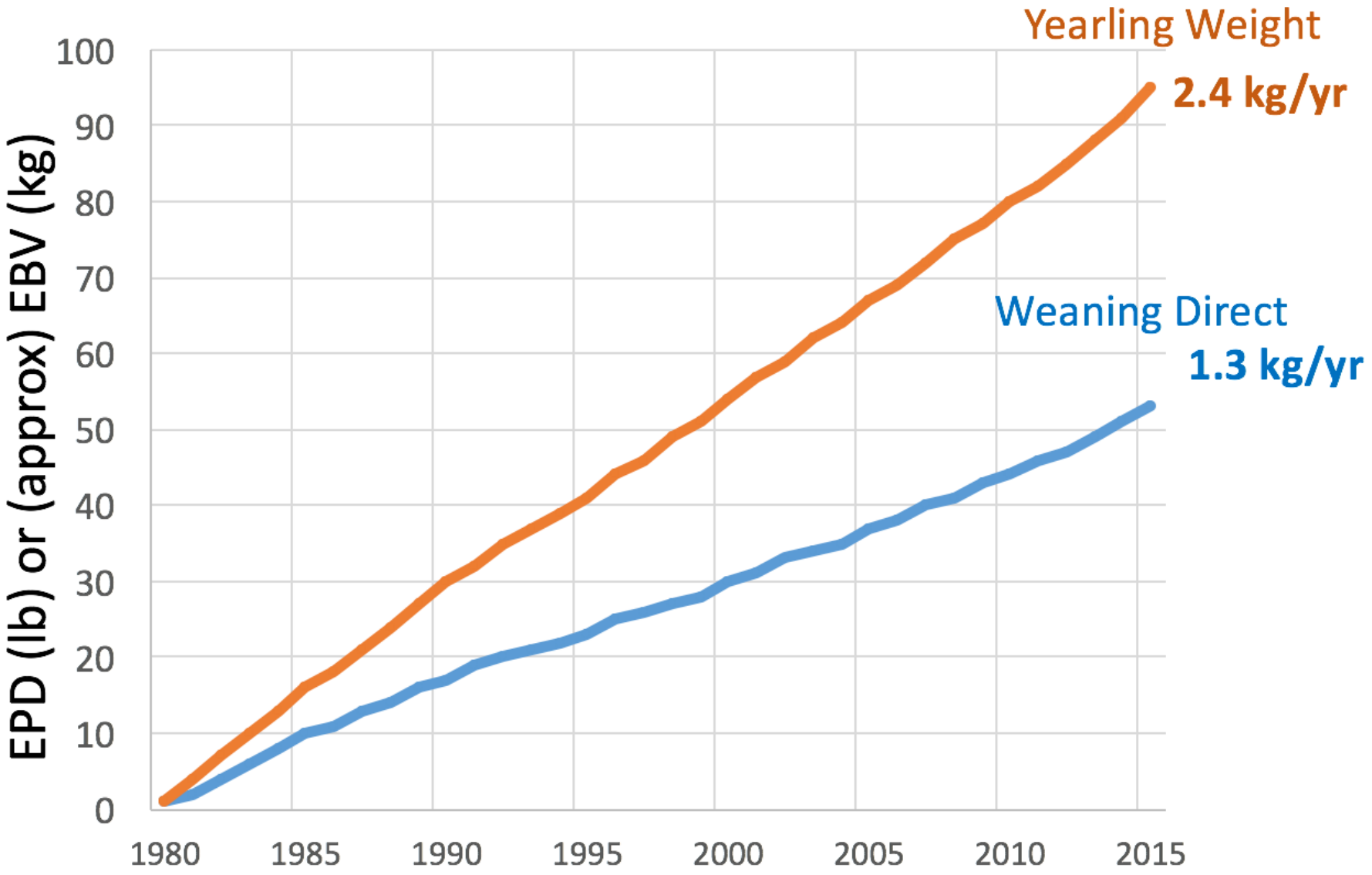
American Hereford Association Genetic Trends



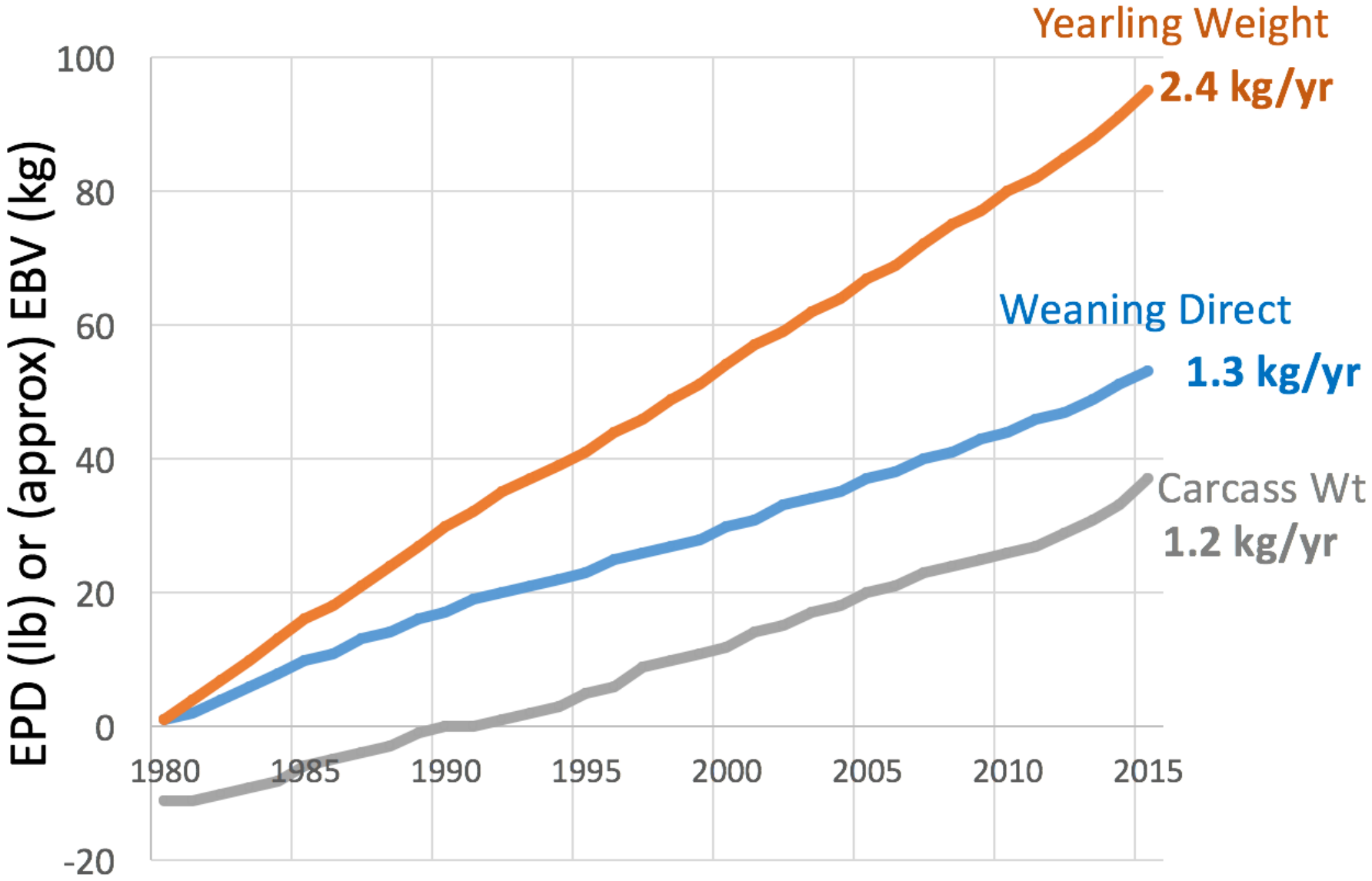
American Hereford Association Genetic Trends



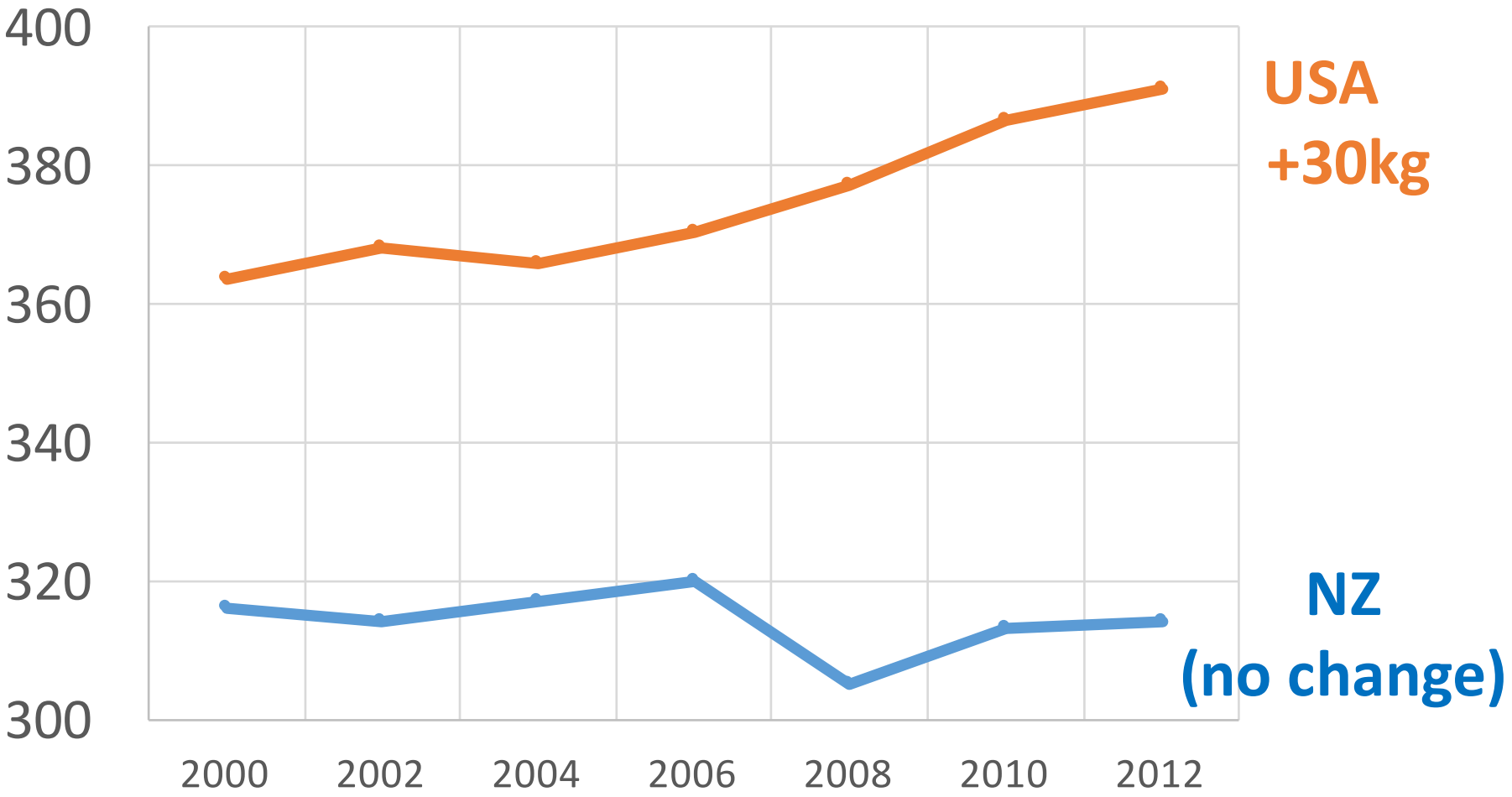
American **Angus** Association Genetic Trends



American **Angus** Association Genetic Trends



Actual Steer Carcass Weights (kg)



US from http://beefmagazine.com/beef-marketingproduct-promotion/industry-glance-how-high-can-steer-carcass-weights-go

Genetic Change

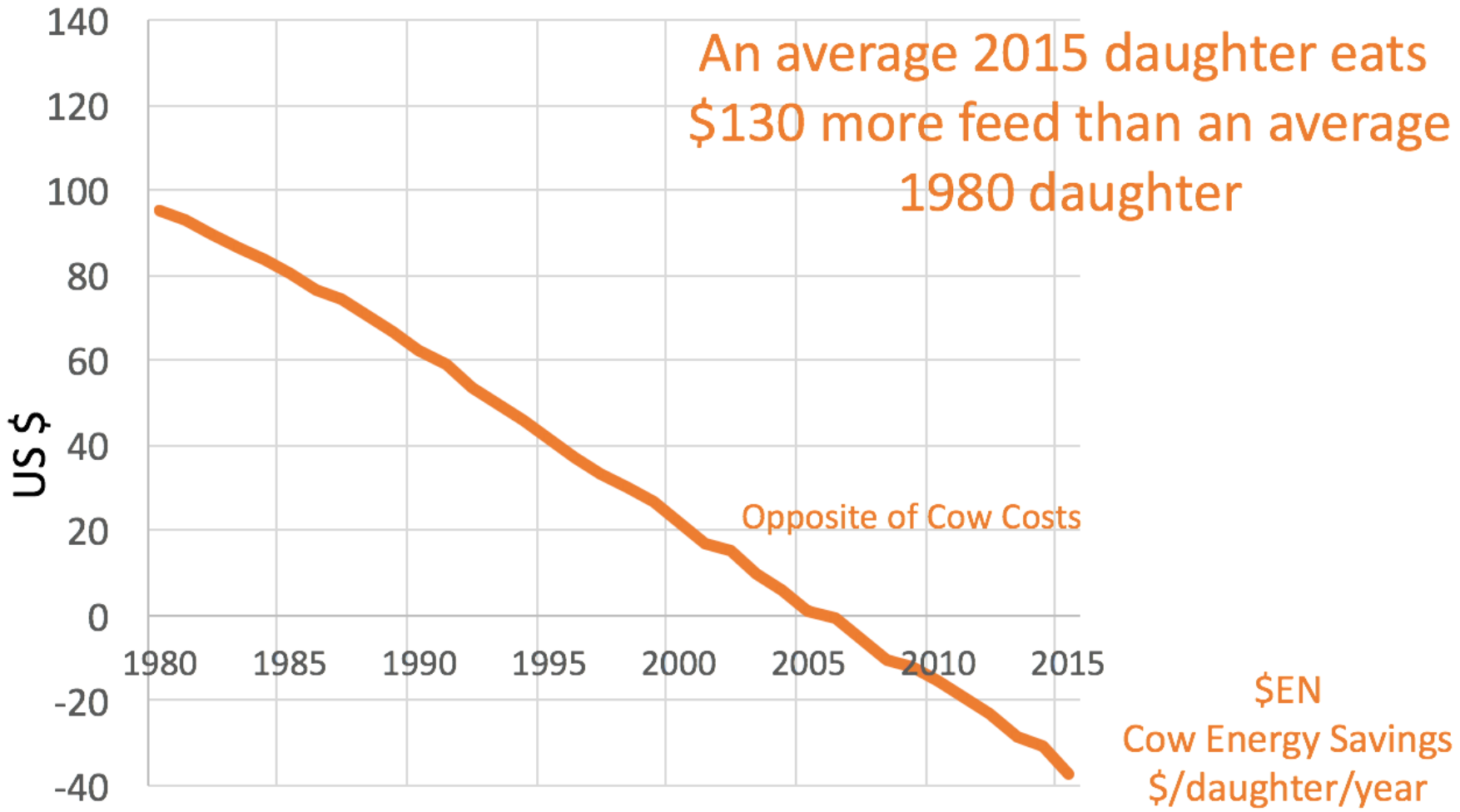
- Genetic change is easy to achieve
- Simply choose as parents those selection candidates that are above average
    - But this will likely lead to simultaneous changes in many other traits, some of these other changes being favourable and others being unfavourable

Genetic Improvement

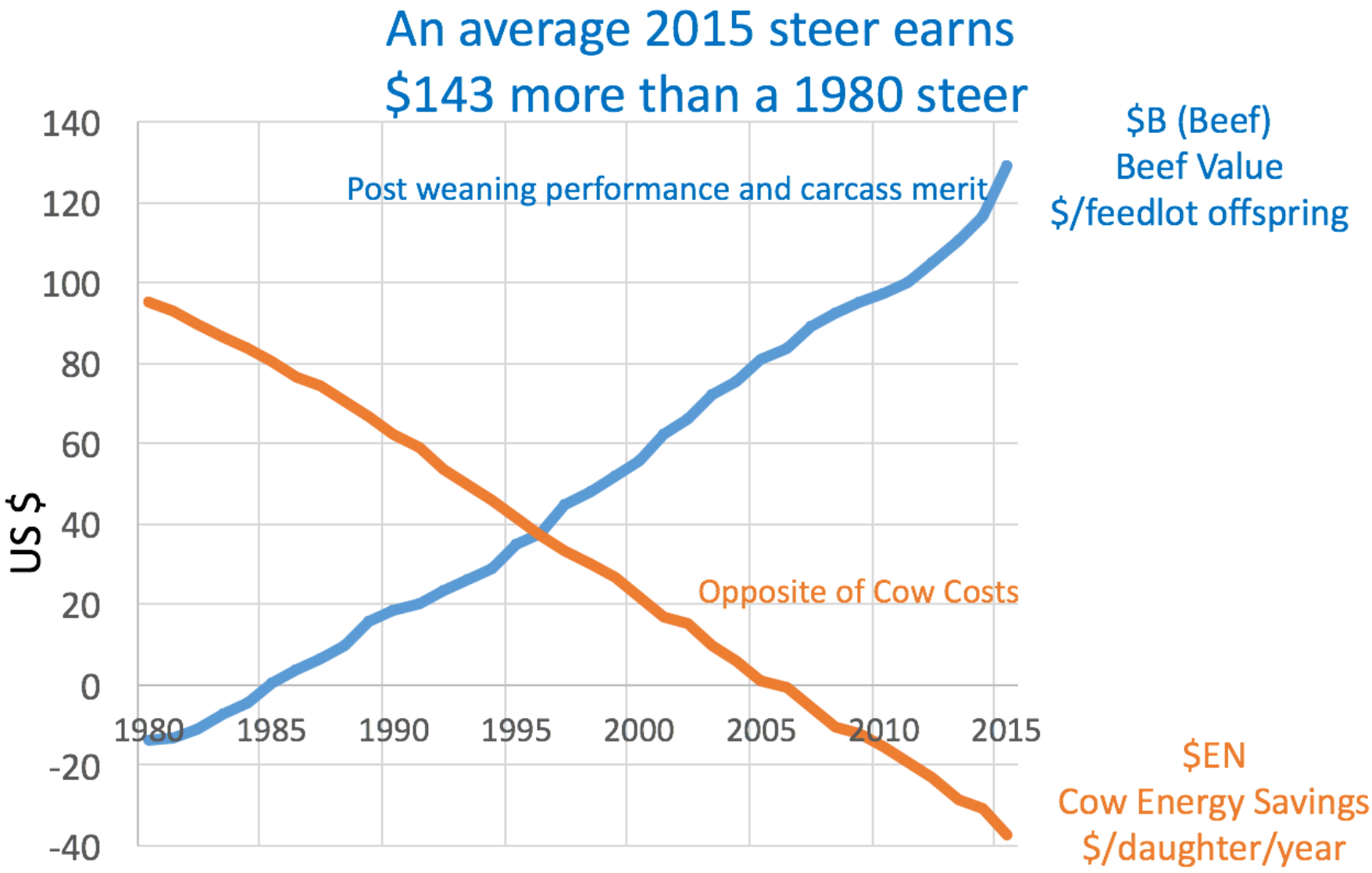
- Genetic improvement is much harder to achieve than genetic change

- It requires that the extra income or reduced costs of all the favourable changes exceeds the reduced income or increased costs of unfavourable changes

American Angus Assoc $index trends



American Angus Assoc $index trends



American Angus Trends

- An average 2015 daughter eats $130 more feed than an average 1980 daughter
  - Heavier liveweight
  - Higher milk production
  - Higher maintenance requirements
- An average 2015 feedlot offspring earns $143 more due to improved post weaning performance and carcass characteristics
  - But not every cow produces a feedlot offspring!
- Collectively, this is genetic change not improvement

Genetic Trends in Reproduction

Genetic Trends in Reproduction

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Getting it right: Data recording in the U.S.

Dorian Garrick

Institute of Veterinary, Animal & Biomedical Science, Massey University

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Data Recording in US seedstock

- Hardly an example of best practice
- Lots of data on growth – birth, weaning, yearling
- Almost no data on reproductive performance
- Some ultrasound data but on seedstock animals
- Almost no carcass data
- No disease data

- Best practice would be more comprehensive phenotypes on smaller numbers of animals

Australian Experience

- “little justification for selecting for growth rate to improve the efficiency of meat production in maternal breeds under favourable environments”.

- ….a major limitation of selection for growth rate was that any increases in gross efficiency among growing stock appeared to be more than offset by higher maintenance requirements of breeding females.

Barlow (1984) Proc 2nd World Congress on Sheep & Beef Breeding

Trangie Selection Experiment

- Began in 1979
  - Using 220 Angus cows selected for individual yearling growth from birth to yearling (adjusted for dam age)
    - 85 High Line
    - 50 Control
    - 85 Low line
  - Response was increase of about 2.11 kg /yr in H (0.9%) and decrease of 2.54 kg/yr (1.1%) in L line

Parnell et al (1994)

Trangie Results – after 15 years

- A self-replacing herd turning off slaughter progeny at 18 months of age the H line returned a higher GM/cow and consumed more feed than the C line

- A 95 cow H line herd consumed a similar amount of feed as a 100 cow C line herd, but returned about $3,750 more profit per year (+15.1%)
  - The H line was more profitable because of the higher carcass weights at 18 months and because the L line had a reduced calving rate

Parnell et al (1994)

Glen Innes

- High, Control and Lowlines were grazed at high, medium or low levels of nutrition

- The H line was more profitable than other lines at all nutrition levels despite its higher feed requirement.

  Increases in gross margin per unit feed for the H line over the C line were 9% 8% and 8% at high, medium and low nutrition levels, respectively. Decreases for the L line from the C line were 24%, 15% and 13%. These differences were largely due to the different turnoff weights for each line

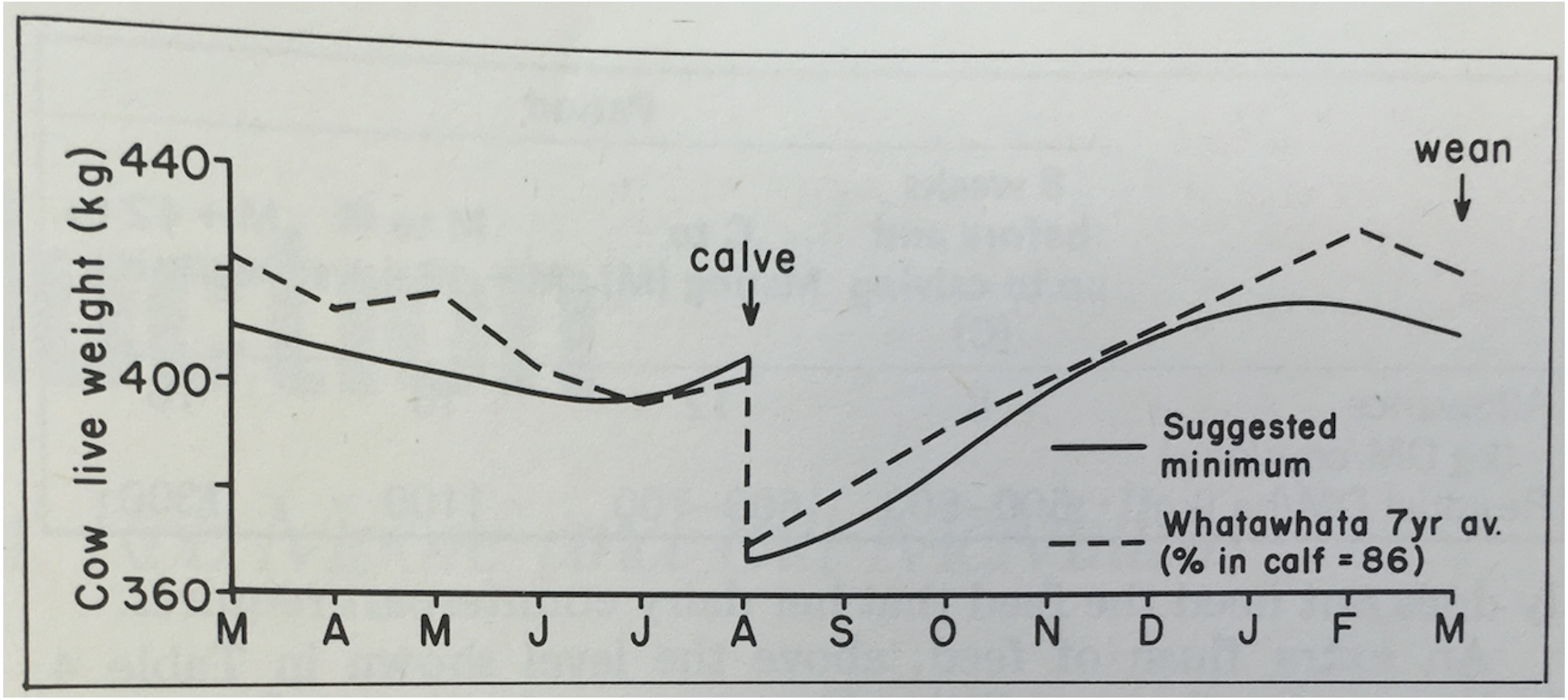
Dicker and Farquharson (1994)

Hamilton – various stocking rates

- Selection for growth increased productivity of cows when compared at similar stocking rates
- At similar grazing pressure (similar cow liveweight/ha) there was no difference between the H and C lines
- Results show only marginal gains in efficiency, (livewt production/ha from a given cow liveweight/ha)
- Selection for growth certainly gives a response in growth, but will not provide a comparable response in efficiency
- Other selection criteria need to be established to enable the industry to select animals for increased efficiency

Graham (1994)

Suggested Liveweights for Average Angus Cows



The Whatawhata Way (1982)

Suckled Angus Breeding Cows

PostPartum	Overall	Block 1	Block 2	Block 3
20 days	383 kg	360	396	391
40 days	378 kg	381	370	385
60 days	397 kg	391	385	414
80 days	406 kg	403	401	413
100 days	421 kg	411	411	441

S.T. Morris MS thesis Massey University 1976

ME Reqts of beef cows

Liveweight (kg)	Month of lactation 1	3	5
350	74	80	75
400	79	85	80
450	85	91	86
500	90	96	91
Calf pasture requirements	—	10	30

NZ Angus – 1976 to 1993

Selection for Net Income per cow lifetime

- Comprising predictions (EBV) for
  - Harvest Weight
  - Dressing % (harvested progeny and cull cows)
  - Fertility (Calves weaned per cow exposed)
  - Cow liveweight at disposal
  - Feed intake
- Based on phenotypic measurements for
  - Weaning weight (about 700 calves per year)
  - Yearling weight
  - Average lifetime cow body weight
  - Fertility – numbers of calves weaned

Enns and Nicoll (2008)

Progress (expressed over 20 years)

Trait	Change over 20 years
Weaning weight (direct)	8.6 kg
Weaning weight (maternal)	0.6 kg
Post-weaning gain	5.8 kg
Yearling weight	14.4 kg
Harvest weight	34.0 kg
Cow weight	2.6 kg
Number calves weaned per cow	1.2%
Dressing %	-0.7%

In 2006 US$ these changes were estimated to be worth $2.5m based on 6,600 heifers per year sired by bulls in the program

Feilding Sale 5 May 2016

	Tally	Cond	Weight
VIC R3yr Heifer			
Ang	85	M/G	400 - 423
VIC MA Cow			
Ang & A/H	8	M/G	564
Ang & A/H	39	M/G	431 - 512
Ang & A/H	6	M	453
Ang/H x	30	G	632 - 669
Ang/H x	33	G	593
Ang/H x	8	G	566
Ang/H x	9	M	568
Ang	25	M/G	607
Ang	17	M/G	525
Ang	21	M	568
Ang	10	M	566
Ang	35	M	473 - 479
Here	32	G	547 - 650
Here	37	M/G	481 - 564
Here/Fr x	9	M	445
S.Dev x	20	M/G	517 - 572
S.Dev x	10	M	500

Cows mature weights in NZ are now 100-200 kg heavier than they were in 30 years ago

Their weights have been increasing say 3-6 kg per year

Comparative Responses in NZ

Species	Change	Improvement	Nucleus
Maize	Huge	Huge	US
Trees (*Pinus Radiata*)	Moderate	Moderate	Rotorua
Broiler Chickens	Huge	Huge	US/Europe
Layer Hens	Huge	Huge	US/Europe
Pigs	Huge	Huge	US/Europe
Grazed Pasture	Small	**Negligible**	NZ
Dairy Cattle	Moderate	Moderate	Hamilton
Sheep	Huge	Moderate	NZ
Beef Cattle	Huge	**Negligible**	NZ/US

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New Zealand into the future: Q&A

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NZ into the future

- There is a clear value proposition for selection of beef cattle to improve their profit per unit pasture consumed
- Genetic trends in US breeds do not appear to be offering these benefits – even in US circumstances with increasing harvest weights
- Genetic improvements in profitability will not be achieved by selection on growth traits alone – but require information on the whole range of traits that influence income and expenses

New Tools

- New devices (RFID, scales etc) can assist in the measurement of additional phenotypes
- New technologies (sequencing, genomics, marker panels, gene editing) provide new approaches to improvement
- The value proposition does not allow bull breeders to recoup investment in these new approaches
    - Market failure means that adoption of these new technologies will require collaborative funding including those from taxpayer or levy funds that other livestock industries such as dairying have been enjoying

Not more of the same

- Genetic change is easy, genetic improvement is much more challenging to achieve

- Improving the profitability of beef cattle for NZ sheep and beef farm circumstances **as a result of selection** will require new approaches, not simply doing more of the same things that have been done for the last few decades

Thank you.