Sire selection for yield improves lamb meat colour

Honor Calnan

Keeping Lamb Meat Red

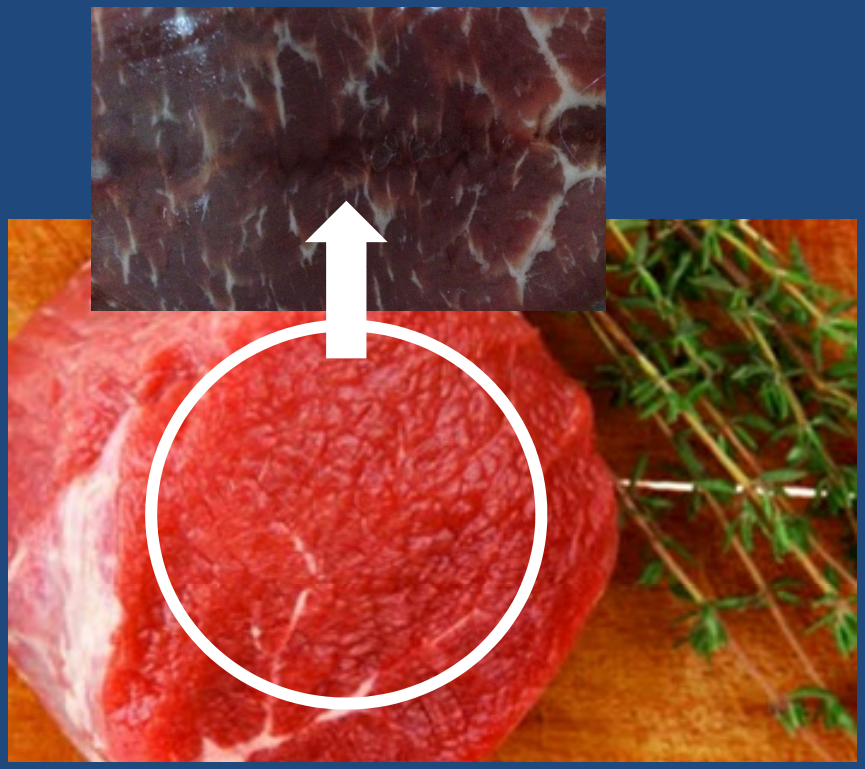
- The importance of meat colour
- Australian Sire Breeding Values
- Experimental design
- Impact of breeding values on colour
- Mechanisms?

Lamb meat colour

- Consumers prefer **bright red** meat

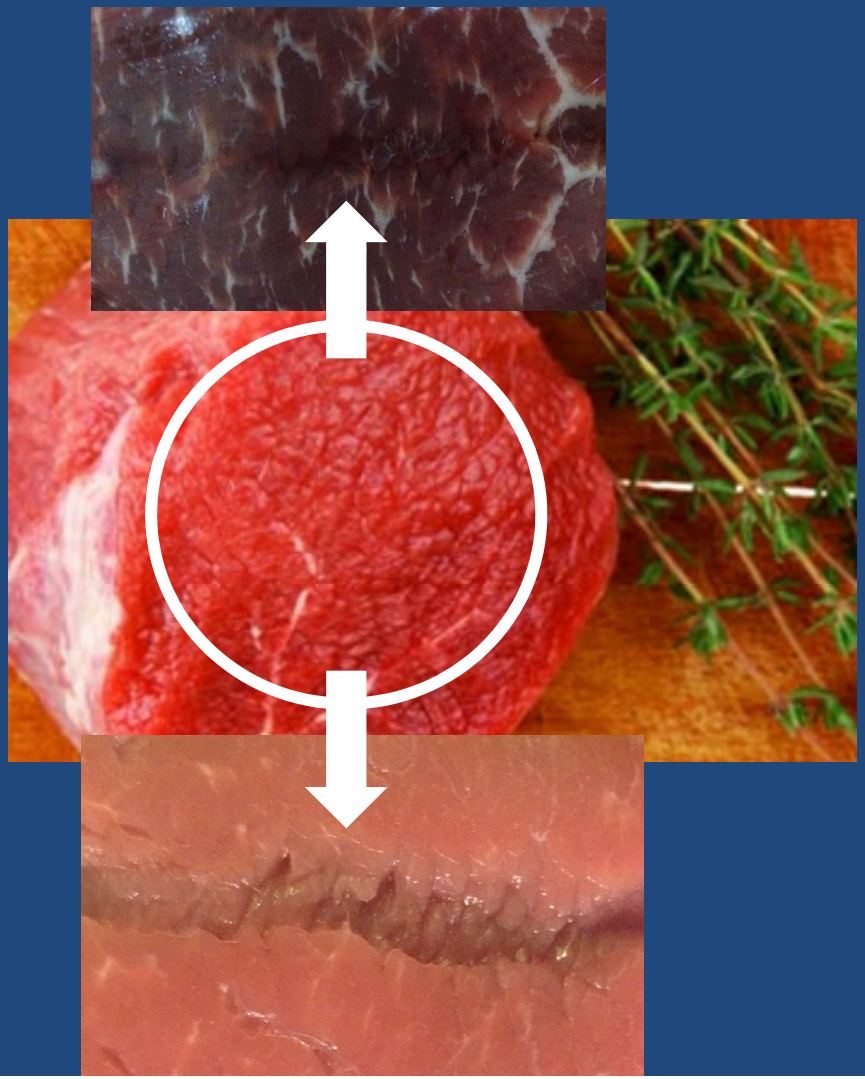
Lamb meat colour

- Consumers prefer **bright red** meat



Lamb meat colour

- Consumers prefer **bright red** meat



Lamb meat colour

- Consumers prefer **bright red** meat

Lamb meat colour

- Consumers prefer **bright red** meat

Controlling fresh meat colour?

Sire selection & Lamb meat colour

- **Australian Sire Breeding Values**
  - **Post-Weaning Eye Muscle Depth**

↑ muscling

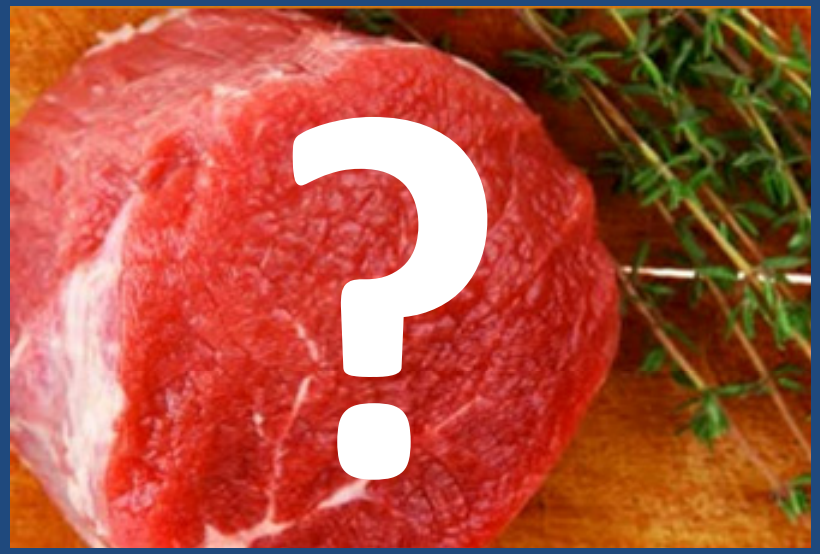
  - **Post-Weaning Fat Depth**

↓ fatness

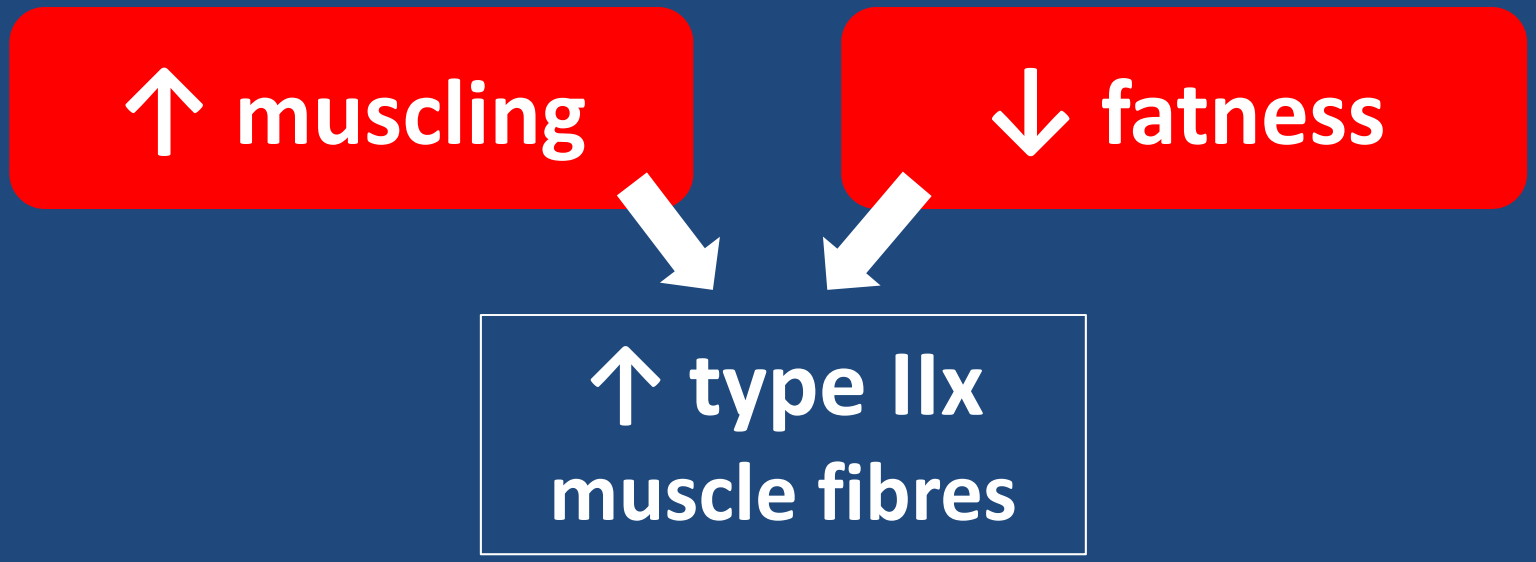
Sire selection & Lamb meat colour

↑ muscling

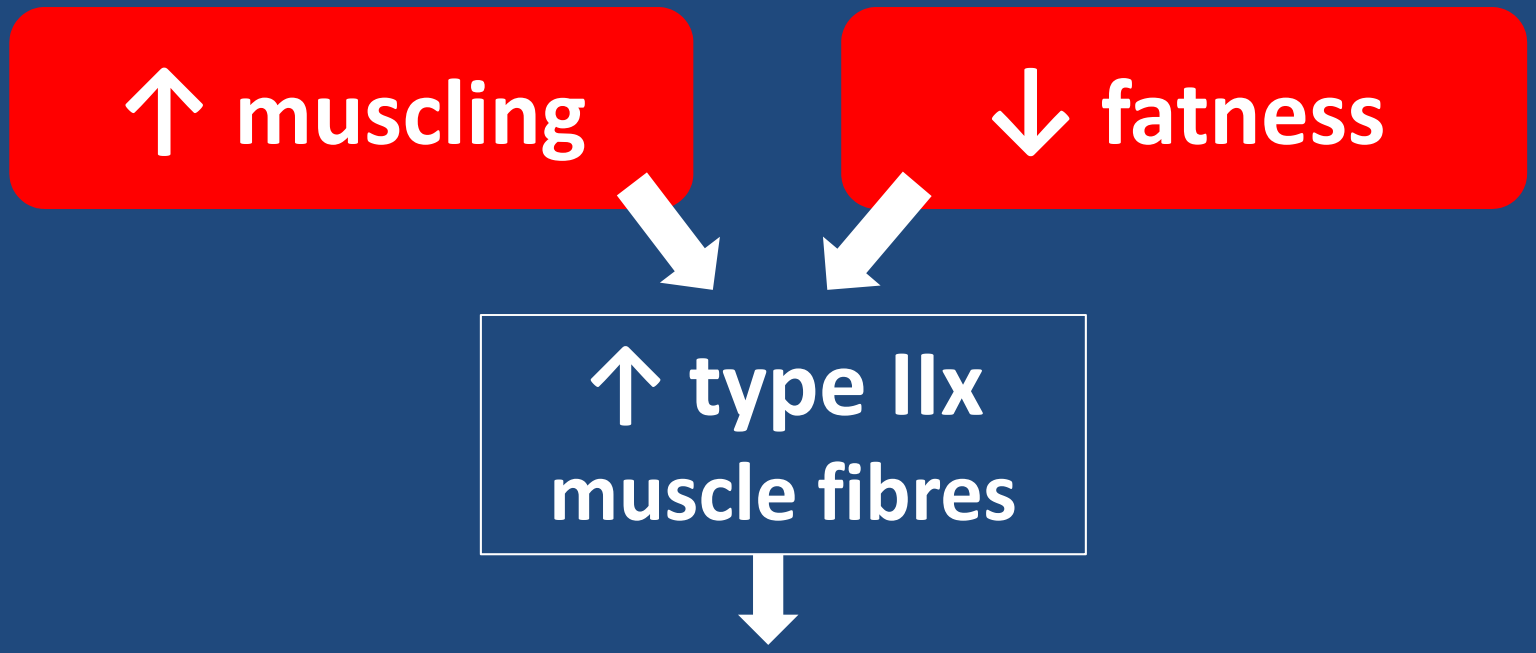
↓ fatness



Sire selection & Lamb meat colour



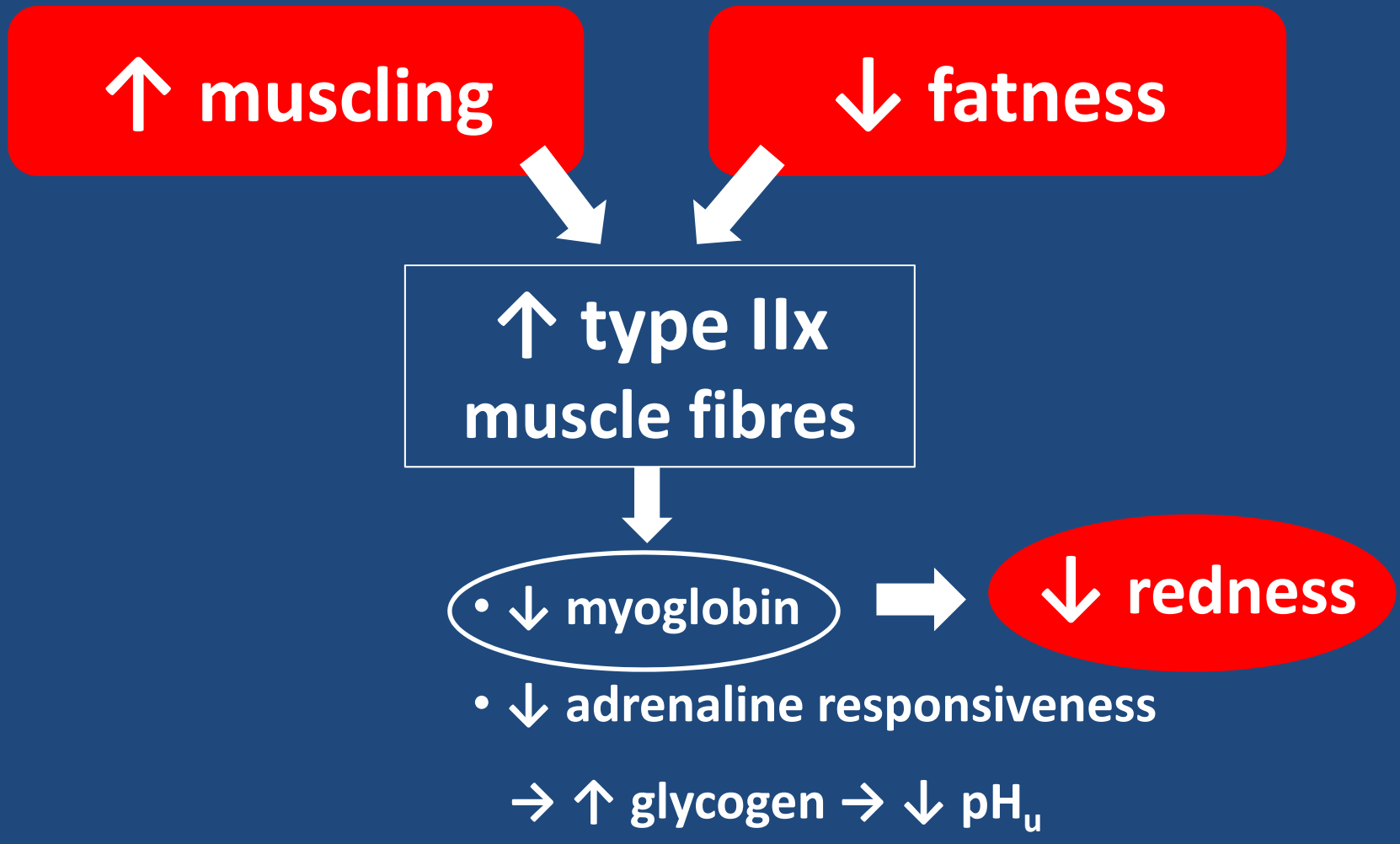
Sire selection & Lamb meat colour



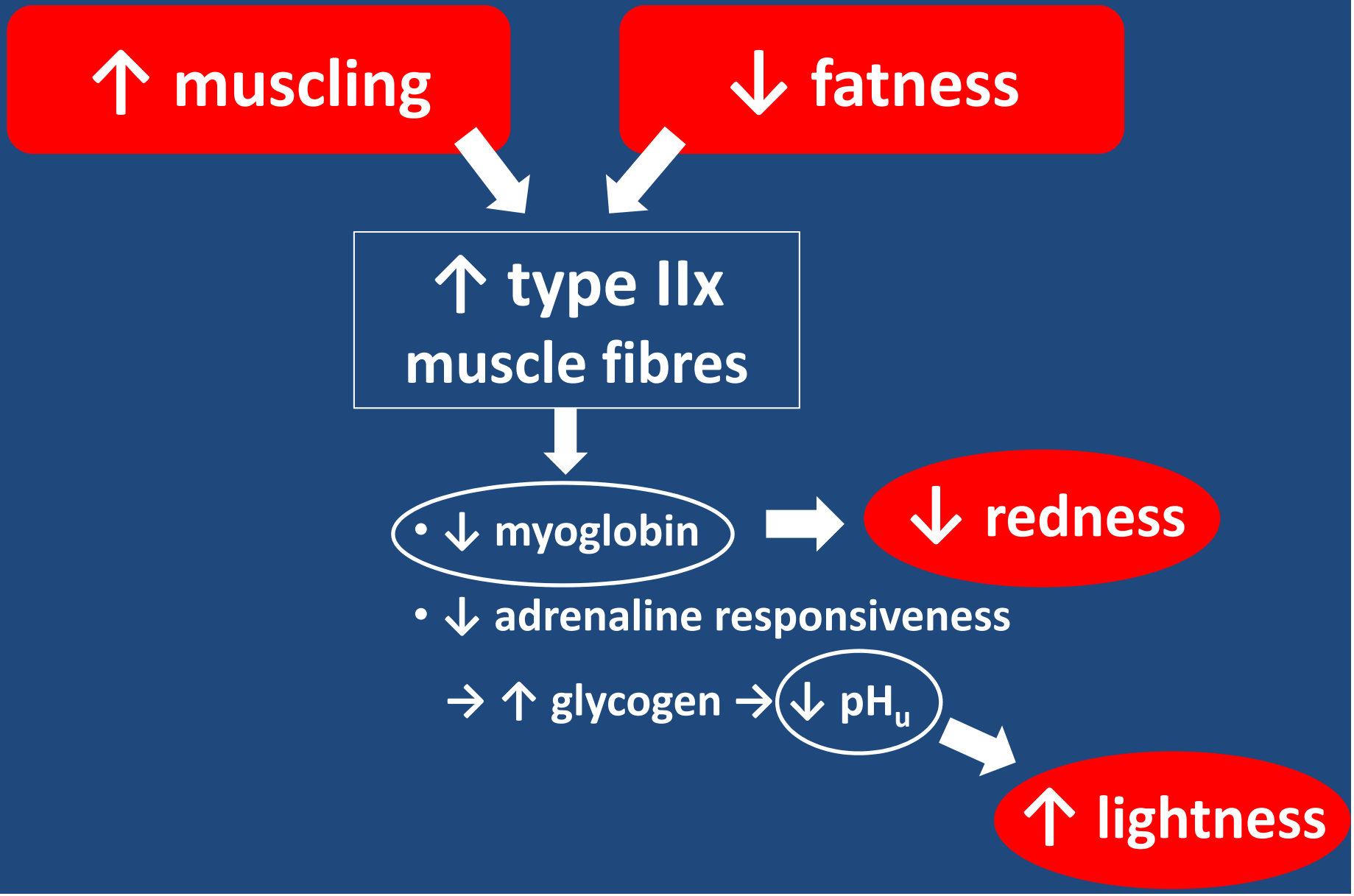
- ↓ myoglobin
- ↓ adrenaline responsiveness

→ ↑ glycogen → ↓ pH_u

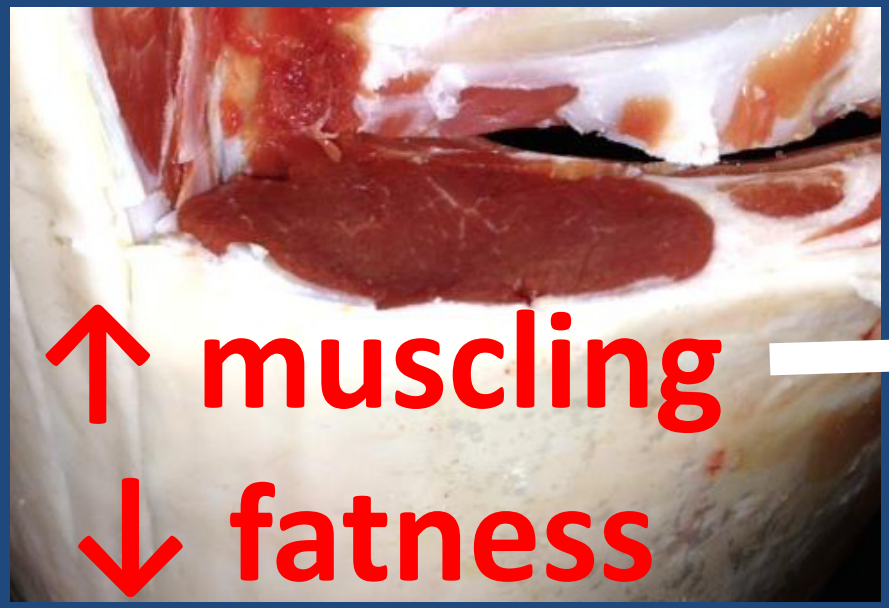
Sire selection & Lamb meat colour



Sire selection & Lamb meat colour



Hypothesis



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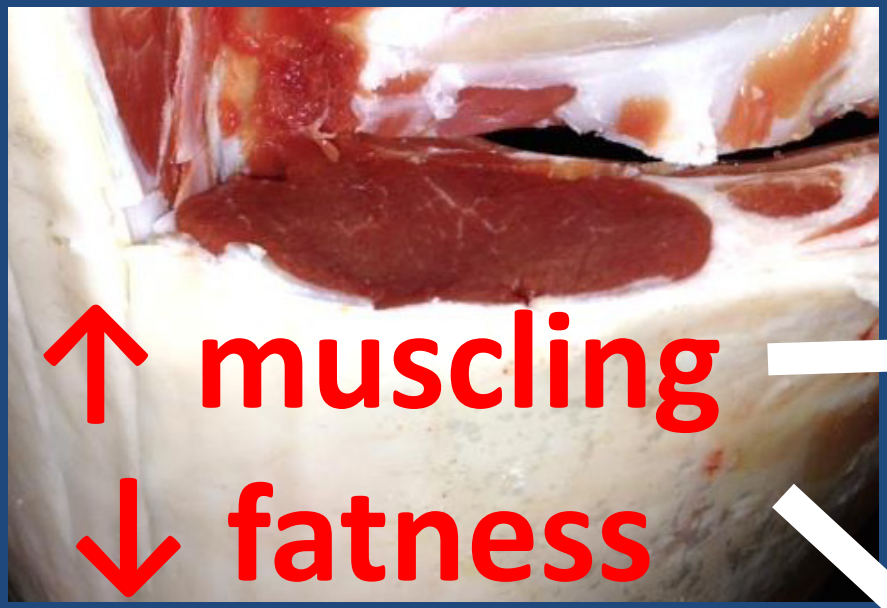


↓ redness

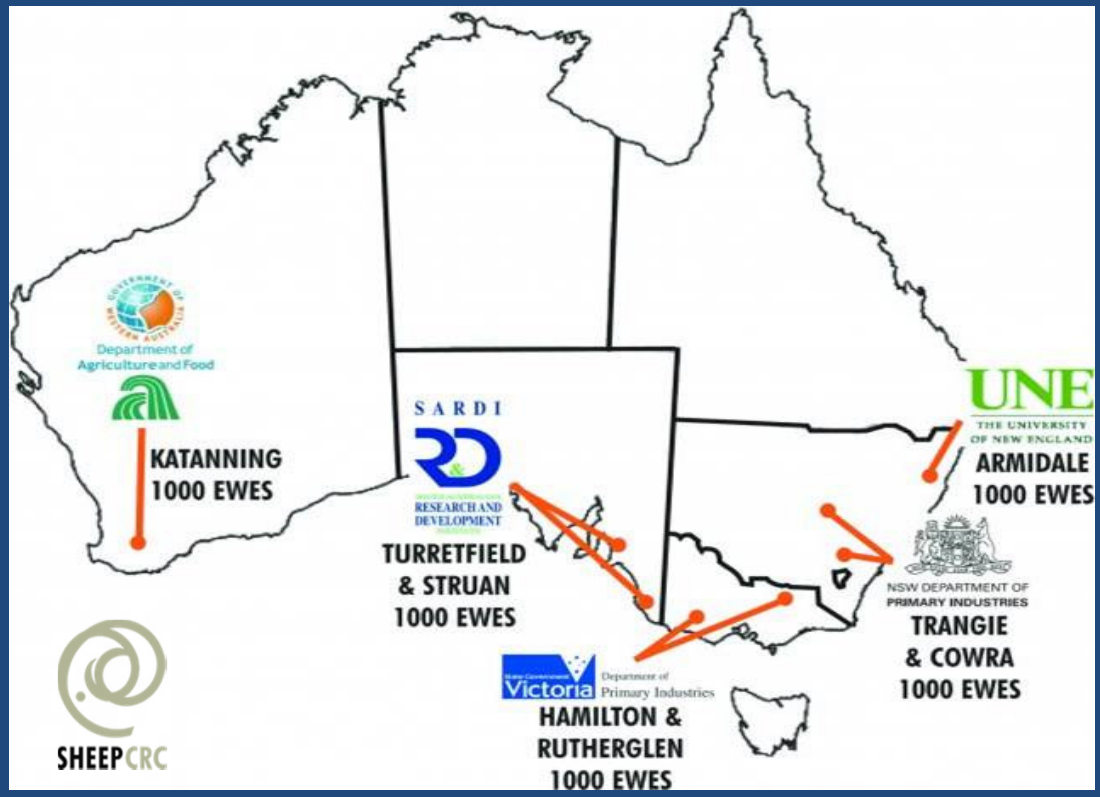
↑ lightness

↓ myoglobin

↓ pH_u

Experimental Design

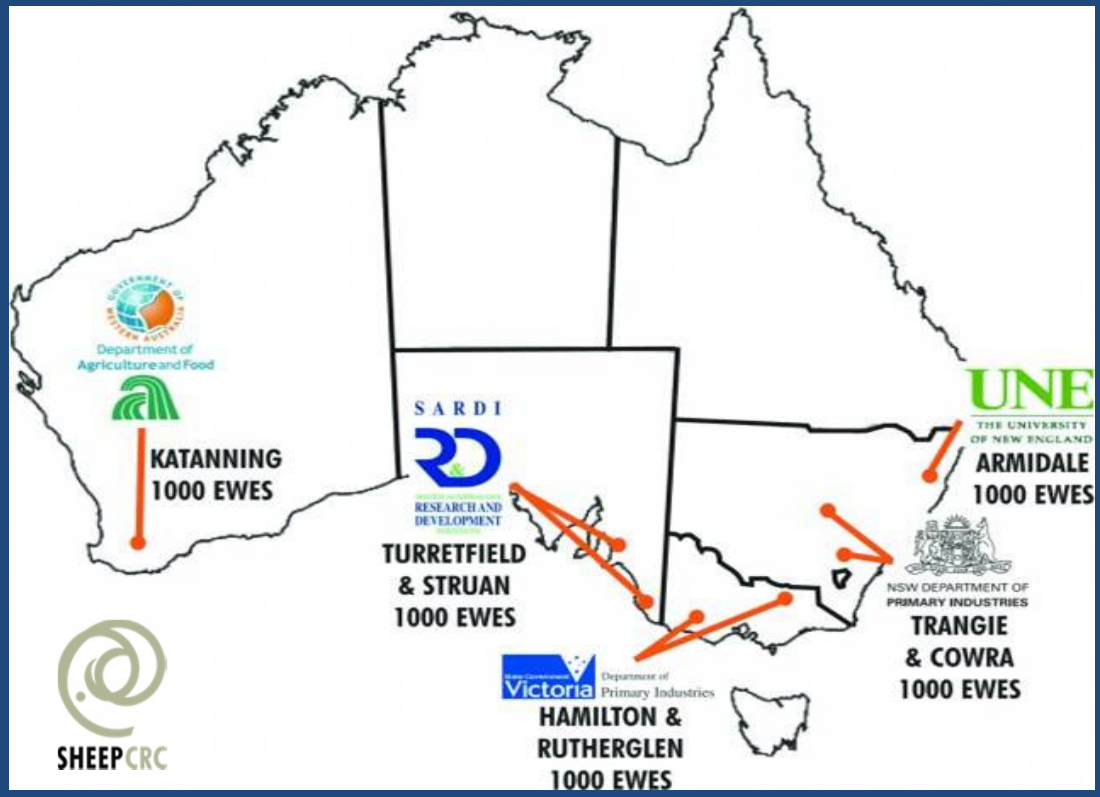
- 7732 lambs
- 8 sites, 5 years



Experiment - Genetic Design

- 7732 lambs
- 8 sites, 5 years

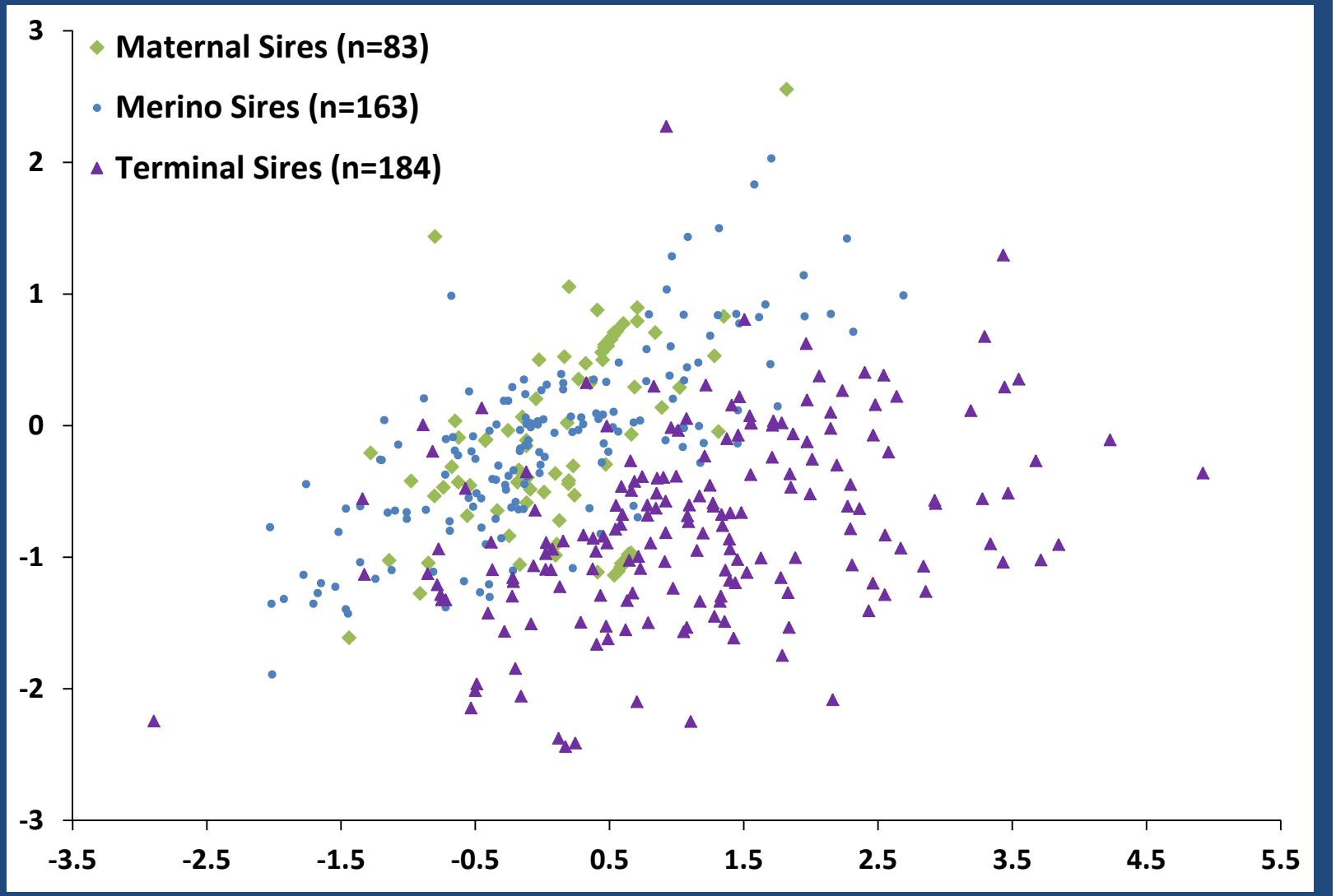
Sires		Dams
Merino	→	Merino
Terminal	→	Maternal
	→	Merino
Maternal	→	Merino



Australian Sheep Breeding Values

- Muscling (Post-weaning Eye Muscle Depth)
- Fatness (Post-weaning Fat Depth)

Experiment - Genetic Design

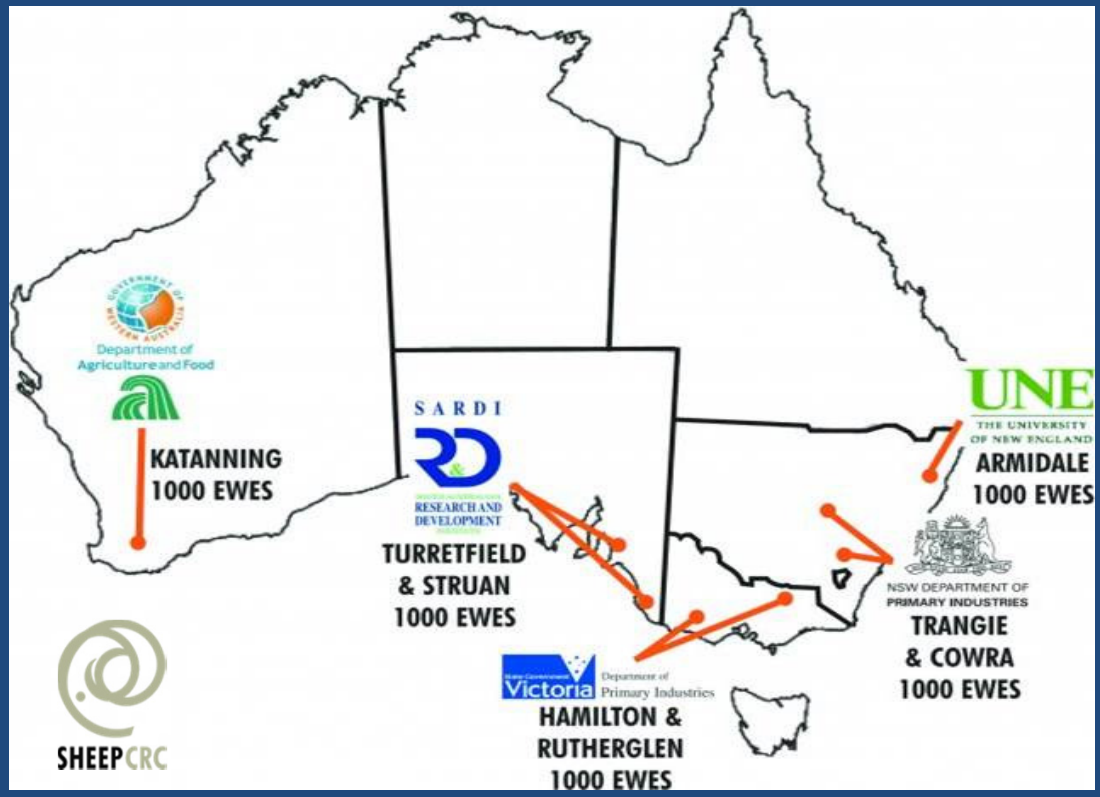


Sire Fatness Estimate

Sire Muscling Estimate

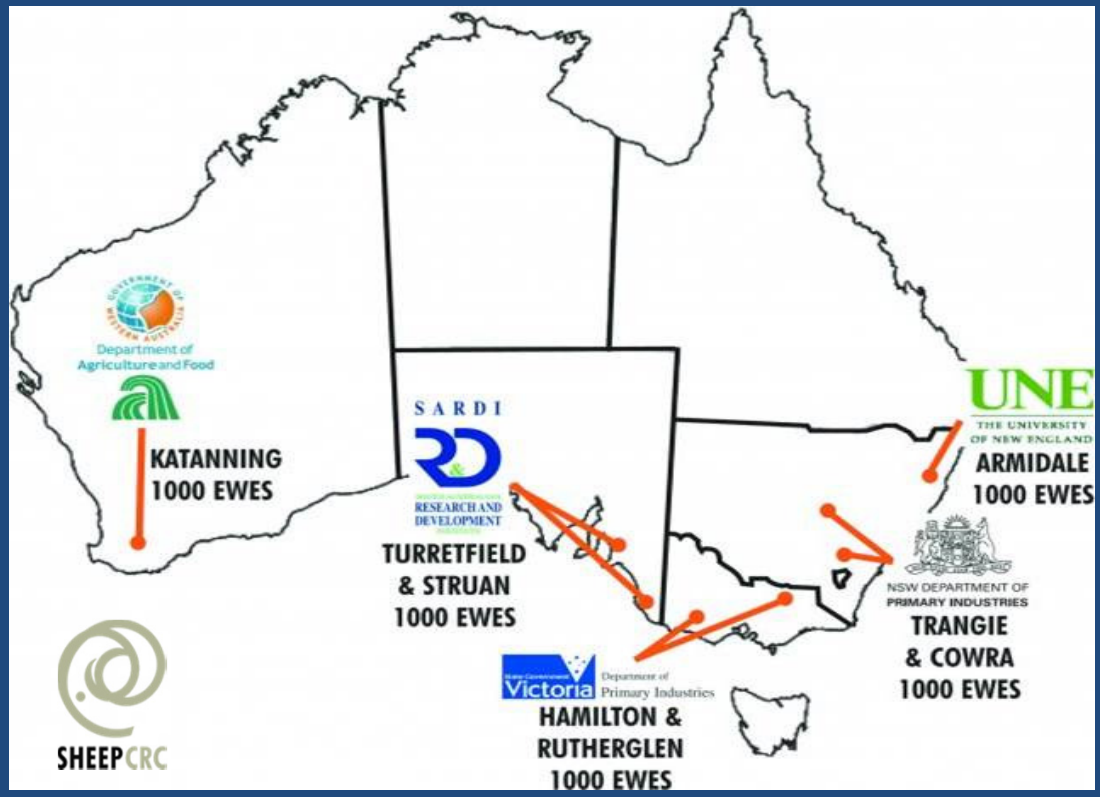
Experimental Design

- 7732 lambs
- 8 sites, 5 years
- Extensive pasture grazing



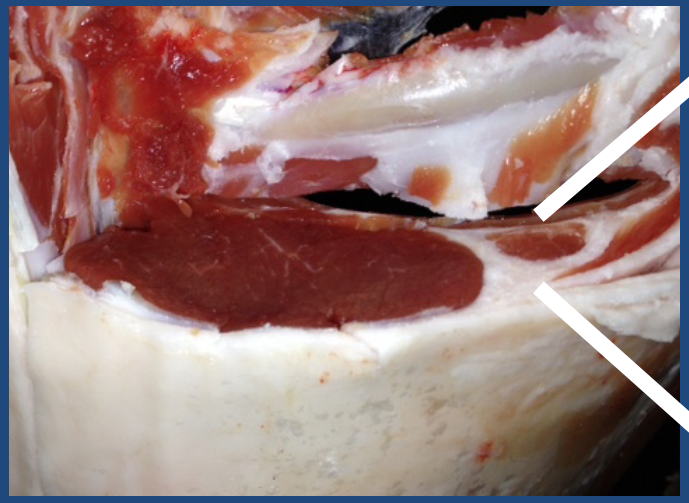
Experimental Design

- 7732 lambs
- 8 sites, 5 years
- Extensive pasture grazing
- Groups killed at ~ 21 kg CW



Experiment – Carcass Measures

- Loin muscle @ 24 hrs



- myoglobin (mg/g muscle)
- $pH_{24} \approx pH_u$

Fresh Colour

L* : Lightness

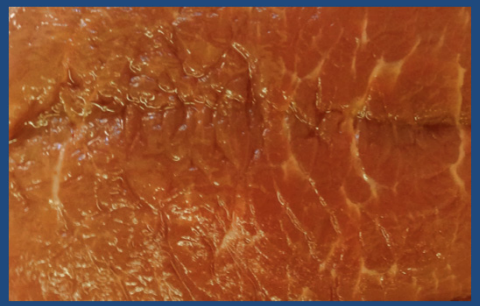
a* : Redness

b*: Yellowness

Colour Measurements

L*: Lightness

a*: Redness



b*: Yellowness

Colour Measurements

L*: Lightness

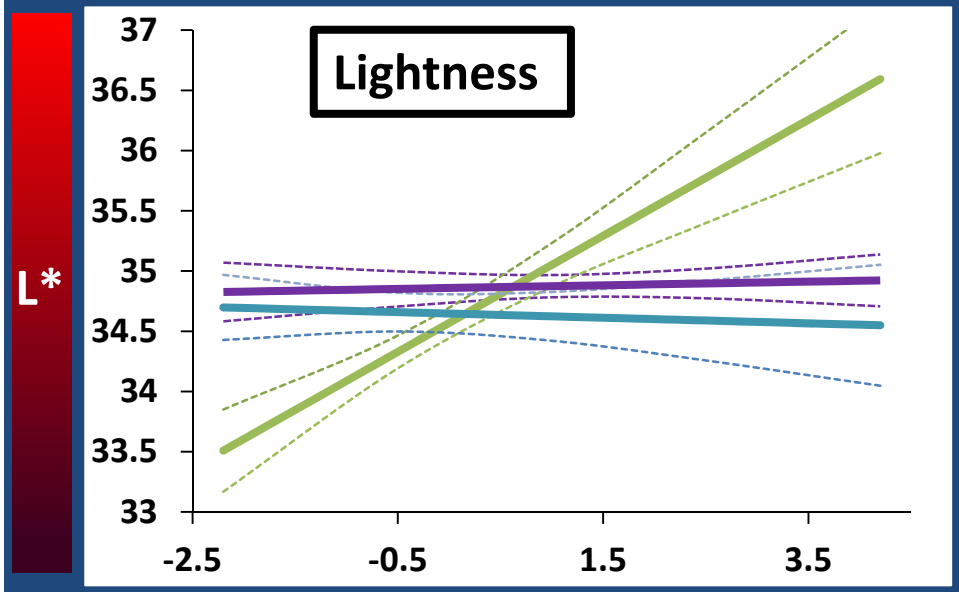
a*: Redness

Statistical Analyses

- Multivariate analysis of L*, a* & b*
  - Fixed Effects
    - Year of birth
    - Site reared
    - Kill group (within site by year)
    - Sire type
    - Sex & Dam breed (within sire type)
  - Random Effects
    - Sire
    - Dam by year
  - Covariate
    - Australian Breeding Values for Muscling & Fatness
    - pH_u
    - Myoglobin
- Linear mixed effects model
  - Least Squared means for each of L* and a*

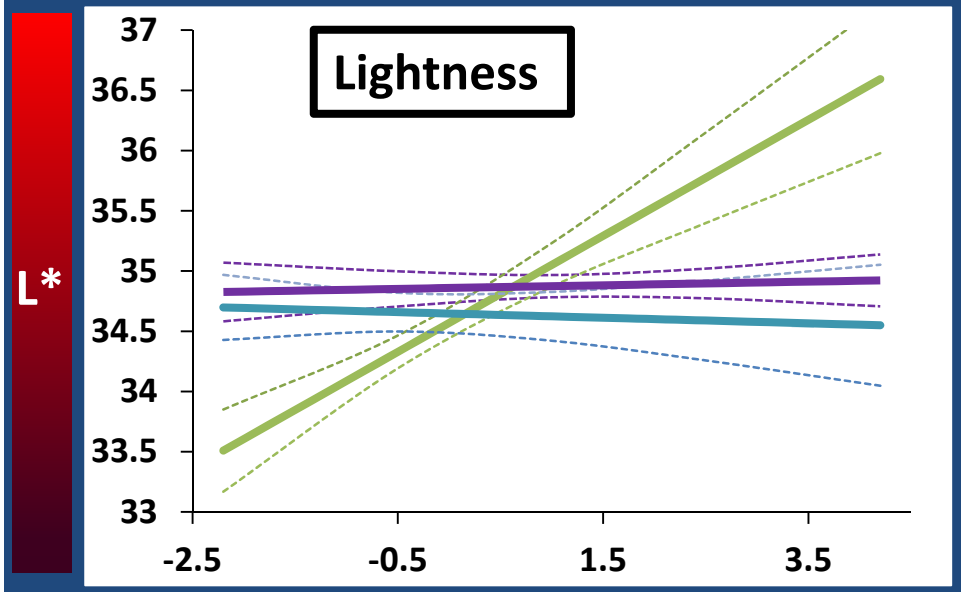
Results

Muscling & Meat Colour



Sire Muscling Estimates

Muscling & Meat Colour



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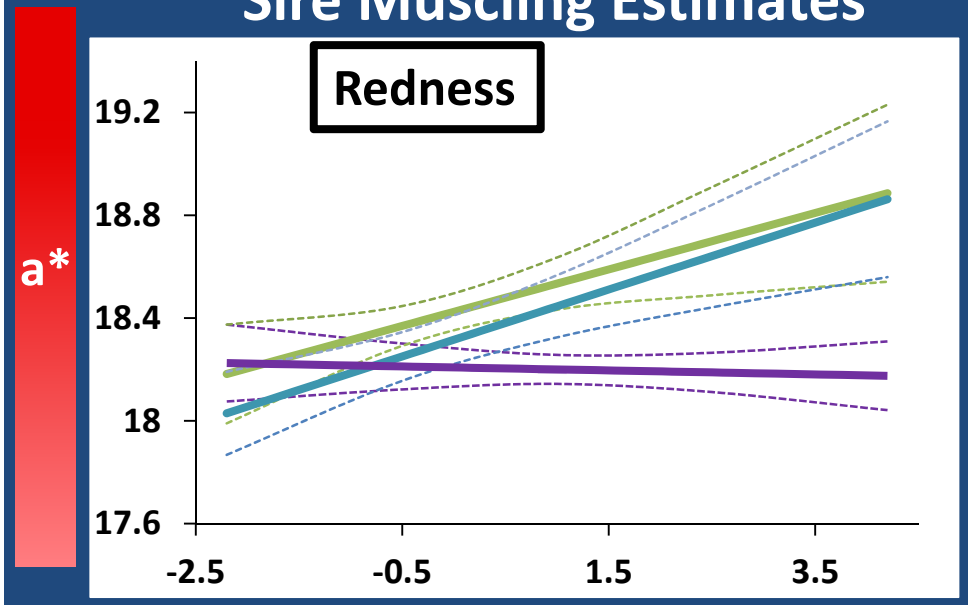
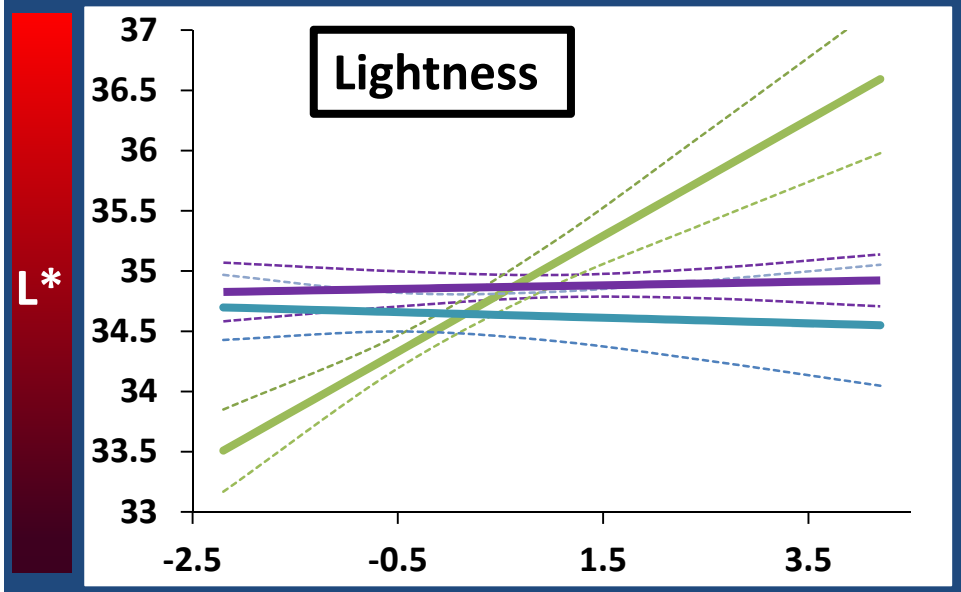


Sire Muscling Estimates

Muscling & Meat Colour



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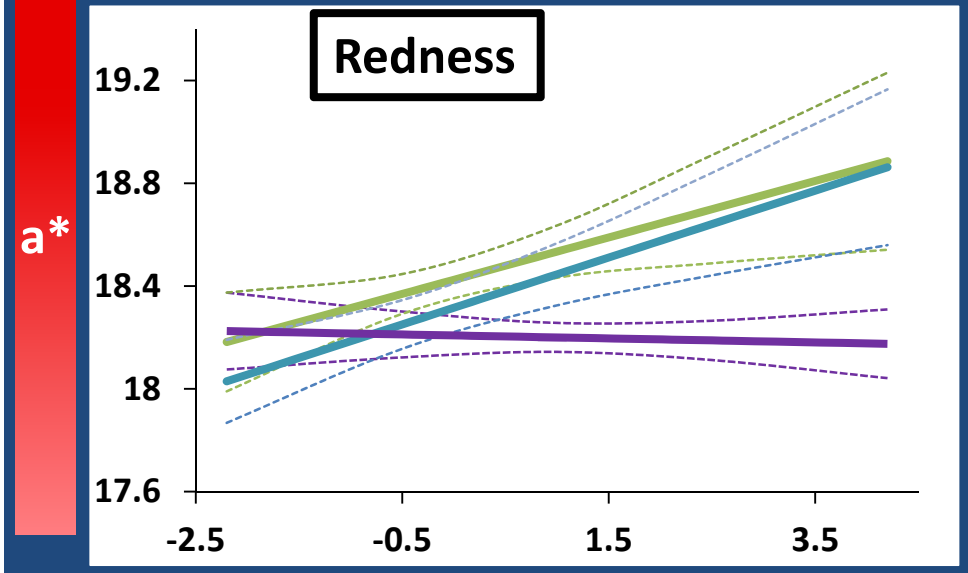
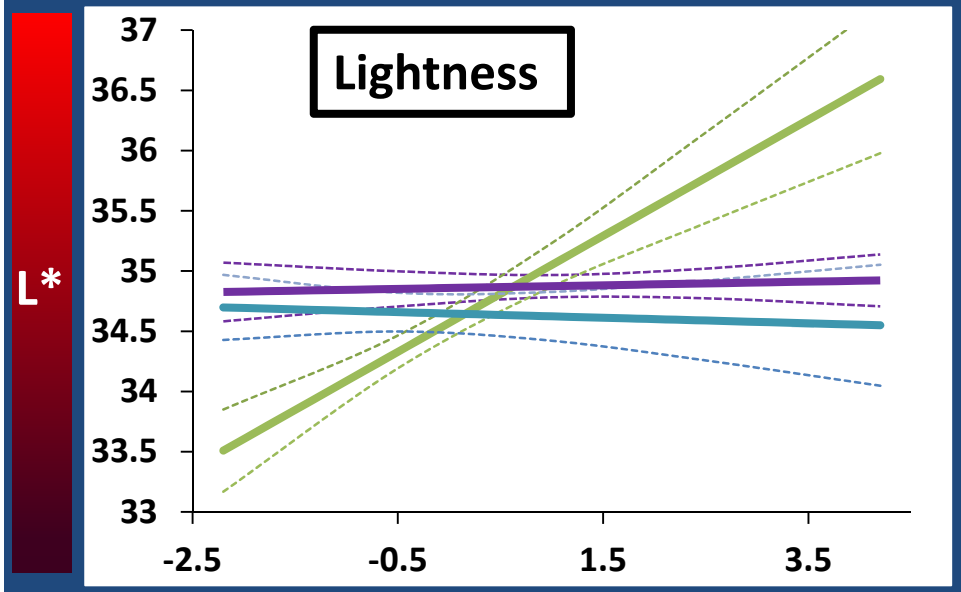


Sire Muscling Estimates

pH_u?

Muscling & Meat Colour



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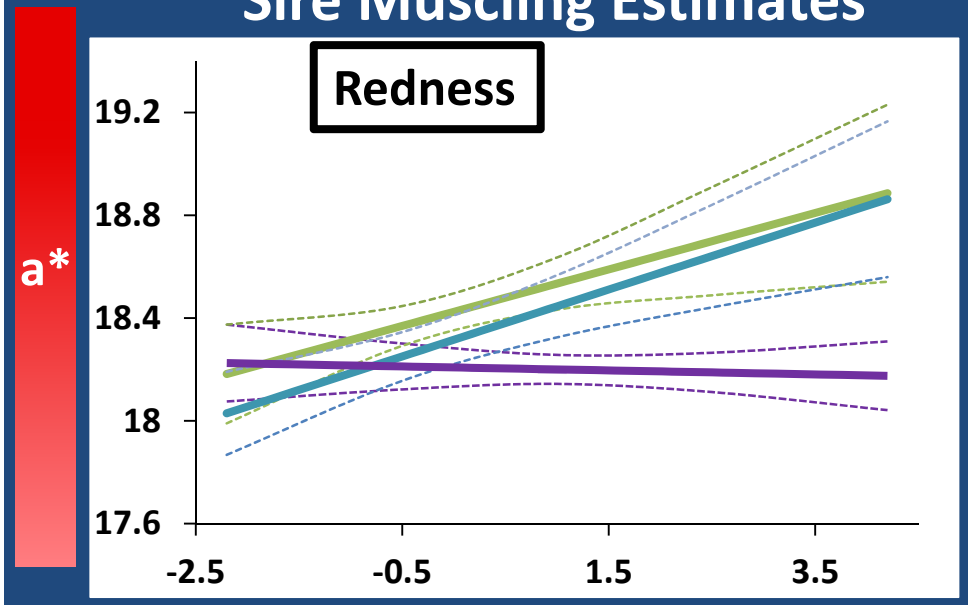


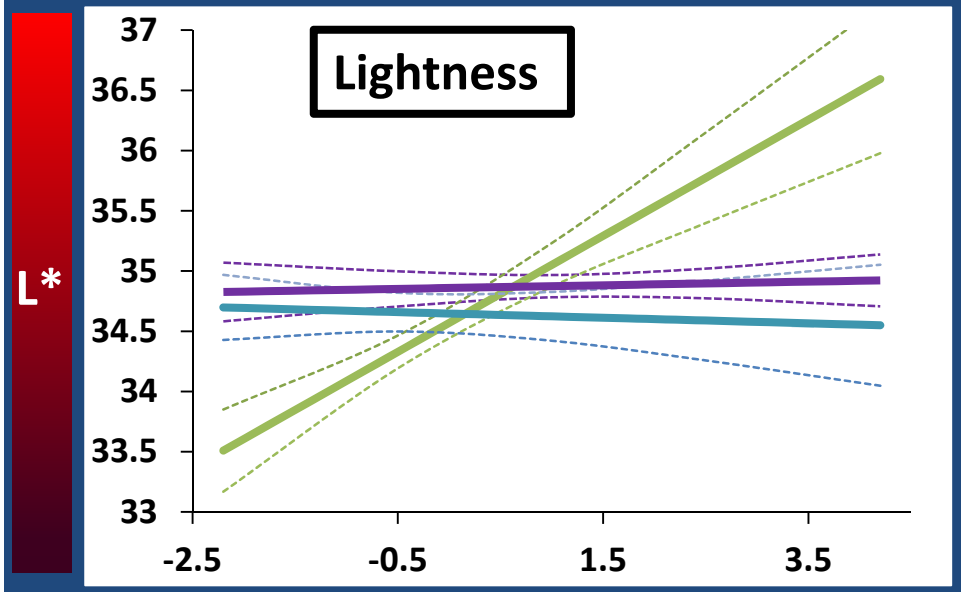
Sire Muscling Estimates

Maternal Sires

Merino Sires

Terminal Sires

Muscling & Meat Colour



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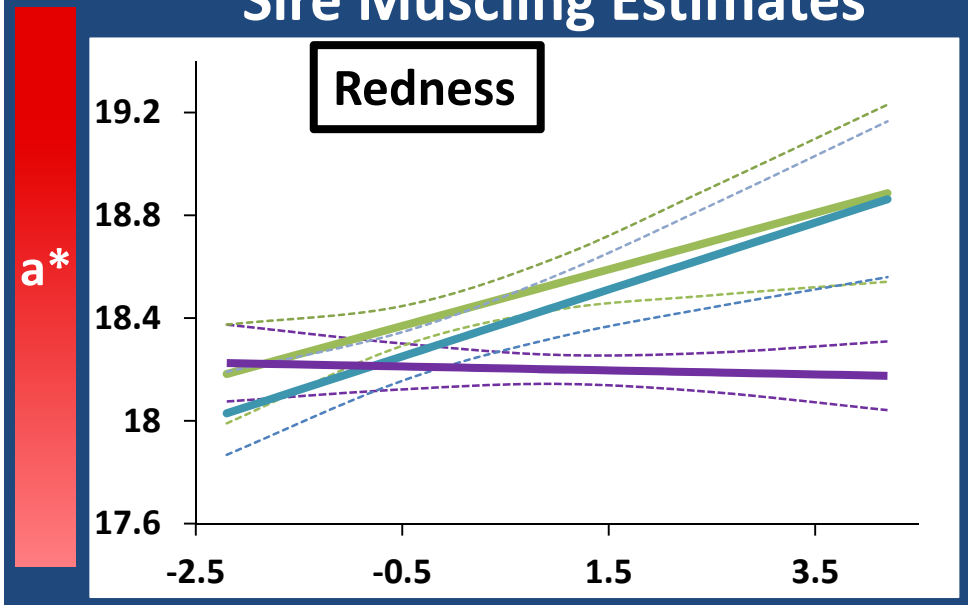
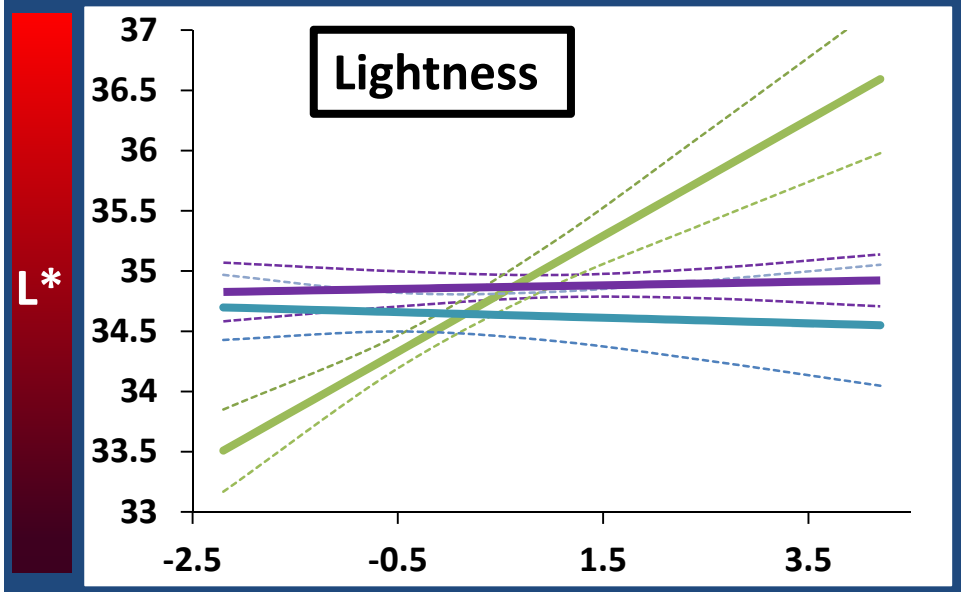


Sire Muscling Estimates

pH?

myoglobin?

Muscling & Meat Colour



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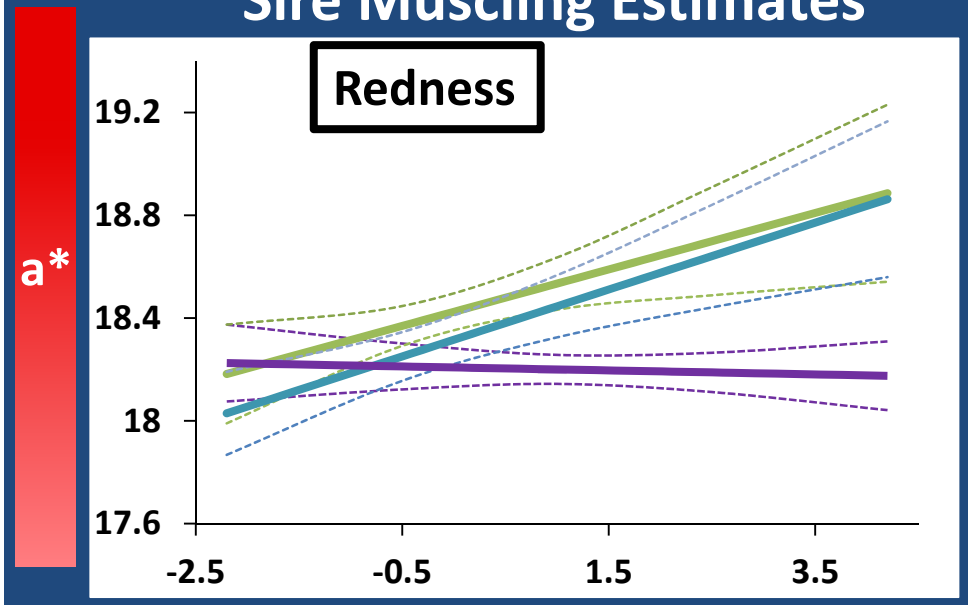
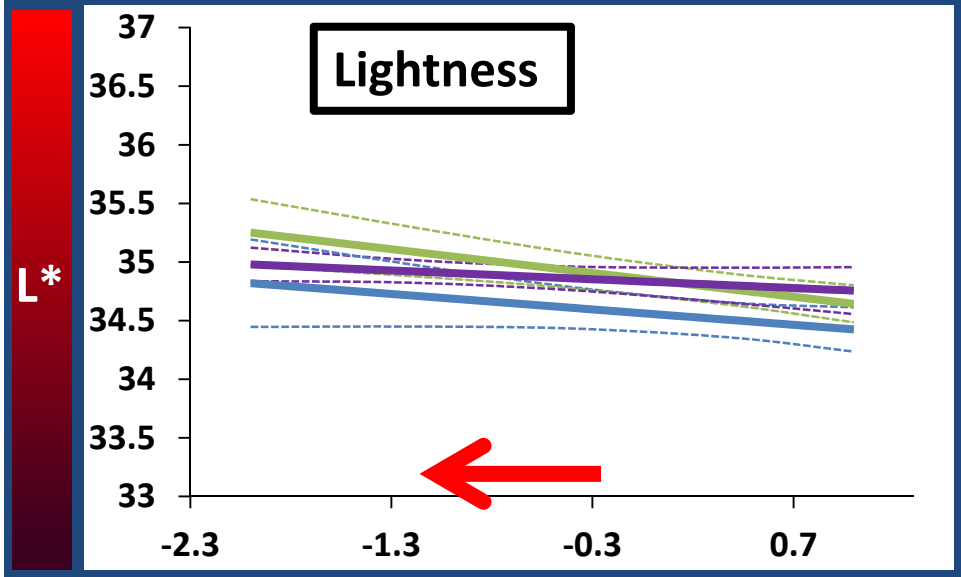


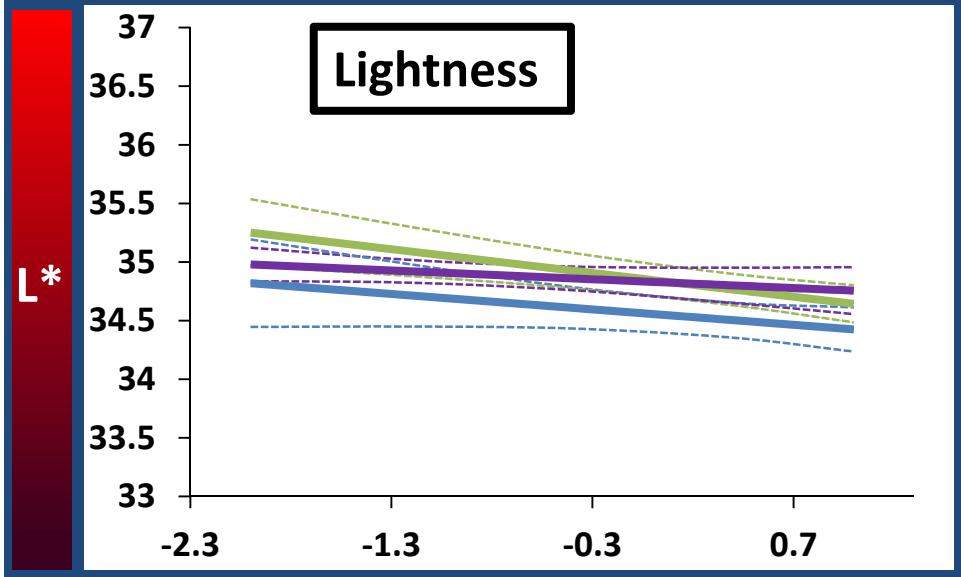
Sire Muscling Estimates

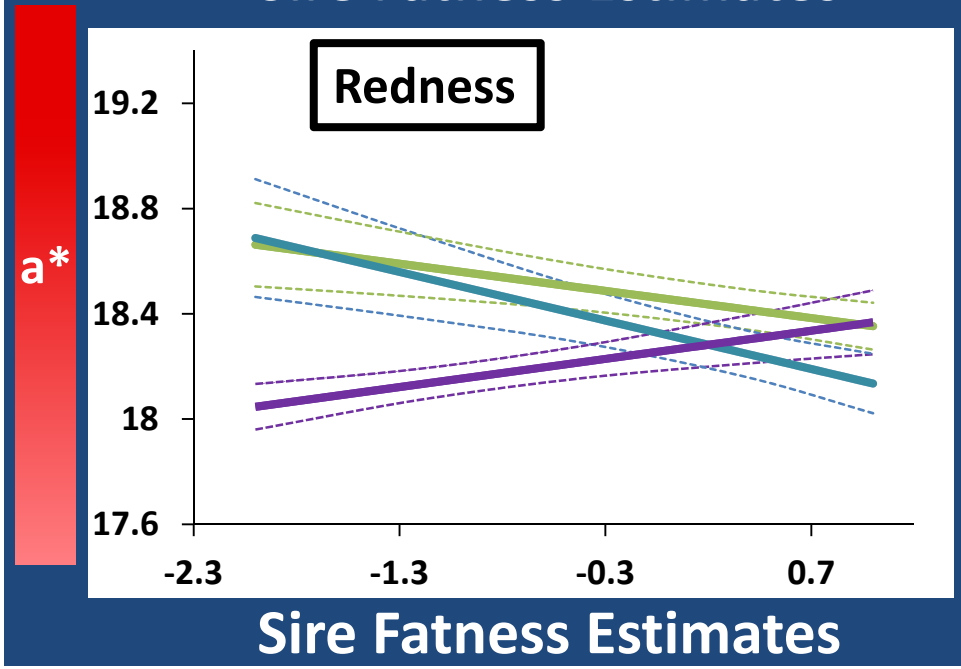
Fatness & Meat Colour



Sire Fatness Estimates

Fatness & Meat Colour



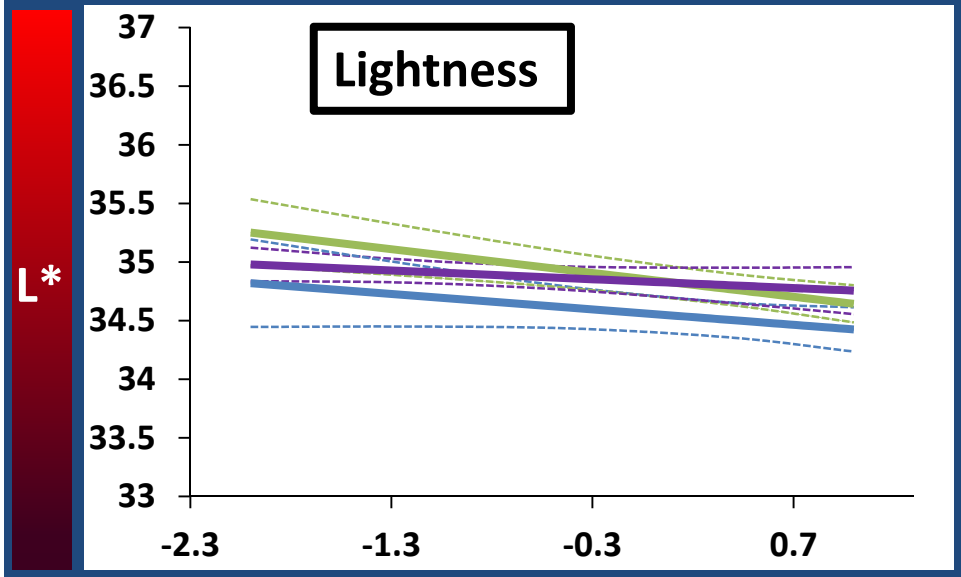


Maternal Sires

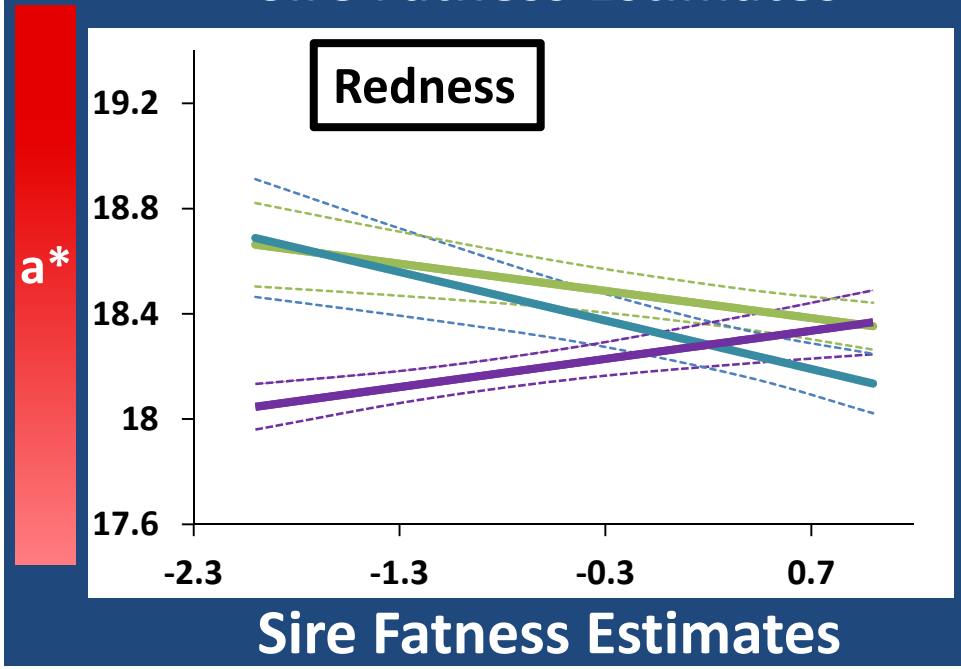
Merino Sires

Terminal Sires

Fatness & Meat Colour



pH_u?



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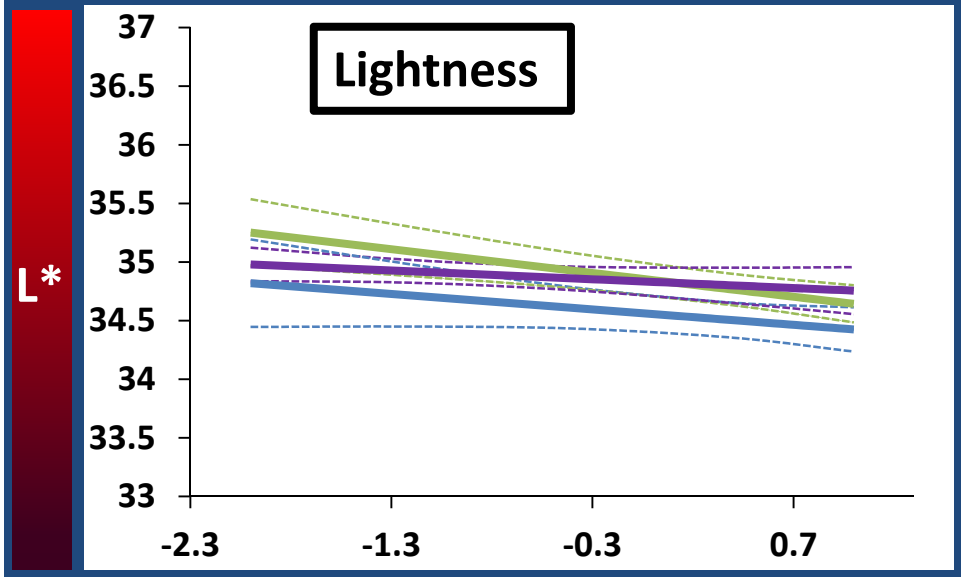
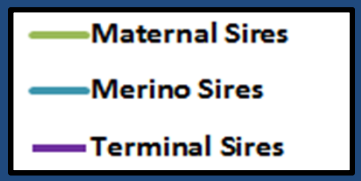
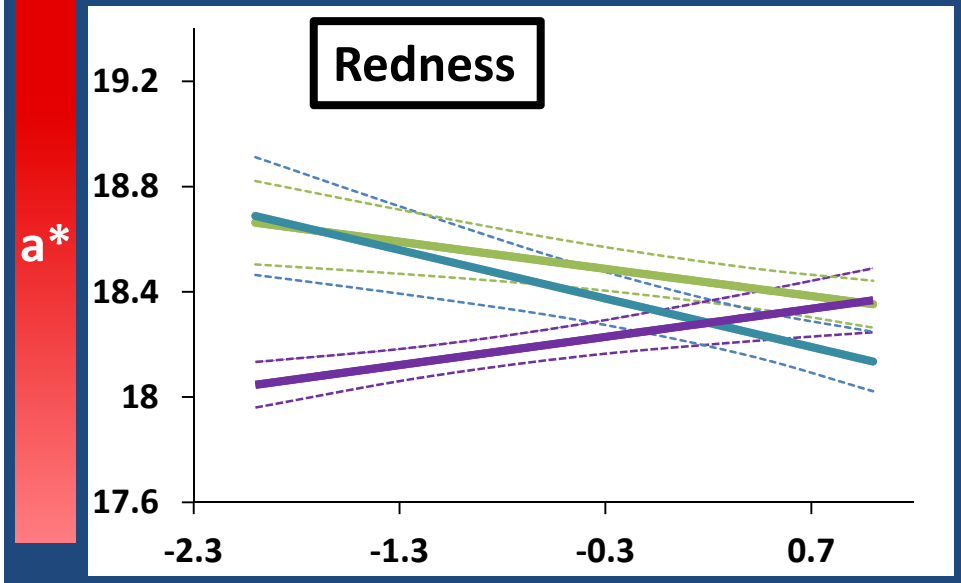
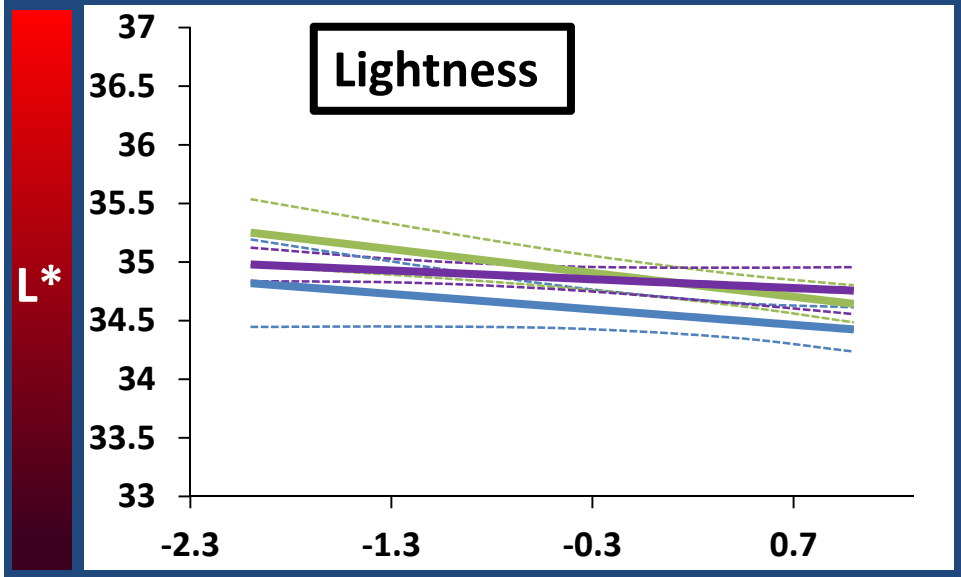
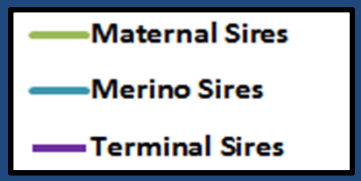


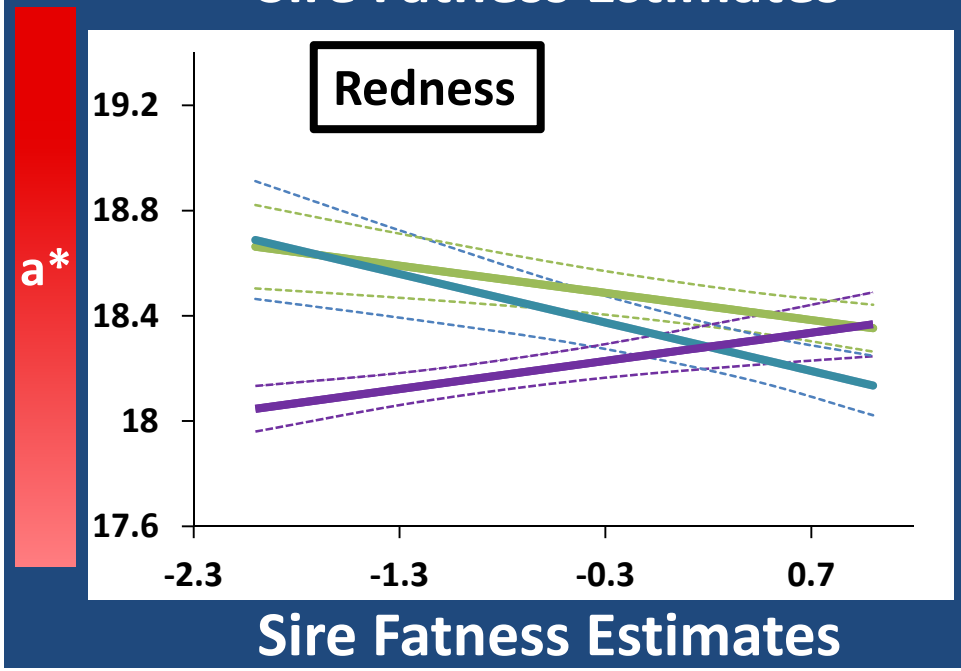




Fatness & Meat Colour

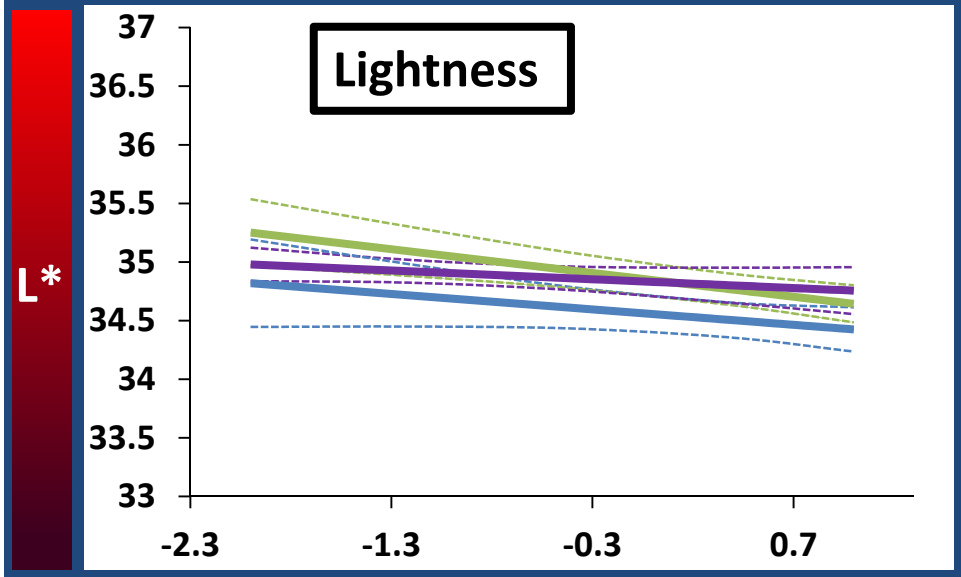


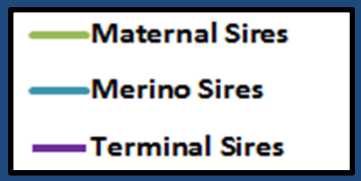


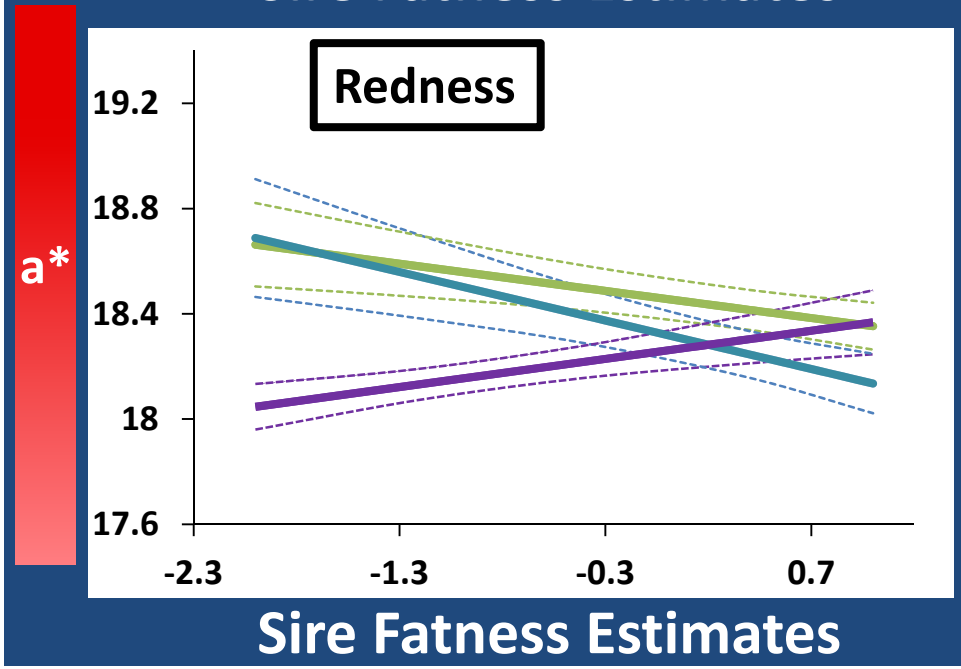


myoglobin?

Fatness & Meat Colour







Hypothesis

Hypothesis

Hypothesis

Hypothesis

Hypothesis

Maternal Merino

↑ redness ✗

↑ lightness ✓

Maternal

Hypothesis

↓ redness

↑ lightness

Hypothesis

↓ redness

↑ lightness

Hypothesis

Hypothesis

Hypothesis

Maternal Merino

↑ redness ✗

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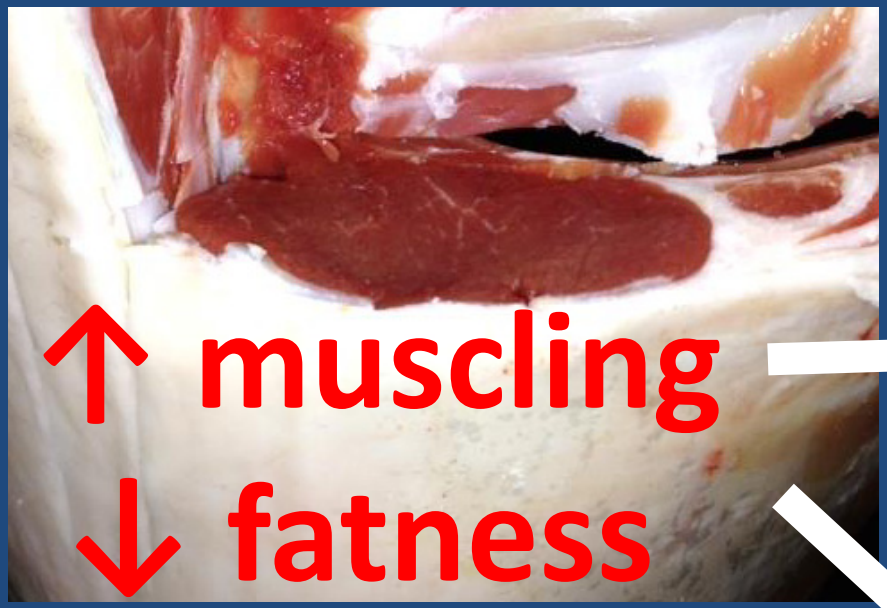
Maternal

Hypothesis



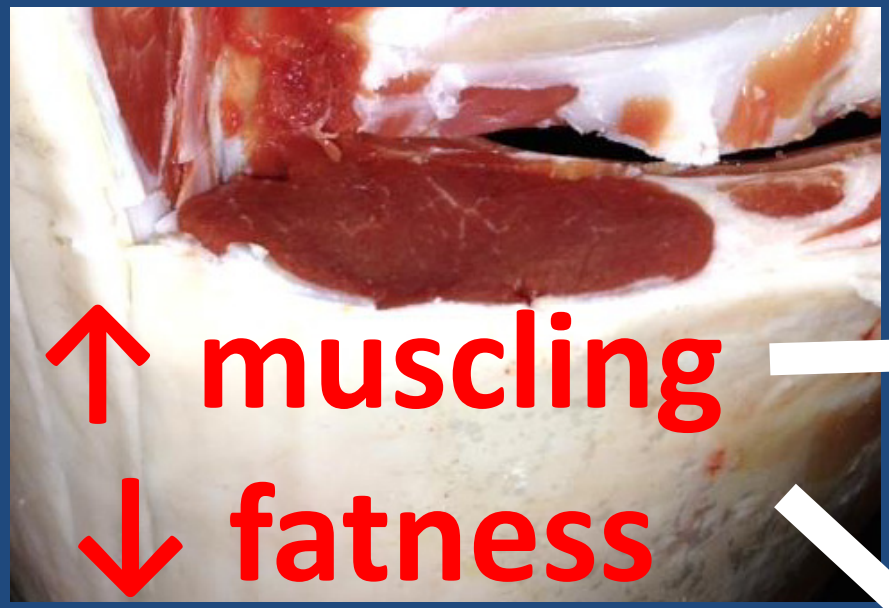
↑ redness

↑ lightness

↓ myoglobin

↓ pH_u

Hypothesis



↑ redness

↑ lightness

↓ myoglobin ✓

↓ pH_u ✗

Sire selection & Lamb meat colour

↑ muscling

↓ fatness

↑ type IIx muscle fibres

- ↓ myoglobin
- ↓ adrenaline responsiveness

→ ↑ glycogen → ↓ pH_u

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Sire selection & Lamb meat colour

↑ muscling

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- ↓ myoglobin ✓
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→ ↑ glycogen → ↓ pH_u ✗

Conclusions

Sire selection for yield (↑ muscling & ↓ fatness) will improve fresh lamb meat colour

Acknowledgements

Supervisors: Assoc. Prof. Graham Gardner

Prof. David Pethick

Dr Robin Jacob

The Australian Sheep CRC & all those involved with the Information Nucleus Flock experiment