Improving carcass quality of UK hill sheep using CT

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Talk outline

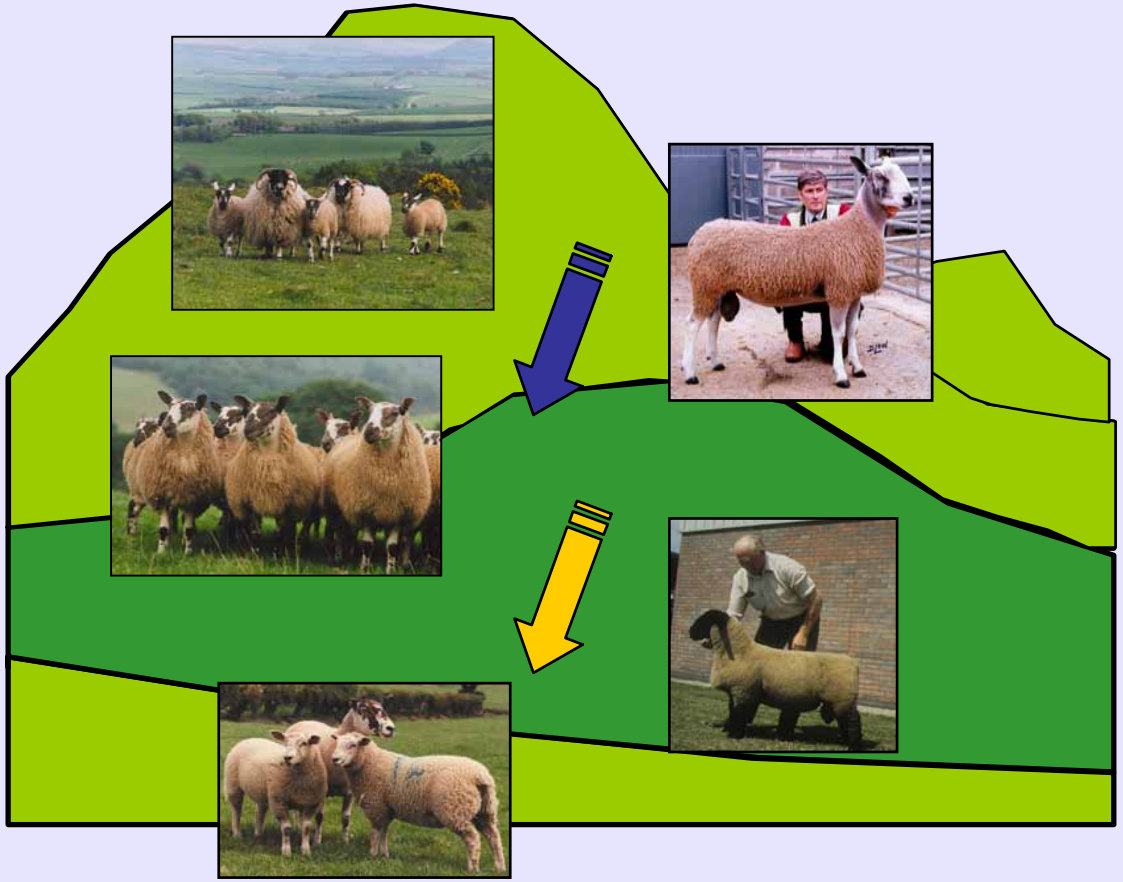
- Introduction
  - Hill sheep in Britain
- Breeding goals for hill sheep
  - Selection experiment at SAC
- Using CT scanning for hill sheep
  - Lamb carcass quality
  - Seasonal changes in maternal body composition
- Modelling 2-stage selection
- Future work

Sheep breeding in the UK

Hill

Upland

Lowland



Multi purpose rôle of hill sheep

- Lamb carcass production
- Supply pure & X-bred females for breeding
- Antagonistic breeding goals?

Breeding Goal Traits

Ewe traits

Mature size

Longevity

No. lambs reared

Lamb survival

Maternal weaning wt

Fleece weight

Lamb traits

Weaning weight

Carcass fat class

Carcass conformation

Carcass weight

Predicted Annual Response: maternal traits

	Response
Mature size(g)	654
Longevity (days)	6.4
Fleece weight (g)	21
Ave. weaning weight (g)	135
No. Lambs reared/ewe	0.023
No. Lambs lost/ ewe	0

Animal Science 2001. 73:413-423

JAS 2004. 82:1290-1304

Predicted Annual Response: lamb performance traits

	Response
Weaning weight (g)	371
Fat class (ESF%)	-0.007
Conformation (units)	-0.006
Carcass weight (g)	121

Animal Science 73:413-42

JAS 2004. 82:1290-130

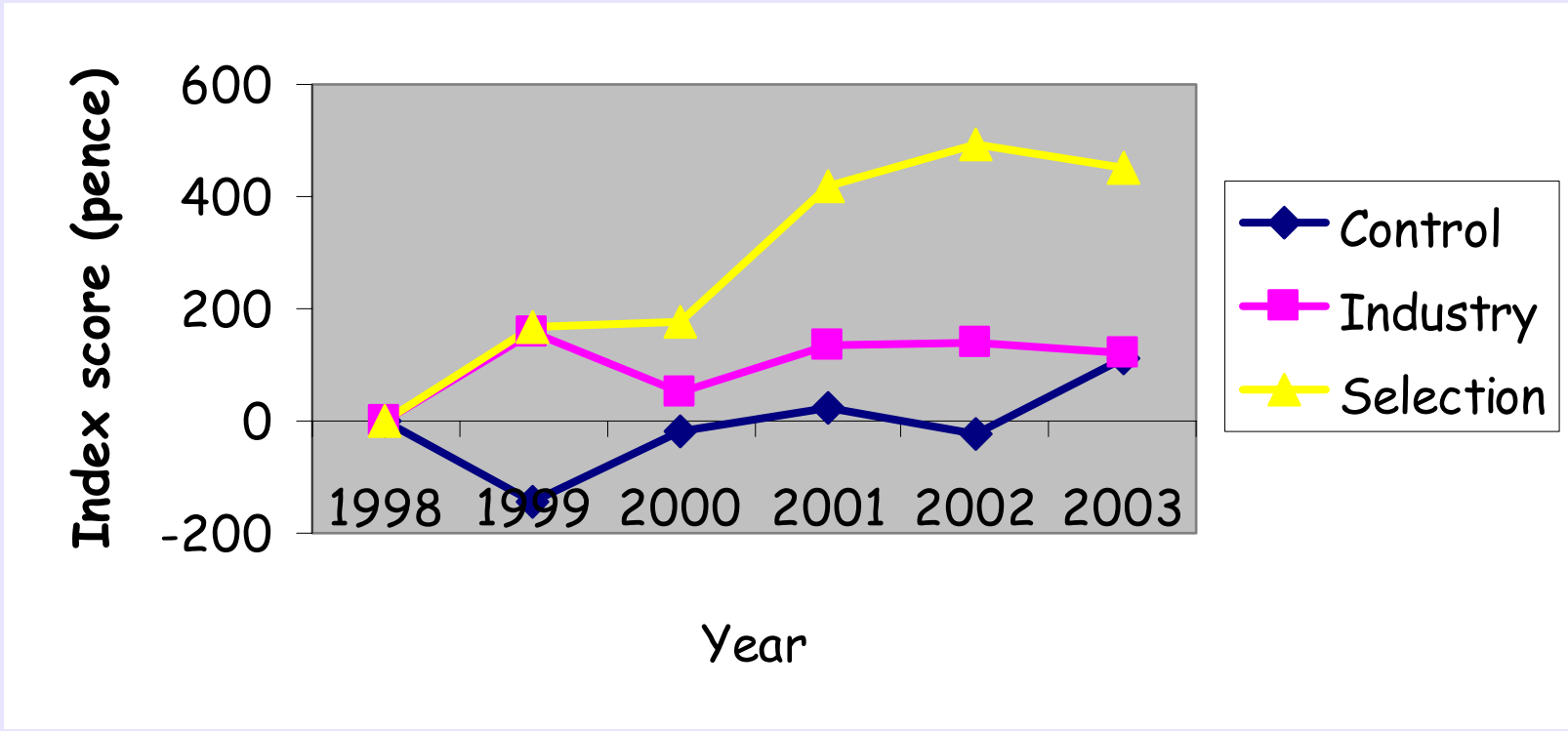
Testing selection index

- 3 lines:
  - Selection - high index score
  - Control - average index score
  - 'Industry' - from industry
    - » selected on phenotype only

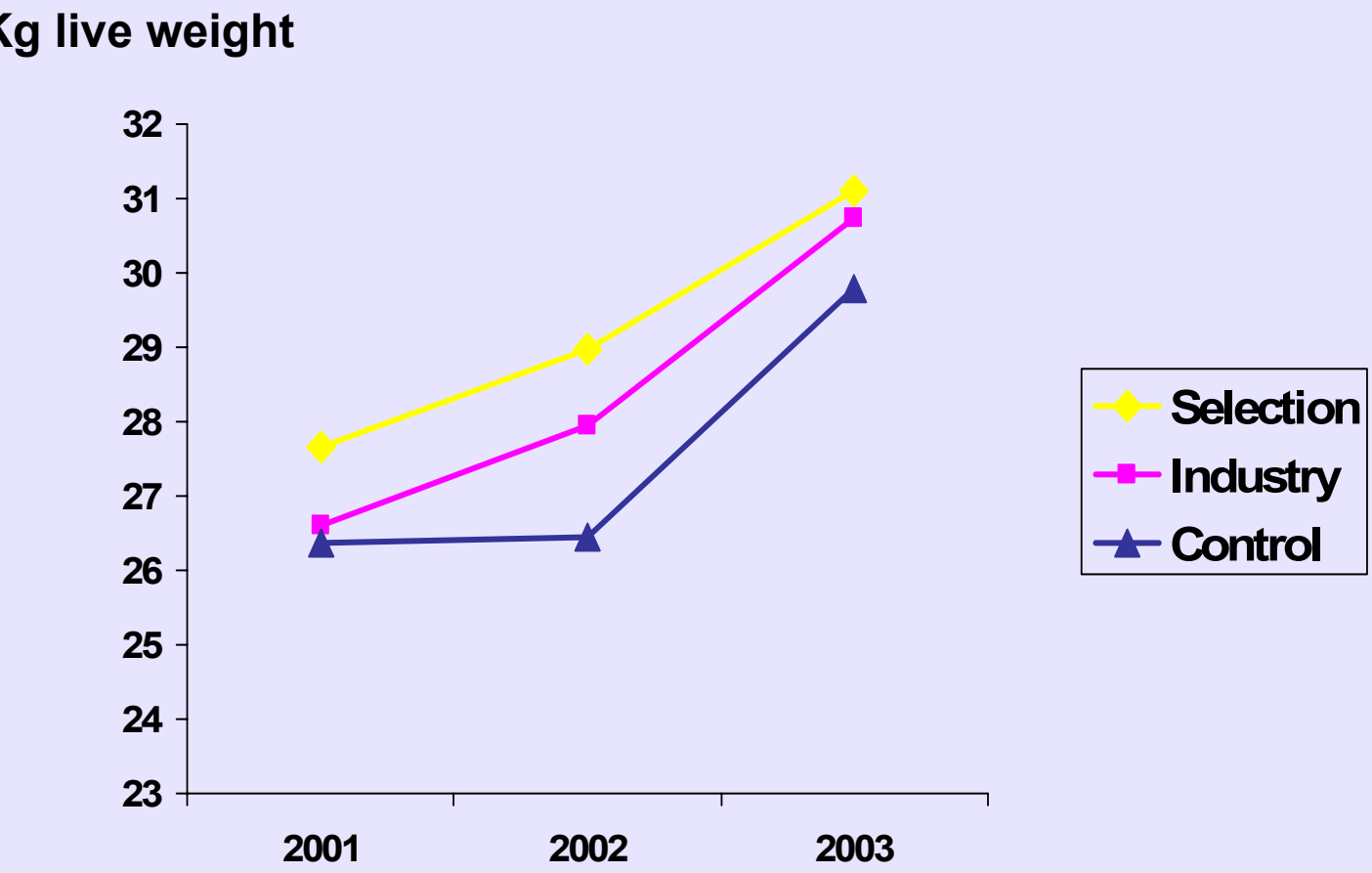
Run together as one flock

Tested on SAC hill farm

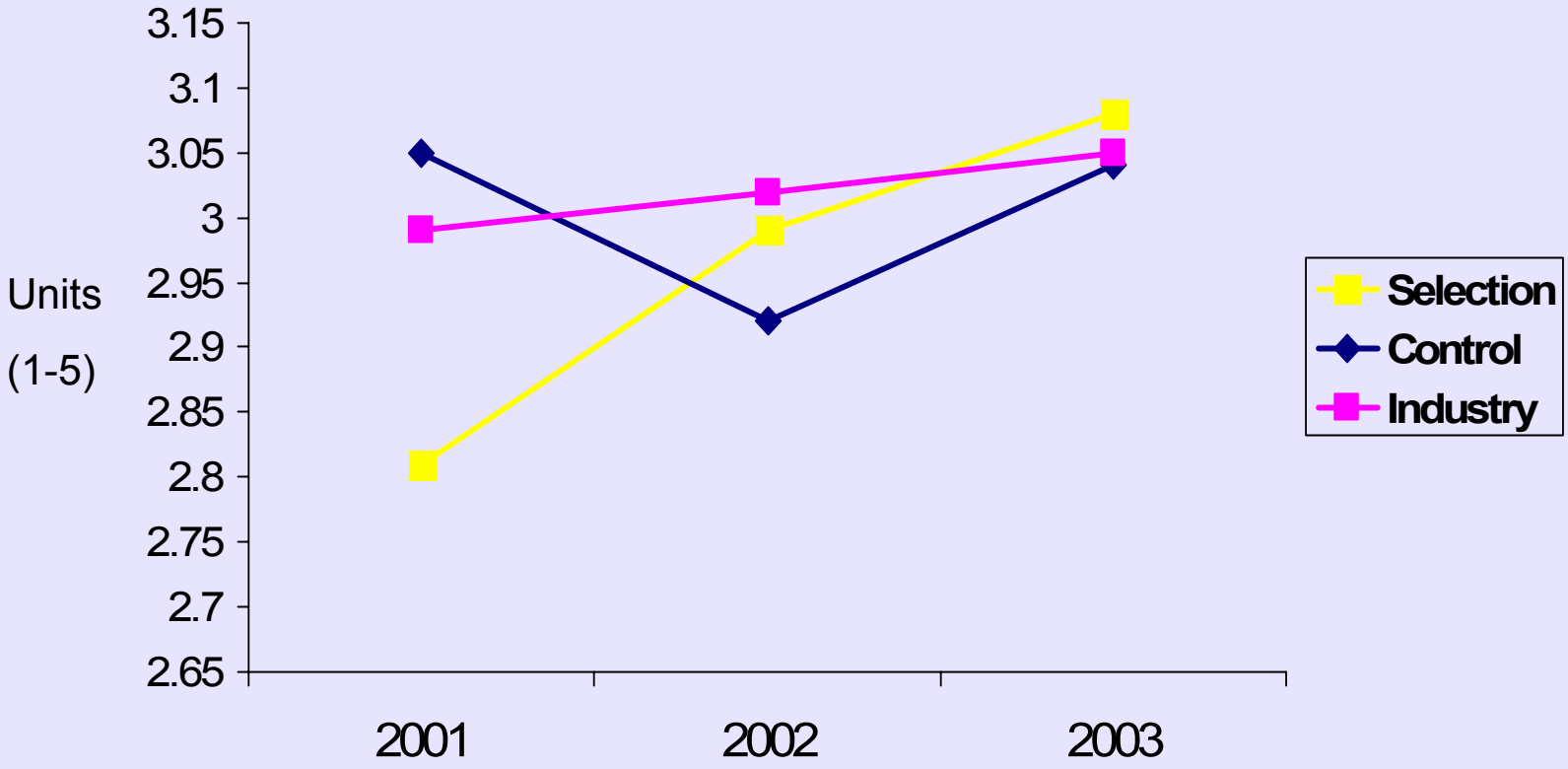
Index trends



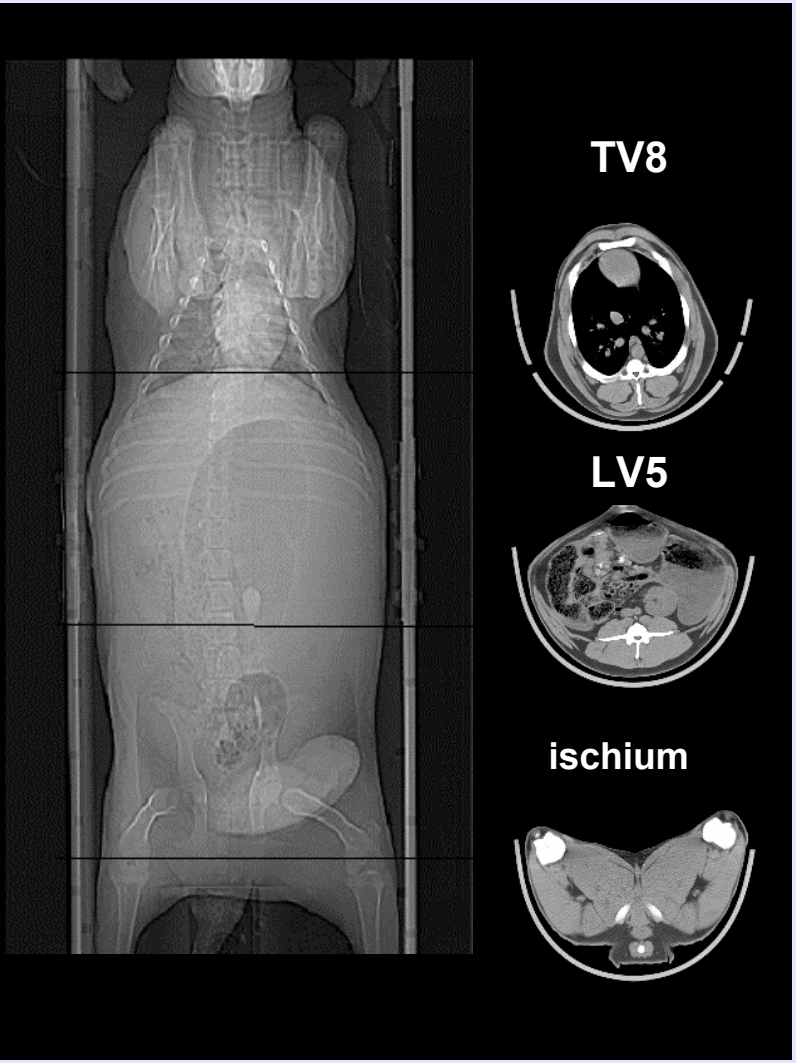
Weaning weight (kg) according to genetic line



Conformation score



X-ray Computed Tomography (CT scanning)



8th rib vertebra (TV8)

5th lumbar vertebra (LV5)

Back of the pelvis (ischium)

Accurate *in vivo* estimates of body composition

	R^2
muscle	92%
fat	96%
bone	81%

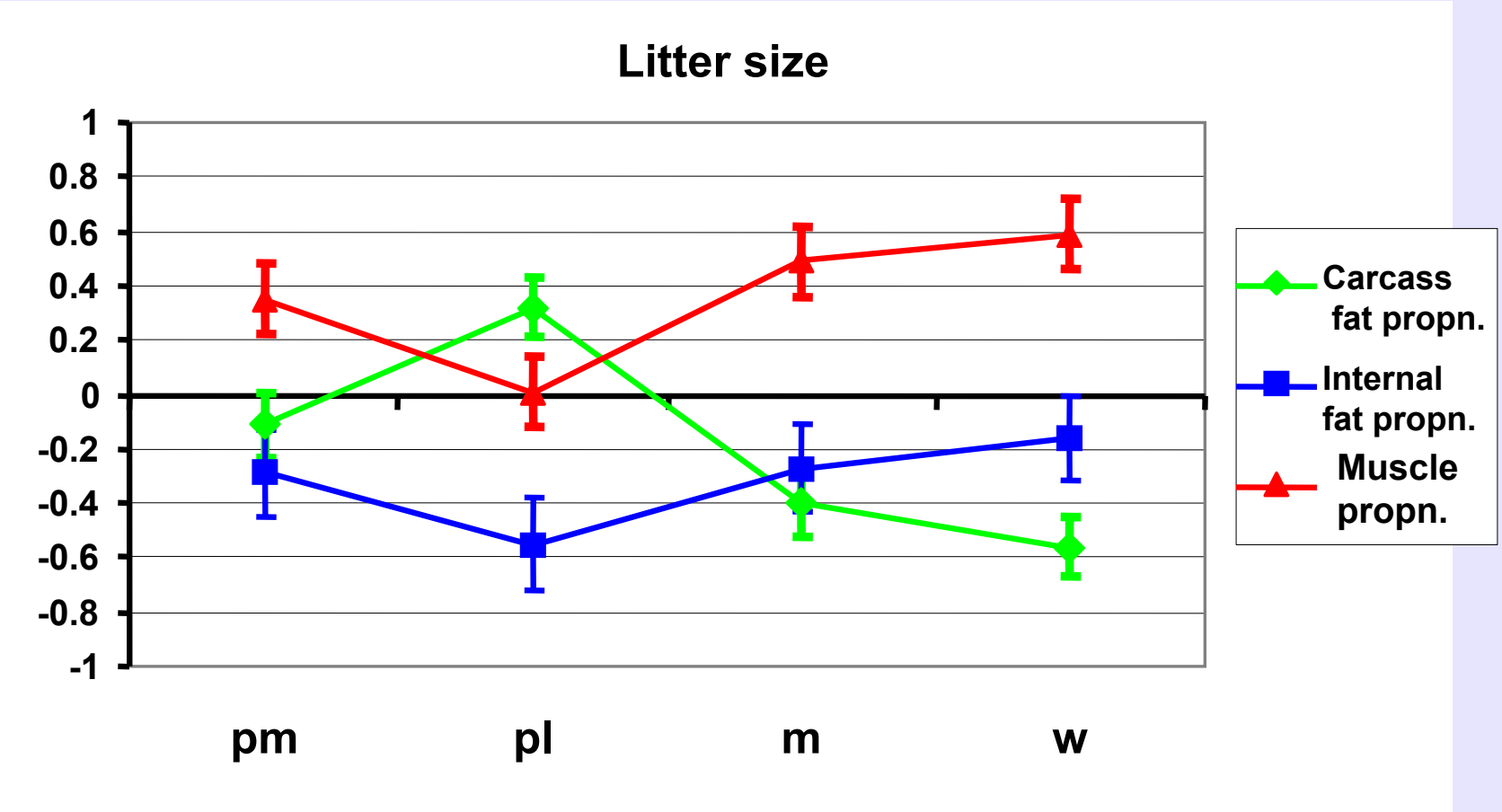
Example of ‘poor’ lamb 36.7 kg

Example of ‘good’ lamb 36.4 kg

BUT … link with maternal body composition and lamb performance in hill environments

- Investigate genetic relationships
  - Annual body composition changes & offspring performance

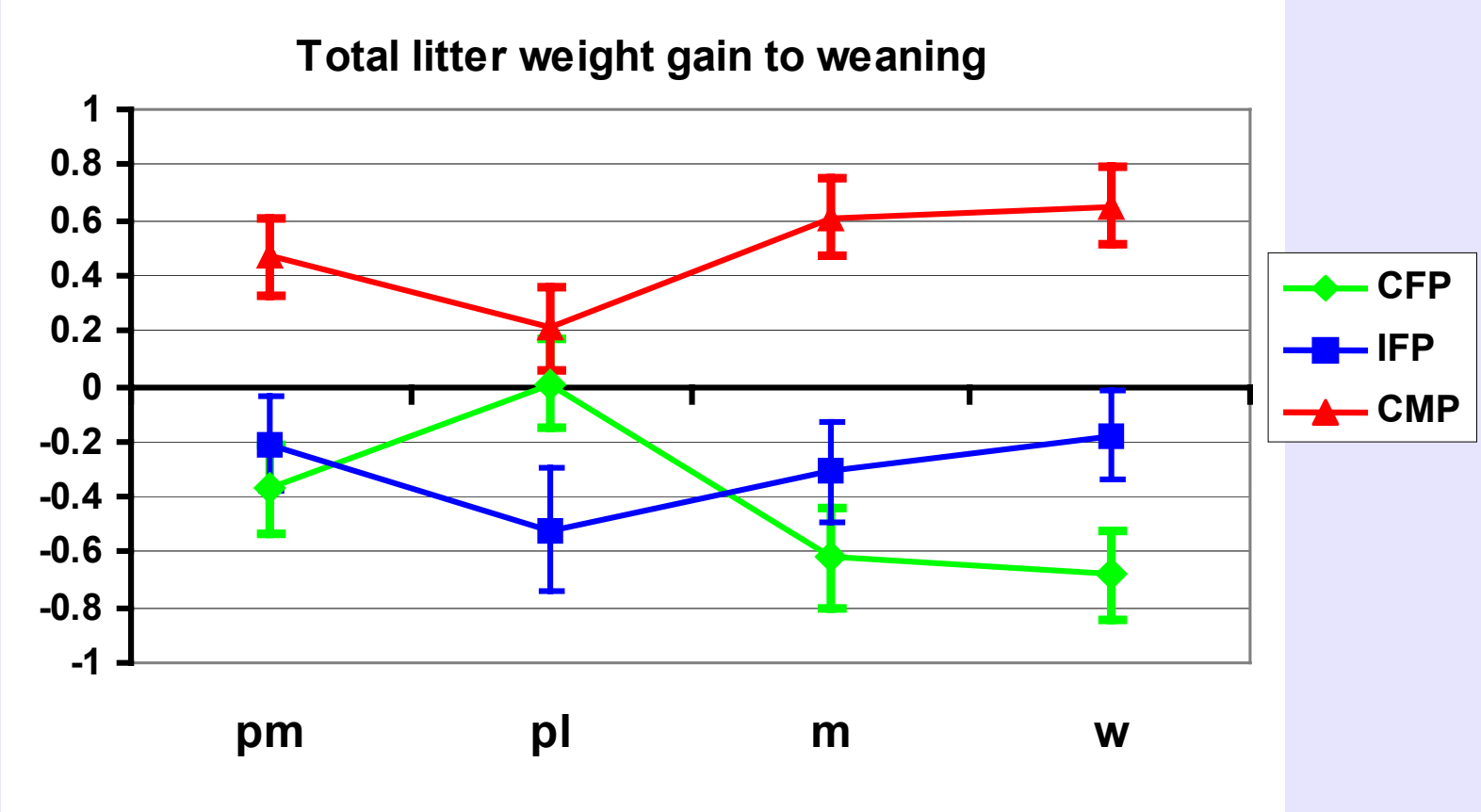
Results - genetic correlations



Relationships with tissue PROPORTIONS

pm =pre-mating, pl =pre-lambing, m =mid-lactation, w= weaning

Results - genetic correlations



Relationships with tissue PROPORTIONS

pm =pre-mating, pl =pre-lambing, m =mid-lactation, w= weaning

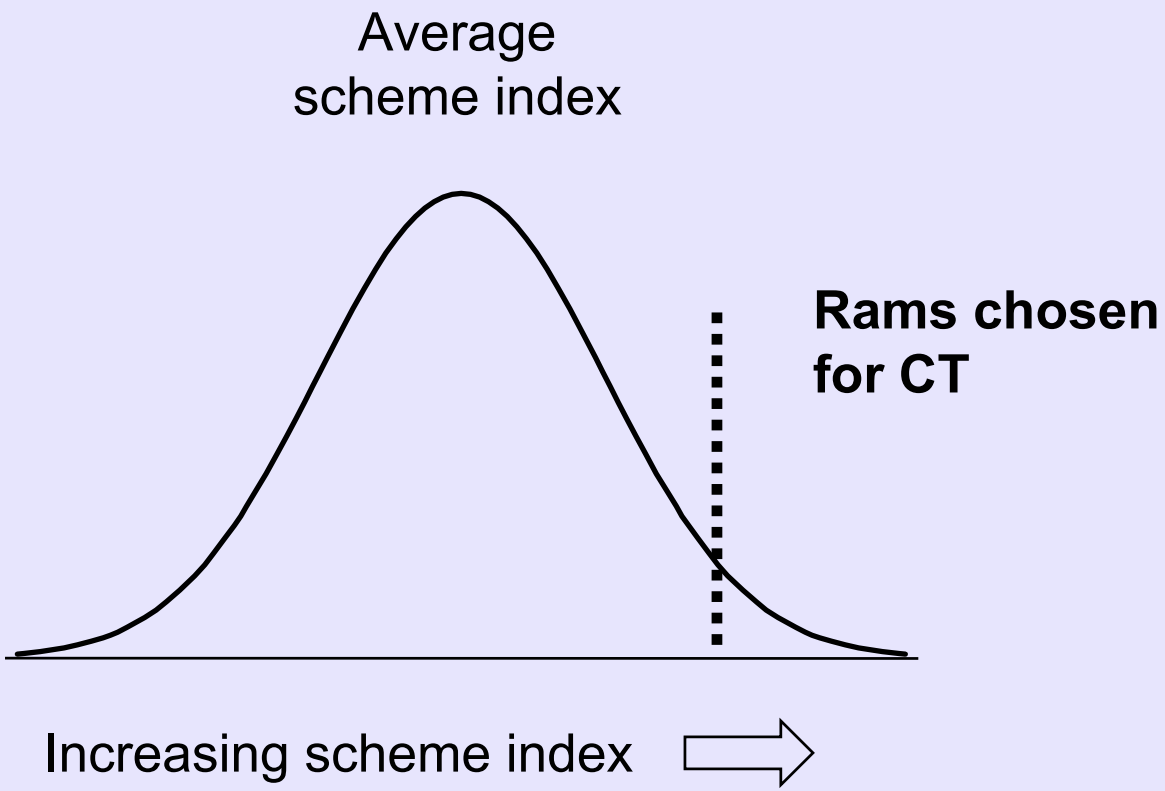
Genetic correlations: implications

- Selecting for increased lean
  - heavier litters reared, due to increased litter size
- Reducing carcass fat (especially pre-lambing)
  - may have a negative impact on average weights and weight gains of lambs
- BUT..
  - Selecting for increased lean and decreased fat will not compromise lamb performance
- Maintaining fat in internal depots
  - spare carcass fat depletion during pregnancy and increase average lamb weight gains

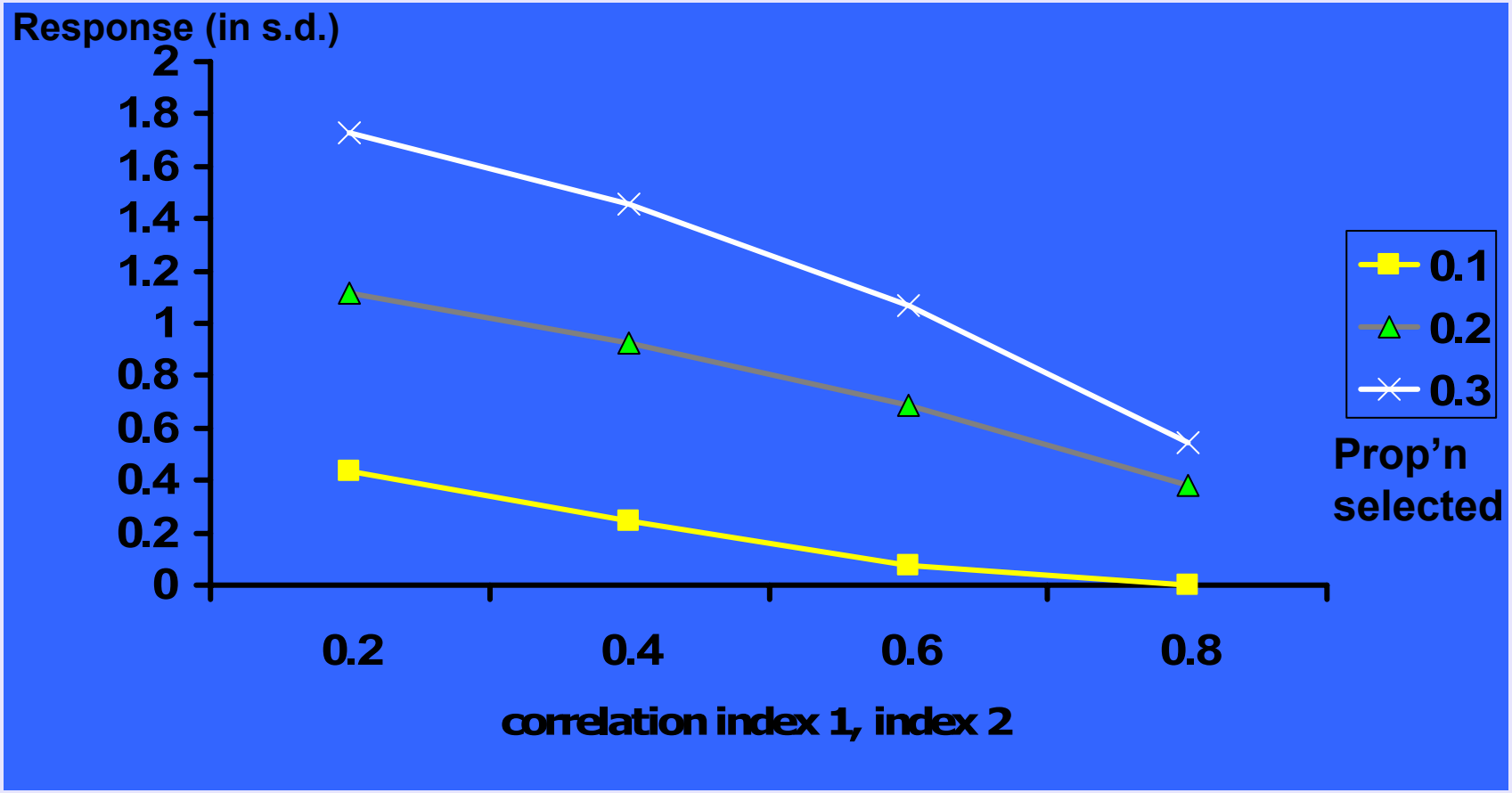
How to include CT into 2-stage selection?

Design optimum two-stage selection programmes to achieve improvements in the indexes in a cost-effective way

Modelling two stage selection



Differences in response to selection (in s.d.) from use of single vs. 2-stage selection - according to r^2 between indexes and proportion selected for CT scanning.



Gaps in knowledge… current & future work

- Estimate parameters among CT carcass and maternal traits
- Define new CT carcass traits
- Derive economic values for these
- Quantify responses to selection (δ_g, £)

Summing Up

- Hill sheep breeding goals are complex
  - antagonistic goals
  - new selection indexes
- Use of CT
  - highly accurate
  - accelerate progress in carcass quality
  - maternal fitness

Summing up..

- **Use of 2-stage selection**
  - Dependent on key parameters
- **Current & future work**
  - Cost-effectiveness of 2-stage selection
  - maternal body composition profiles
    - which are the best ones

Acknowledgements

SAC colleagues

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