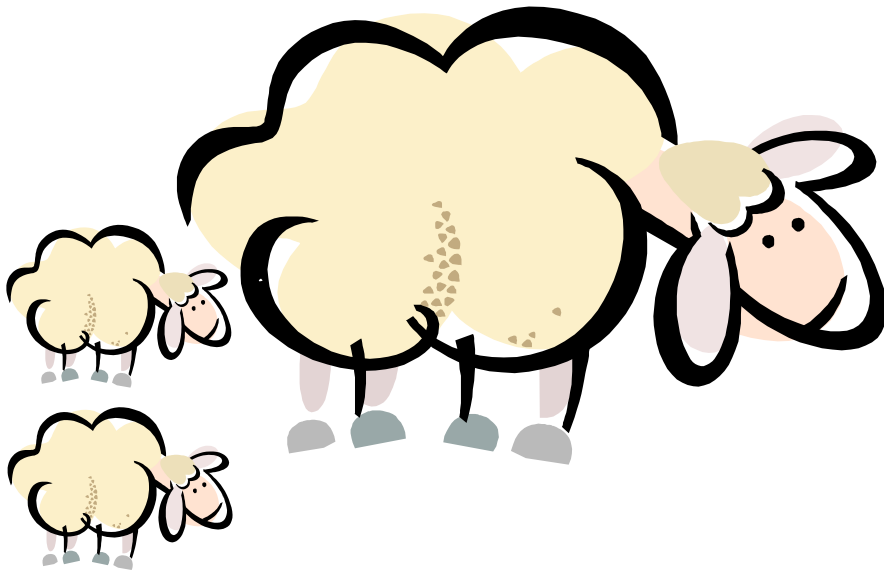
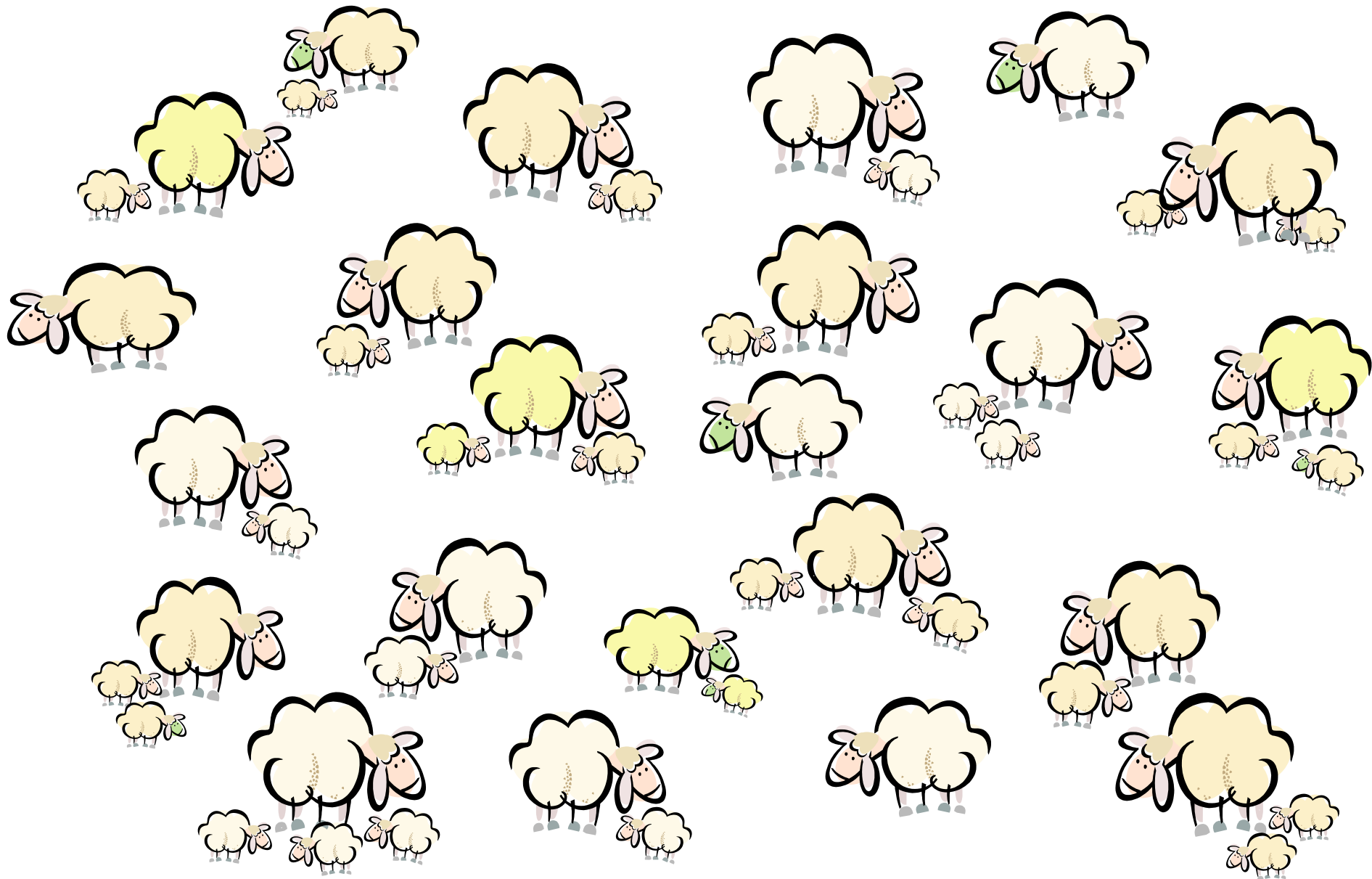


Driving productivity improvement through precision sheep management



Dr Sue Hatcher
Principal Research Scientist

Not all sheep are the same...

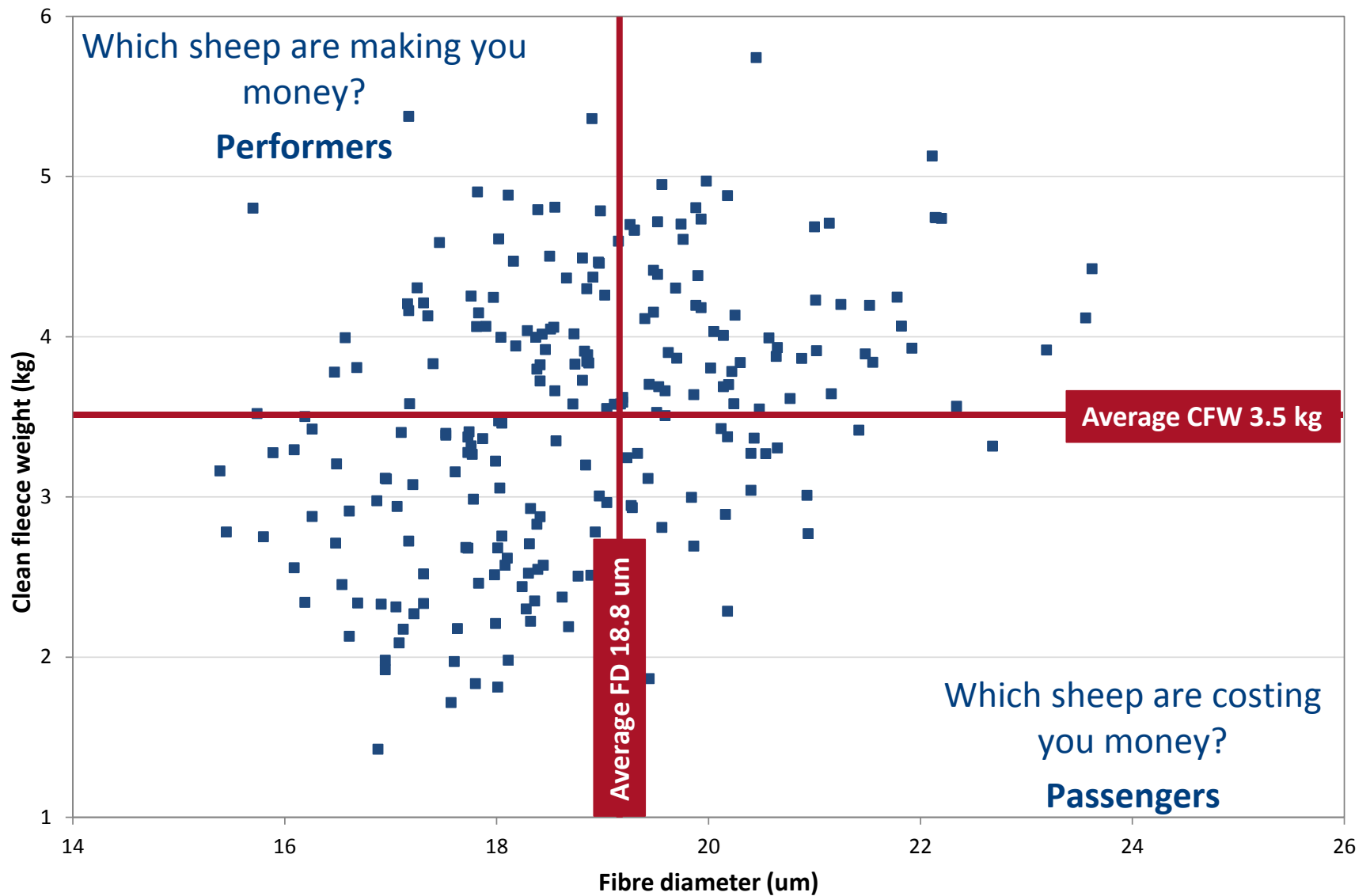


Phenotypic variation in key traits

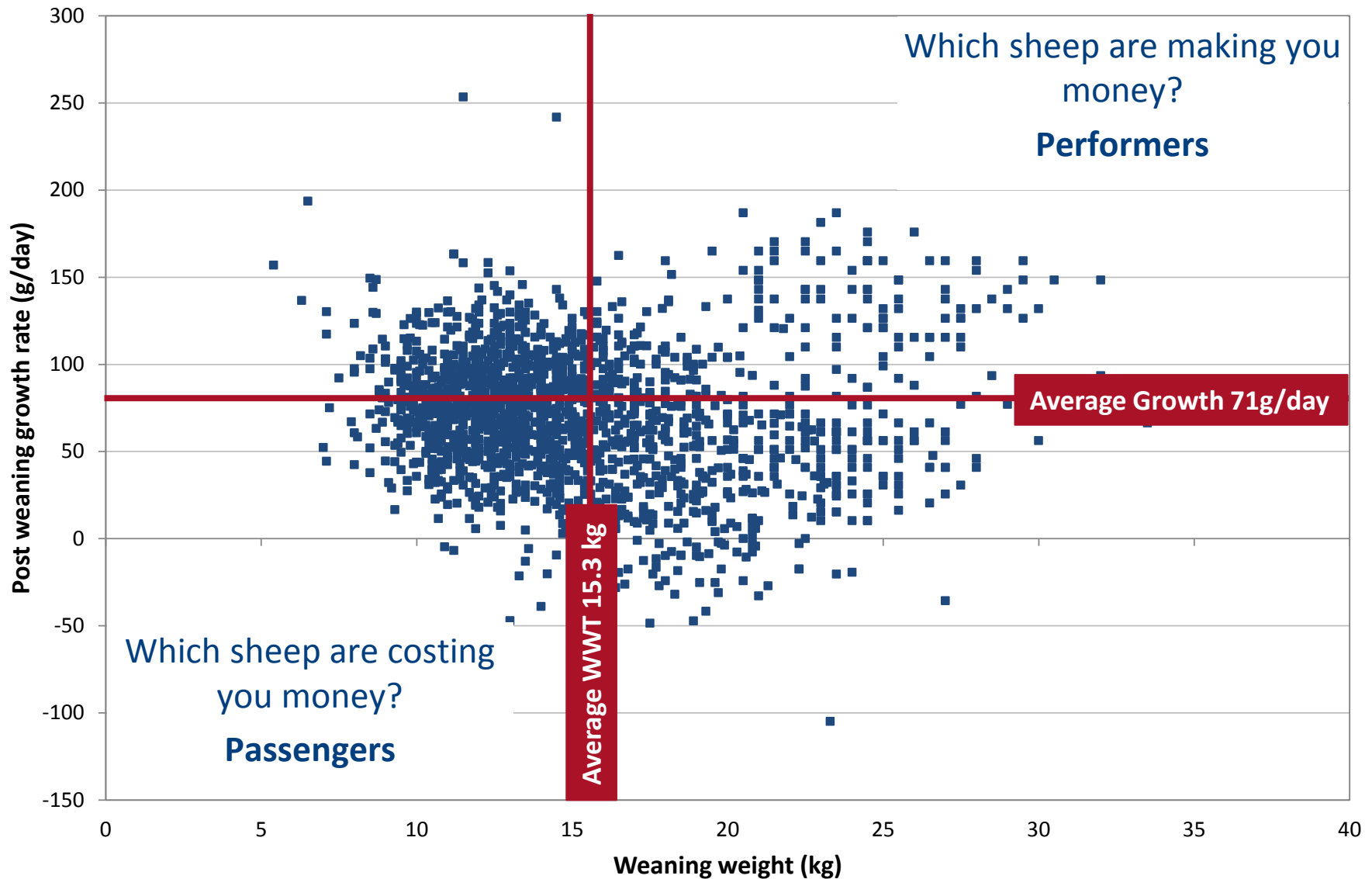
Trait	Bottom 25%	Average	Top 25%
Wool traits			
Fleece weight (kg)	3.9	4.6	5.3
Fibre diameter (um)	21.9	20.4	18.9
Staple strength (N/ktex)	28	35	42
Meat traits			
Growth rate (g/day)	200	284	357
Fat depth (mm)	12.5	10.6	8.9
Reproduction			
Lambs weaned per ewe joined	0.28	0.86	1.43
Profitability traits			
Fleece value per ewe (\$)	37	54	82
Carcase value per ewe (\$)	12	33	56

Source: Atkins *et al.* (2006)

Passengers versus Performers

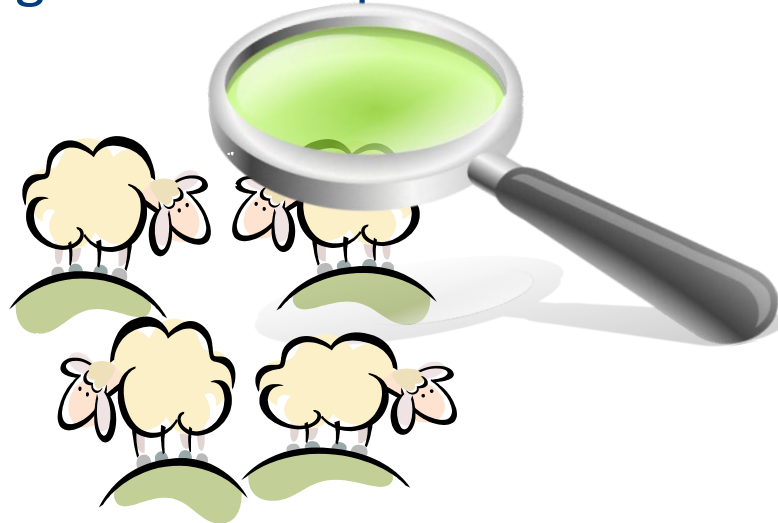


Passengers versus performers



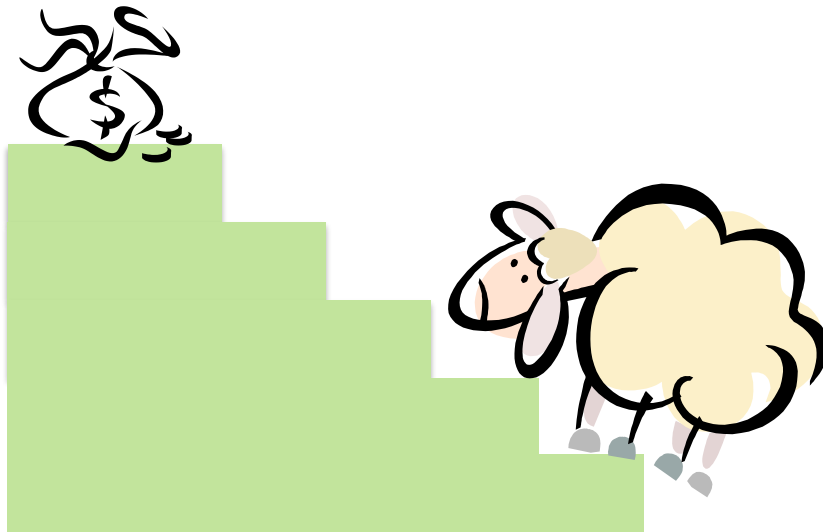
Precision Sheep Management

- Managing (groups of) animals differentially according to their level of production or risk, rather than managing the 'flock' uniformly
- Increases in on-farm productivity
 - ➔ improved selection, nutrition & disease management
 - ➔ delivering to market specifications



Pathways to benefits

- Current generation gains
- Genetic gains – future generations
- Optimise flock structure – age groups, sexes
- Target markets
 - choosing animals for high value markets
 - reducing costs to meet low value markets

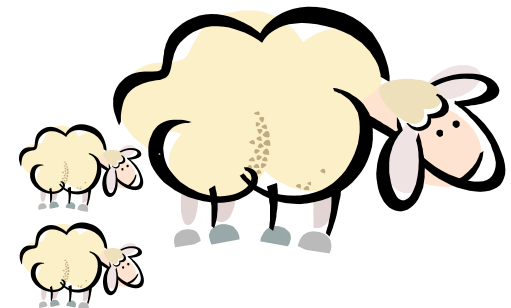
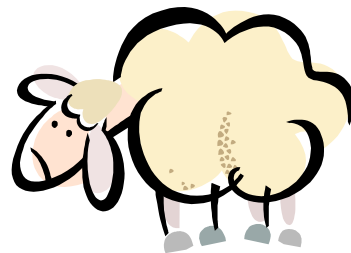


Reproduction

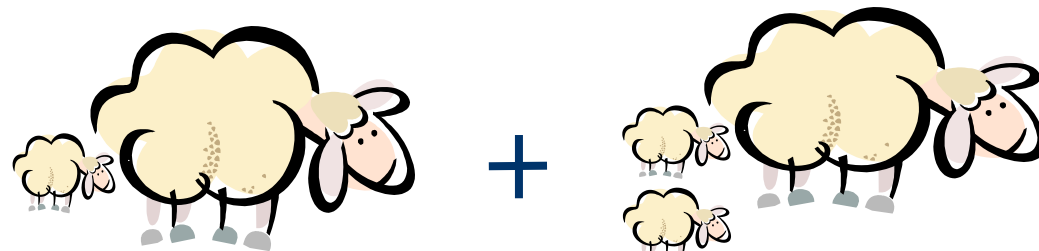
Variation in Net Reproduction Rate (NRR) & its components

Component of reproduction	Ewes ranked on lifetime reproduction rate		
	Bottom 25%	Average	Top 25%
Fertility %	55	79	85
Litter size	1.28	1.42	1.64
Survival %	47	73	90
NRR %	30	84	138

Source: Lee *et al.* (2009)



Early NRR can predict Lifetime NRR

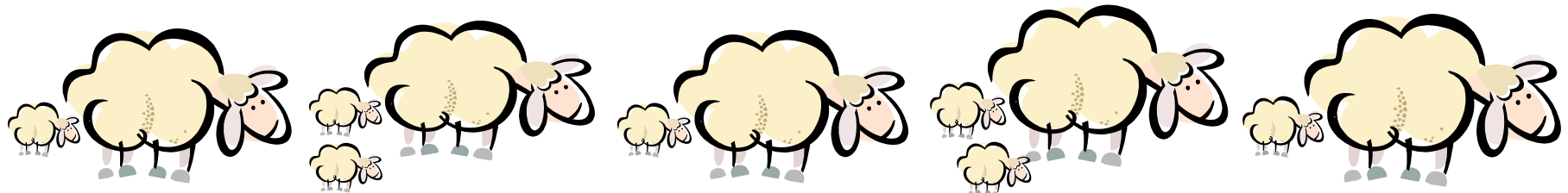


NRR
2 years of age

NRR
3 years of age



Lifetime NRR



2 years

3 years

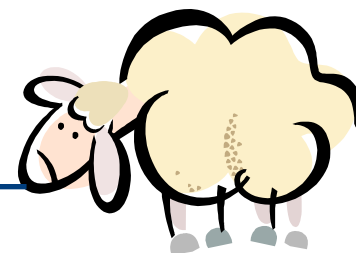
4 years

5 years

6 years

Who are the passengers?

- Pregnancy scanning tells us which ewes are pregnant & how many fetus(s)
→ identifies the *passengers*



Performance at 2 + 3 years

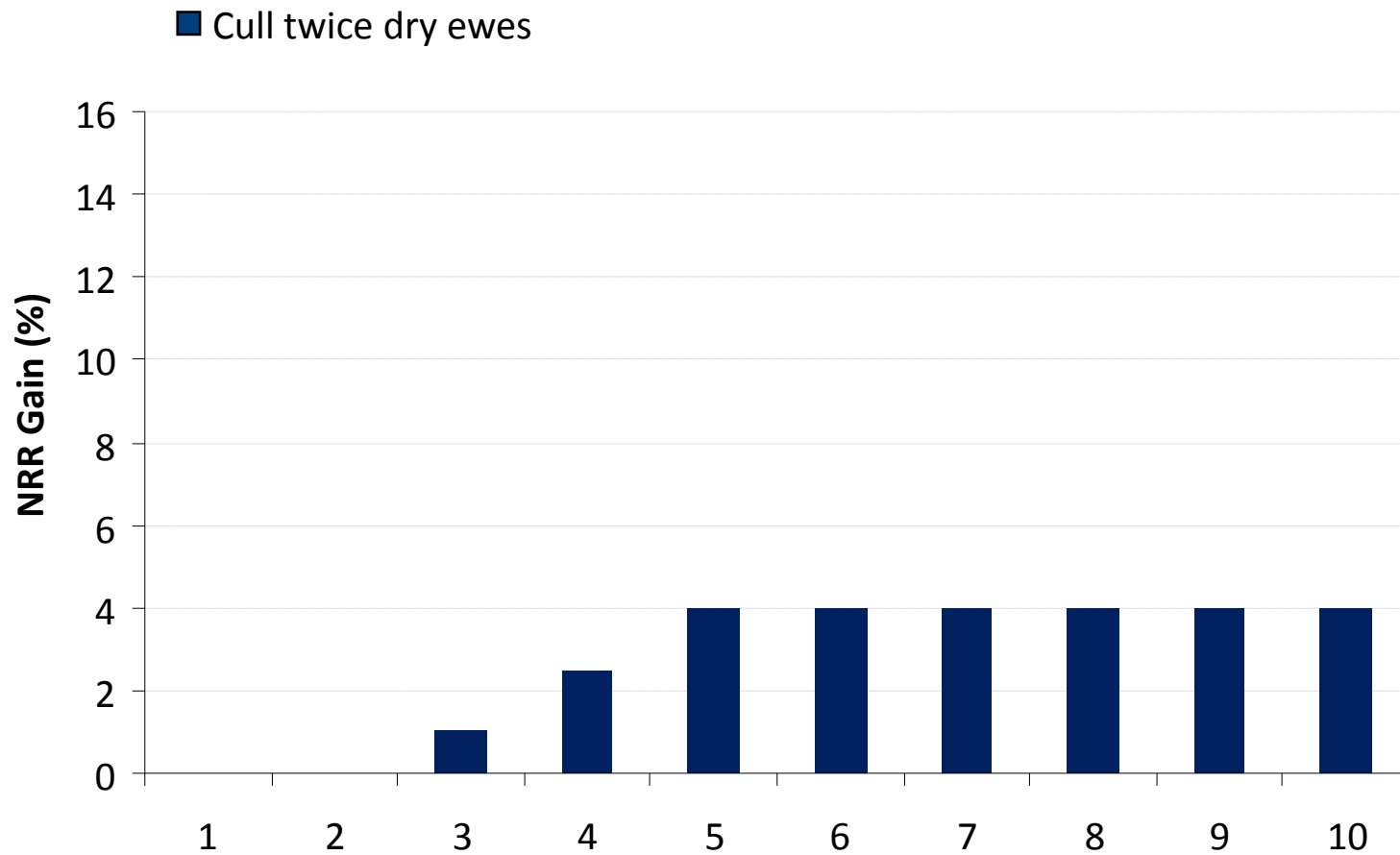
Dry twice

Fertility %	52.3
Litter size	1.40
Survival %	62.0
NRR %	47.4

Source: Lee & Atkins (1996)

Cull twice dry ewes

Gain from culling passengers

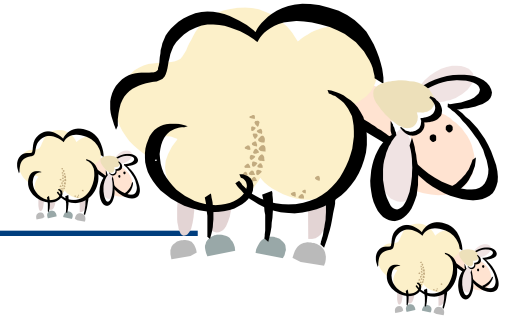


Source: Lee *et al.* (2011)

Culling passengers → 4% gain in 5 years

Who are the performers?

- Udder examination at marking tells us which ewe reared her lamb/s
→ identifies the *performers*



Performance at 2 + 3 years

	Dry twice	Lambd once	Lambd twice
Fertility %	52.3 _a	73.7 _b	80.1 _c
Litter size	1.40 _a	1.47 _b	1.48 _b
Survival %	62.0 _a	72.1 _b	76.3 _c
NRR %	47.4 _a	78.1 _b	90.9 _c

Source: Lee & Atkins (1996)

Retain 50% of older ewes who rear their lambs for 1 – 2 more years

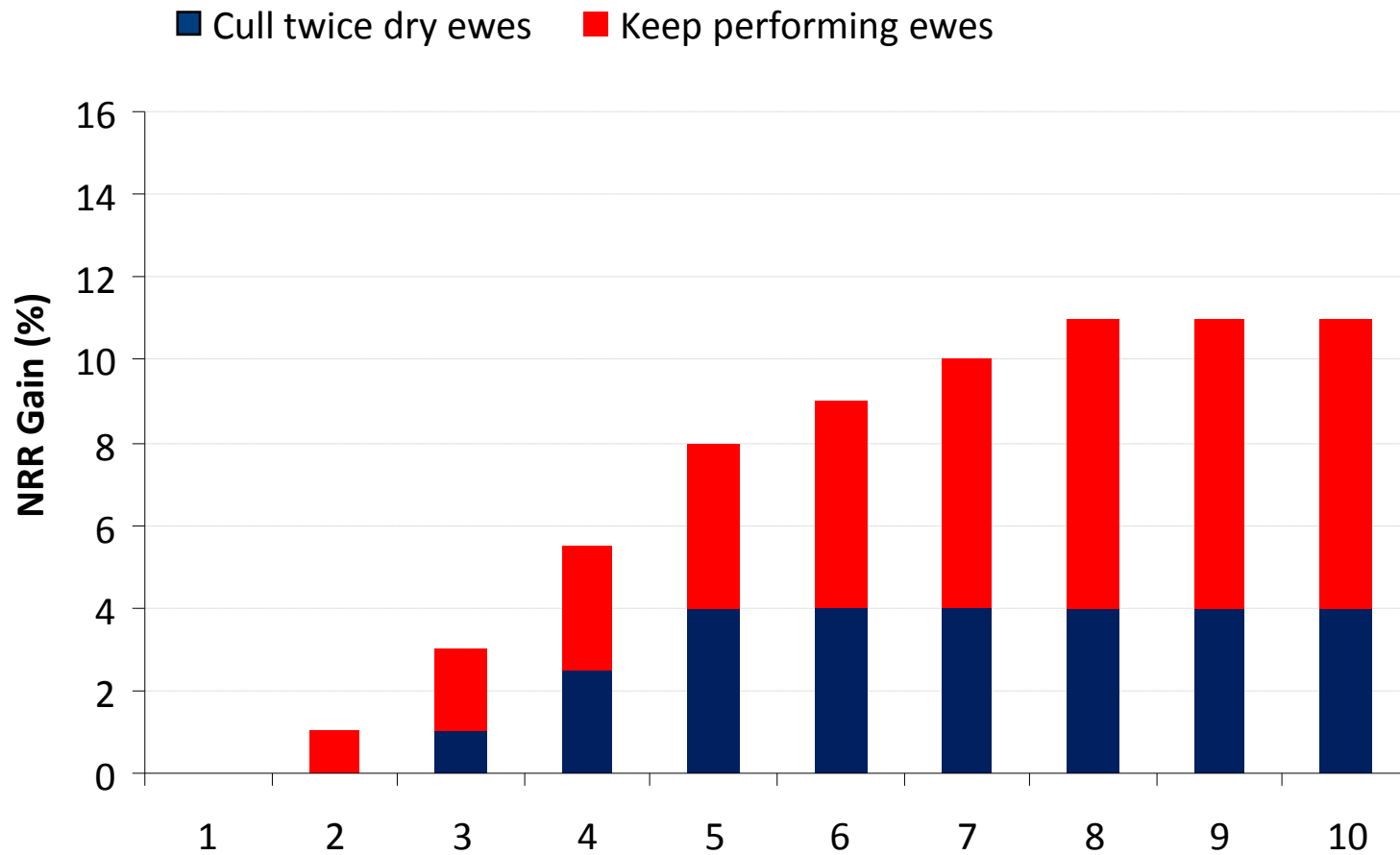
Key fitness indicators for older ewes

- Fitness to remain in the breeding flock should be based on the condition of a ewe's:
 - udders, teeth & feet
- These 3 indicators can have a large impact on ewe productivity.



Check older ewes for key fitness indicators at marking.

Gain from keeping performers



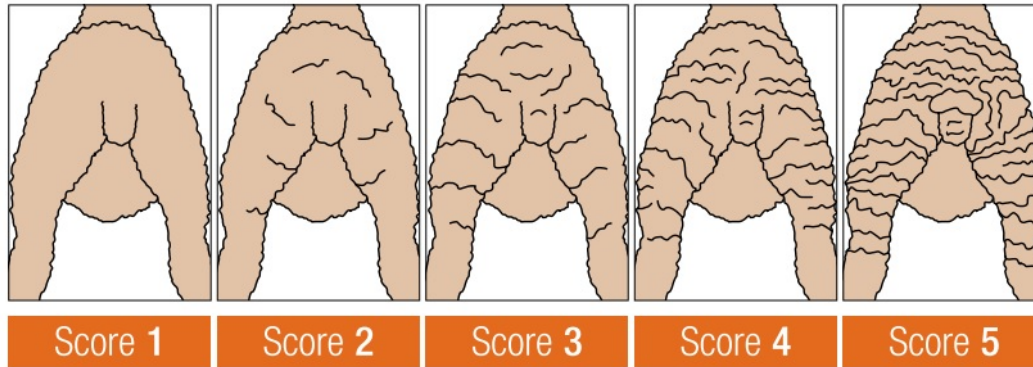
Source: Lee *et al.* (2011)

**Keep performers & cull passengers → 11%
gain in 8 years**

Easy care sheep - breech wrinkle

- Breech wrinkle is a key indicator trait for flystrike
- Industry standard 1-5 scoring system

Breech wrinkle (BRWR)



Source: AWI & MLA (2013)

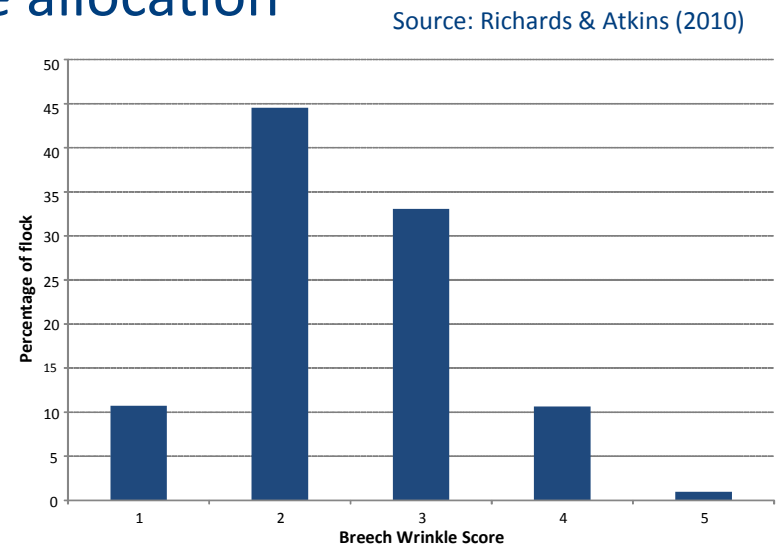
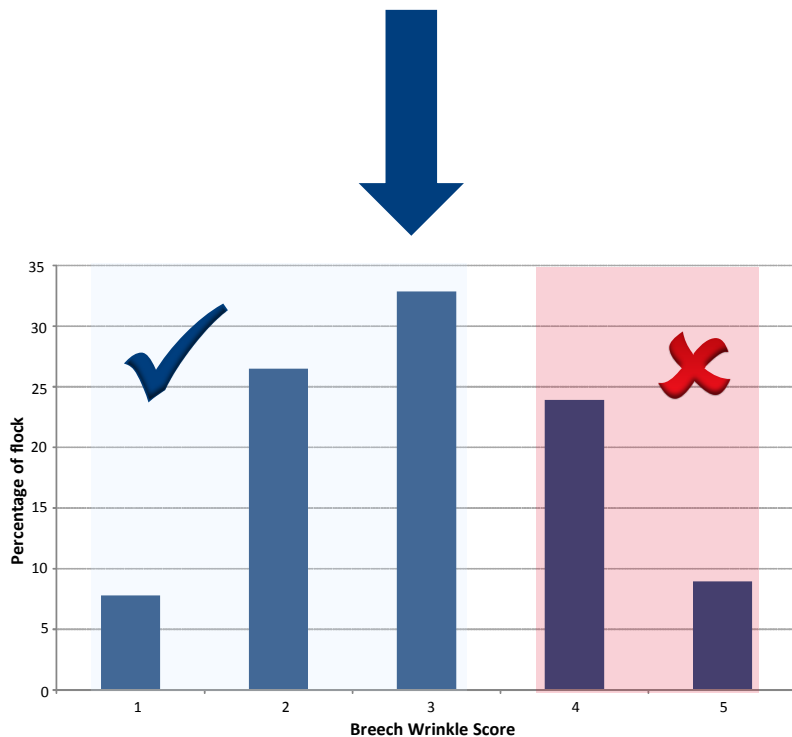
- ASBVs for breech wrinkle → to select for plainer sheep
 - incorporate into Merino breeding programs
- Potential for precision sheep management?

Using the variation

Age	Average	CV (%)
Marking	3.00	31.3
Yearling	2.47	29.2
Adult	2.47	28.0

Source: Hatcher & Preston (2016)

- **Current generation selection & management strategies**
 - cull the wrinkliest animals
 - manage groups according to score
→ crutch and treat all 4 & 5
- **Future generation options**
 - purchase low wrinkle rams
 - select plainer ewe replacements
 - mate allocation



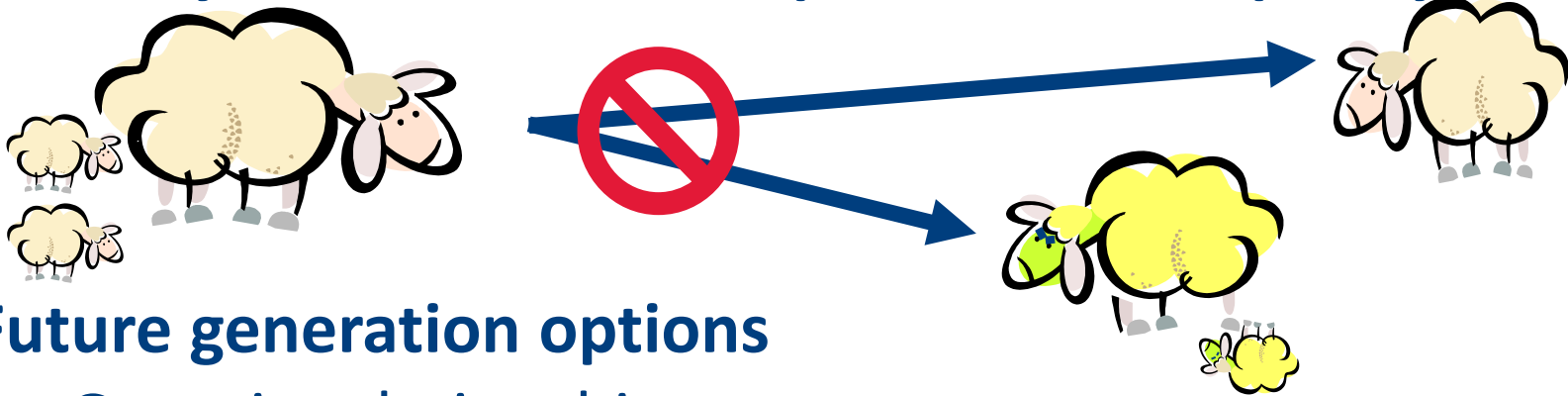
Source: Richards & Atkins (2010)

Impacts on other traits

Current generation selection & management

- Phenotypic relationships
 - favourable with liveweight & wool quality
 - antagonistic with wool production

Unlikely to influence wool production or quality.



Future generation options

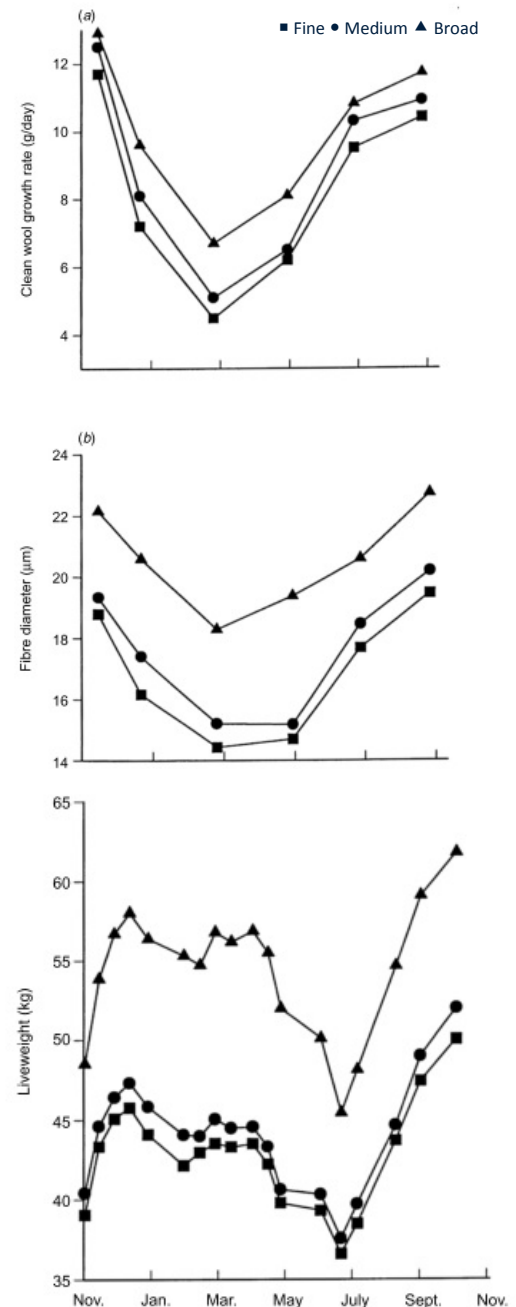
- Genetic relationships
 - favourable with liveweight & wool quality
 - antagonistic with wool production

Including breech traits in a selection index is needed to account for these antagonisms.

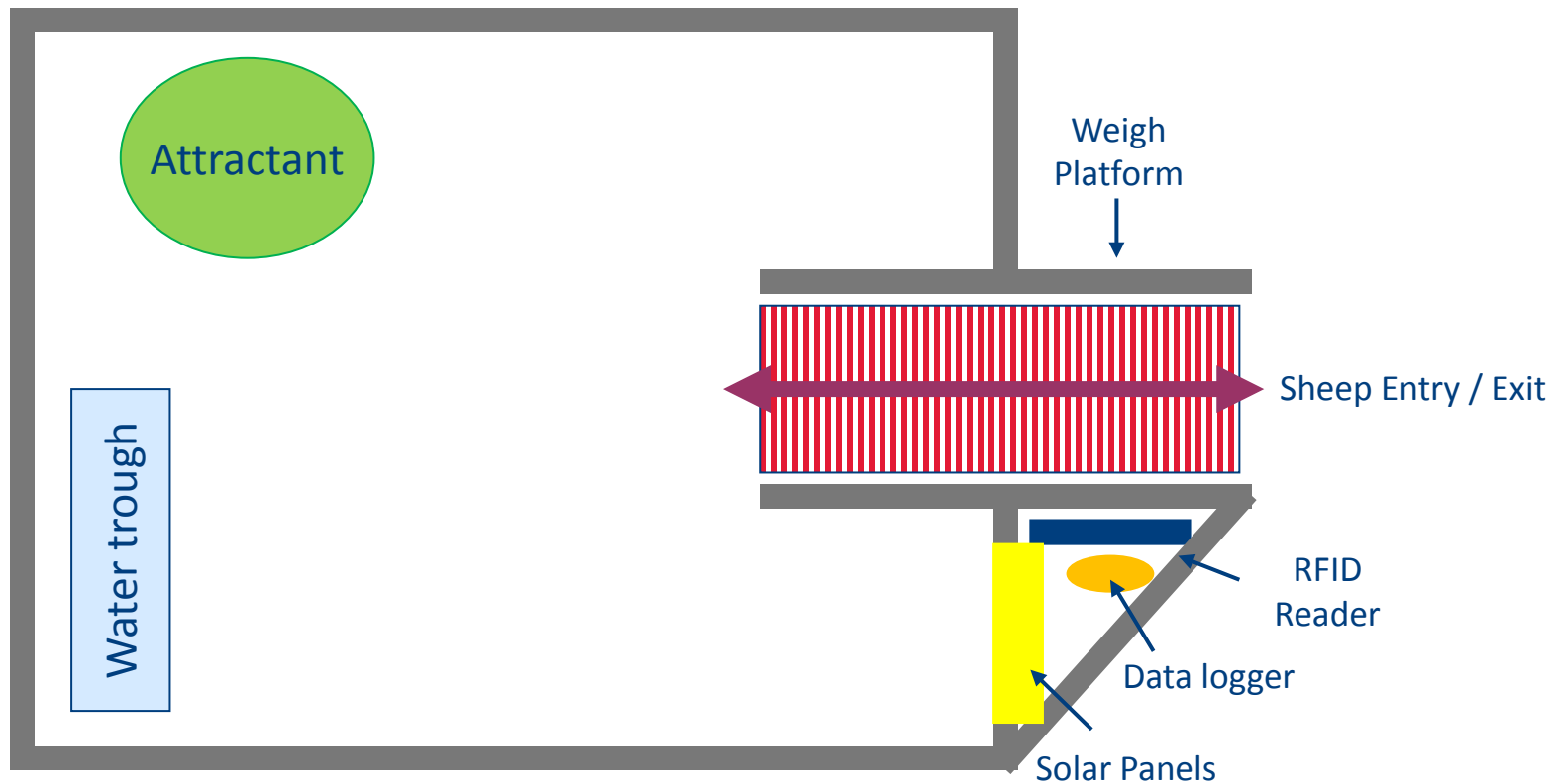
Liveweight & productivity

- Opportunity to increase production through liveweight management
- Changes in liveweight affects key sheep production parameters:
 - ewe wool production
 - lamb birthweight and survival
 - progeny growth potential
 - progeny wool growth and fibre diameter

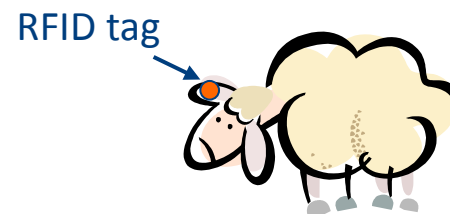
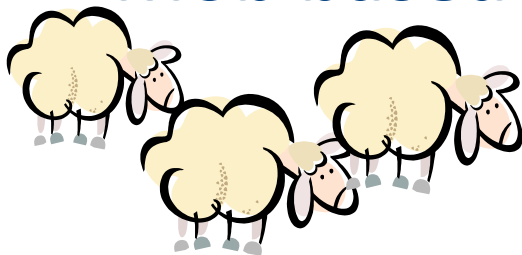
Accurate and timely feedback on liveweight



Walk Over Weighing (WOW)



Mob based or individual ID

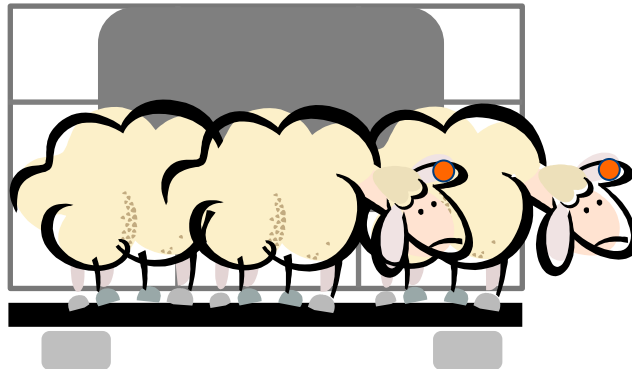
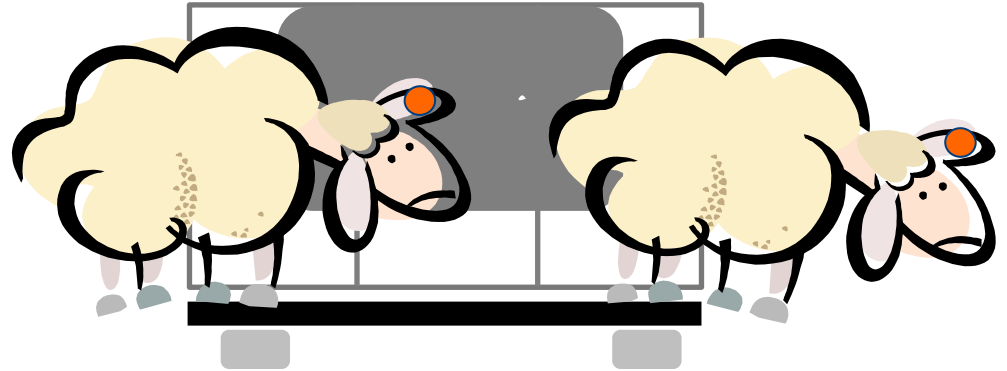
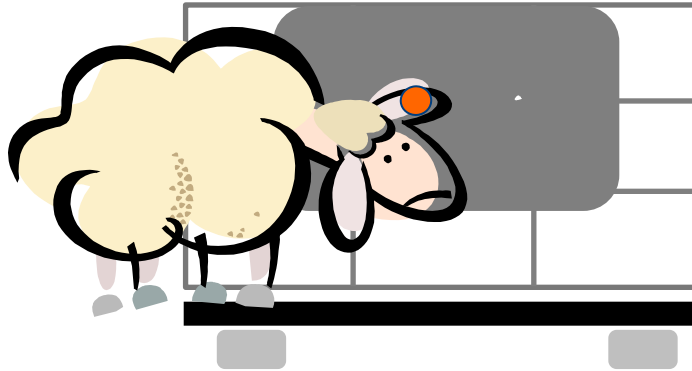
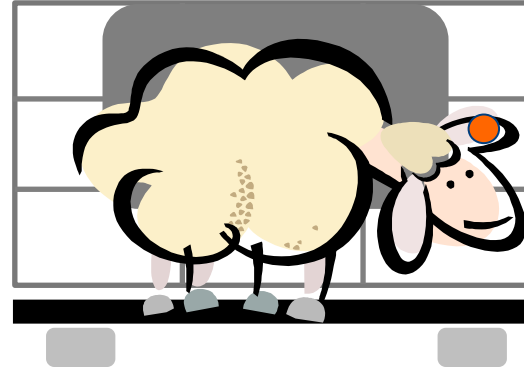
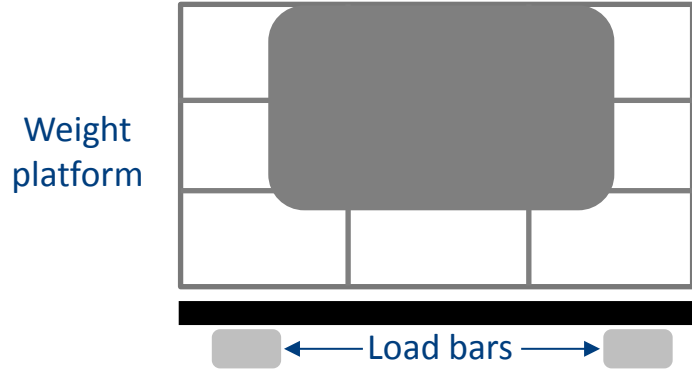


What is a valid weight?

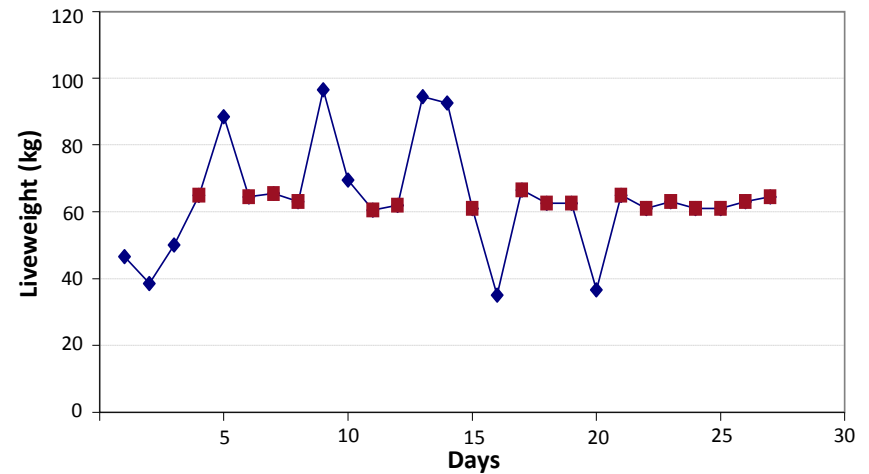
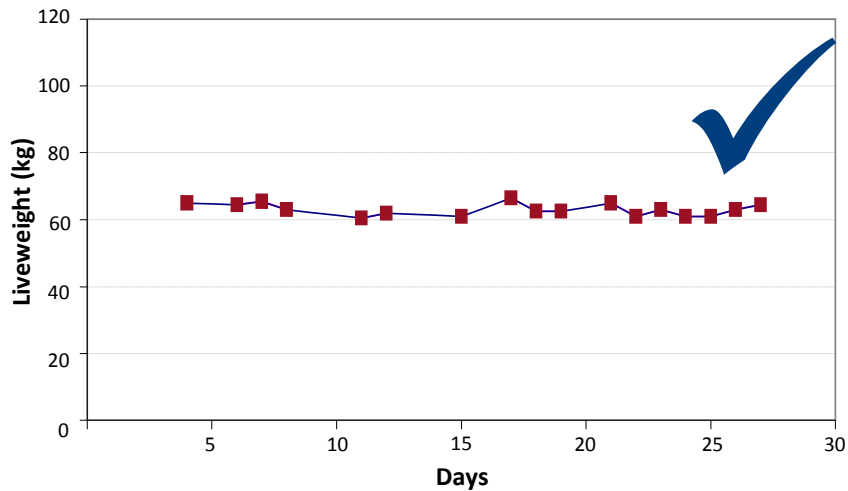
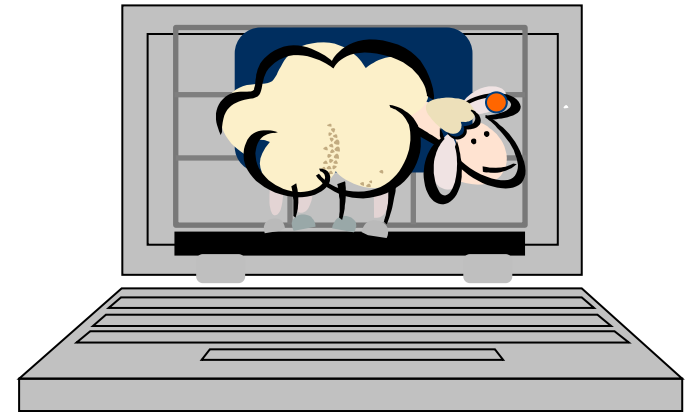
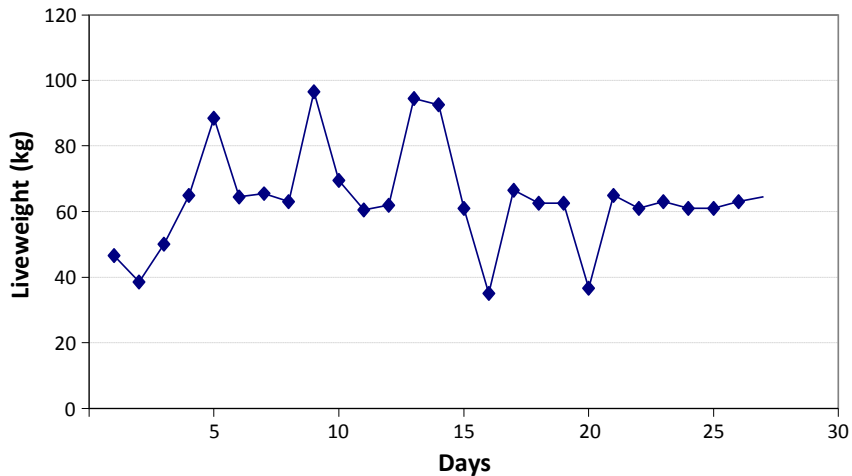
RFID reader

Weight platform

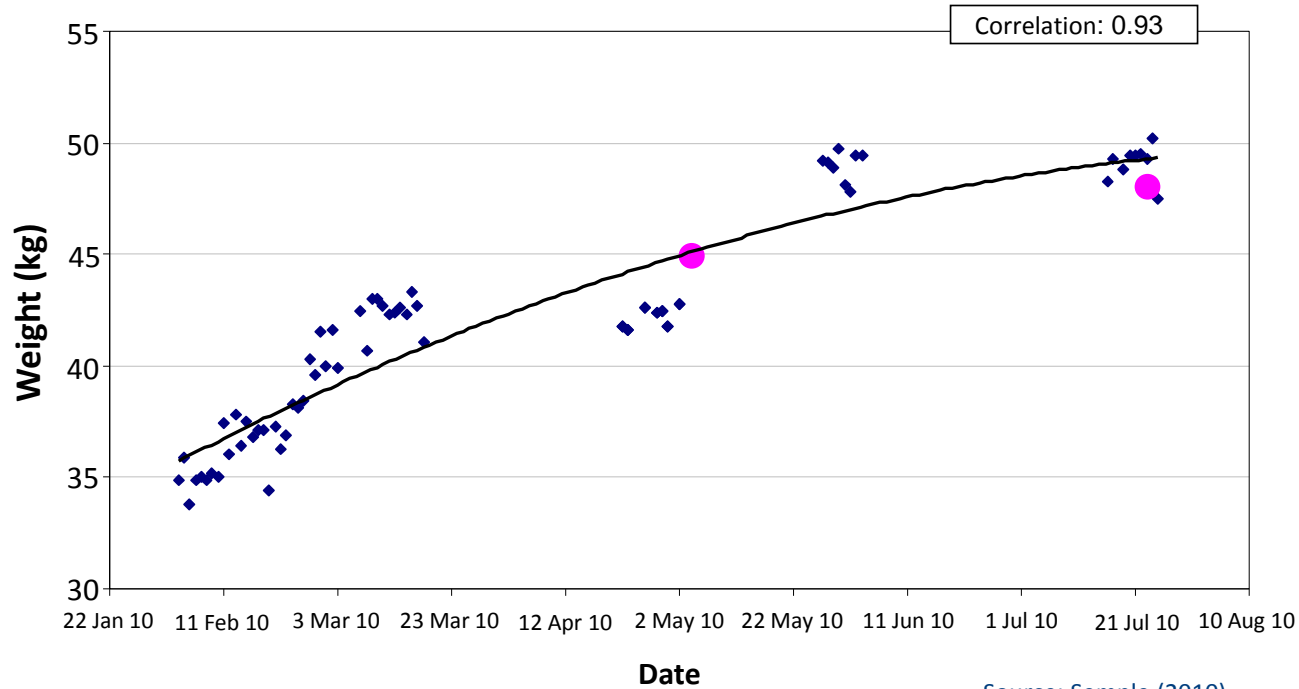
Load bars



Making sense of the data...



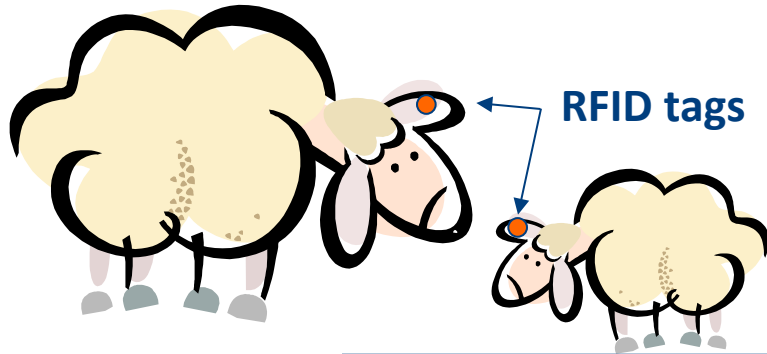
Mob based WOW



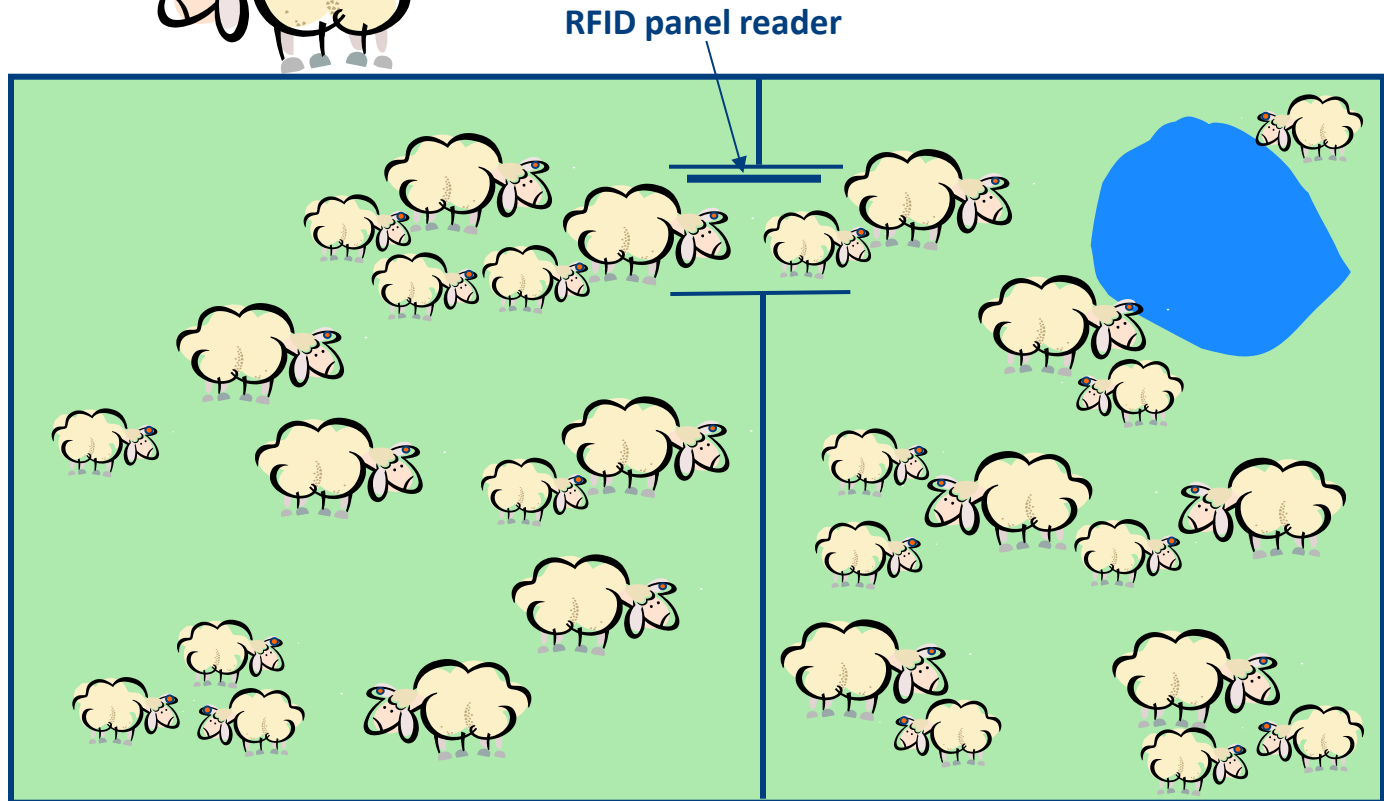
Source: Semple (2010)



Pedigree MatchMaker



- Lambs follow their mothers closely
- System records time-ordered tag list
- Software → **DAM PEDIGREE**



Benefits of PSM

'Flock' management

- Genetics determined by ram purchases
- Cull adults on age
- Manage breeding ewes on average condition
- Supplement all animals when required
- Mate older age group(s) to terminal sires
- Uniform parasite treatment of all animals
- Mules all animals

Individual animal management

- *Effective selection possible among ewes & wethers*
- *Retain animals on production*
- *Feed animals according to condition & history*
- *Identify animals requiring supplement*
- *Mating allocation on fitness for purpose*
- *Treat parasites based on assessed need*
- *Mules according to breech score*

PSM in Australia

- Network of private service providers
 - training workshops for producers
 - contract data collection on-farm
 - advise on setting up PSM systems
 - data management & reporting

achieve
AG solutions

aginnovate

Agri Partner
CONSULTING
...creating options



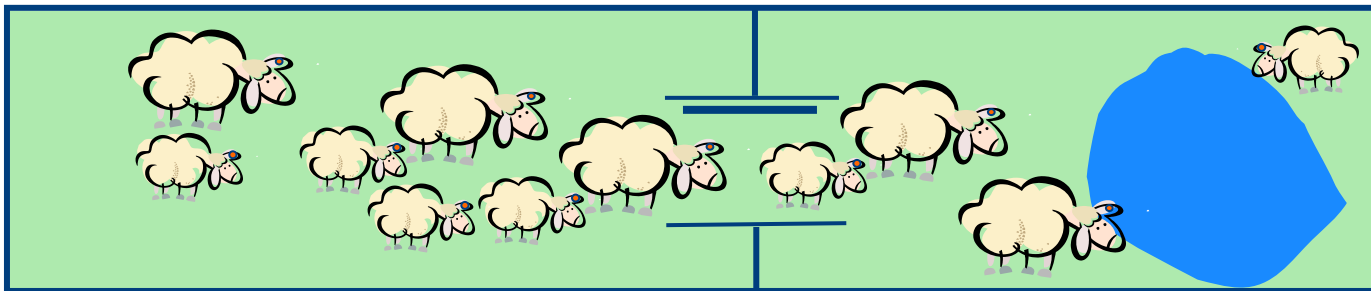
 **Sapien**Technology



Pedigree MatchMaker - more info?

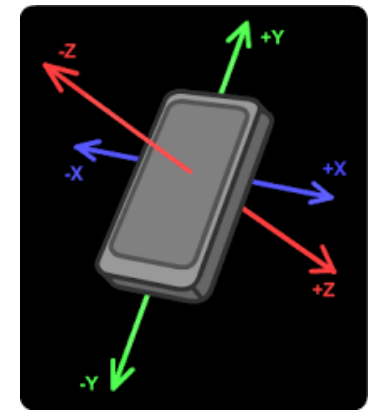
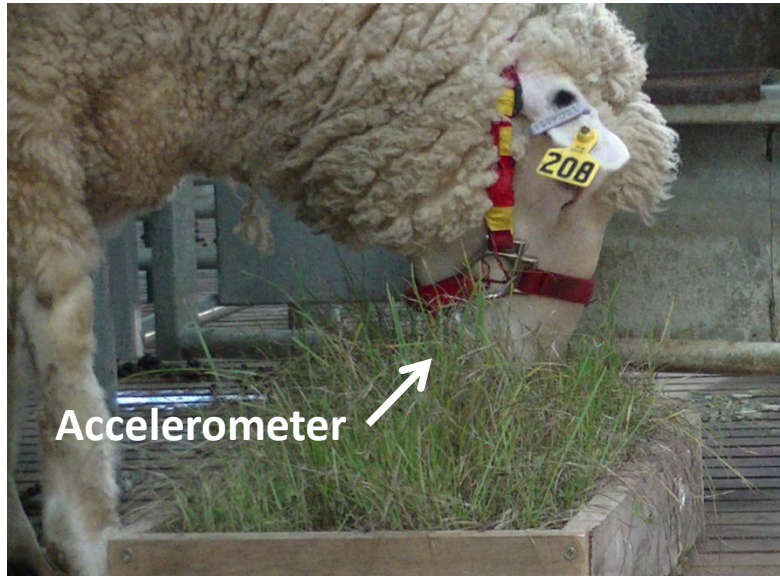
Trait	Mean	σ^2_p	h^2
Compat	48.5	4132.0	0.33 ± 0.09
CloseReads	6.9	26.0	0.53 ± 0.10
AvSecs	2.4	0.7	0.15 ± 0.08
nTimes	22.8	106.6	0.42 ± 0.03
AvgTime	10.7	3.8	0.32 ± 0.03
nDays	12.0	17.1	0.42 ± 0.03
Times/day	1.9	0.4	0.36 ± 0.03

Source: Brown et al. (2011)

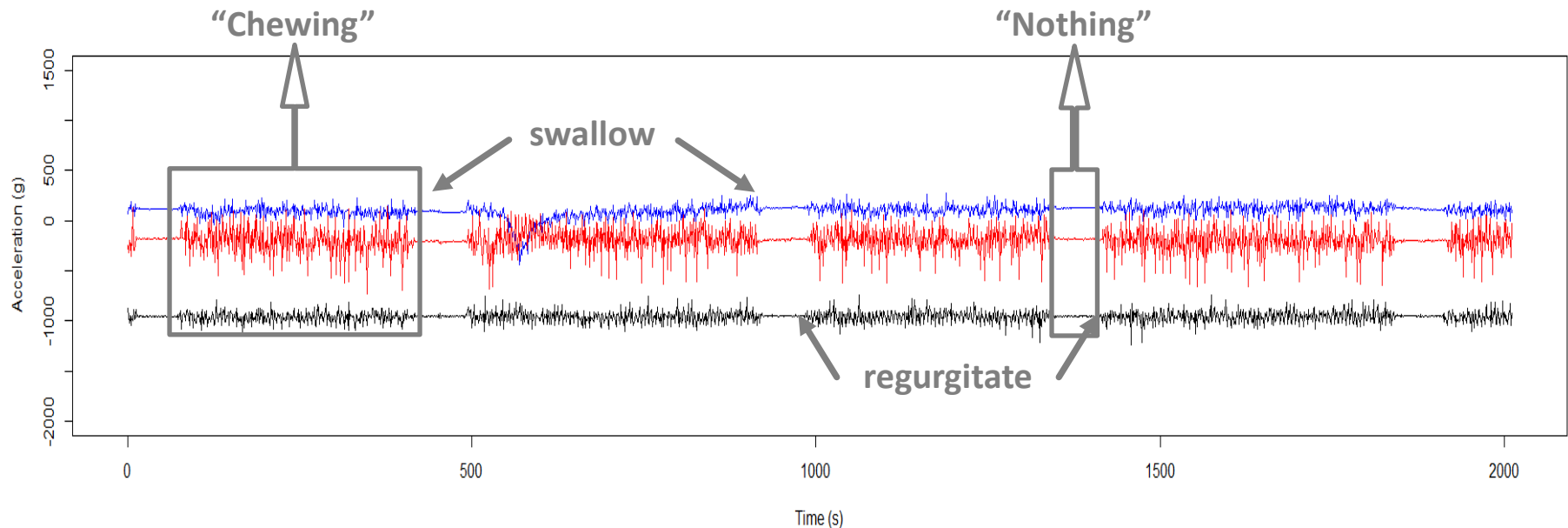


Favourable relationships between these traits and some production traits

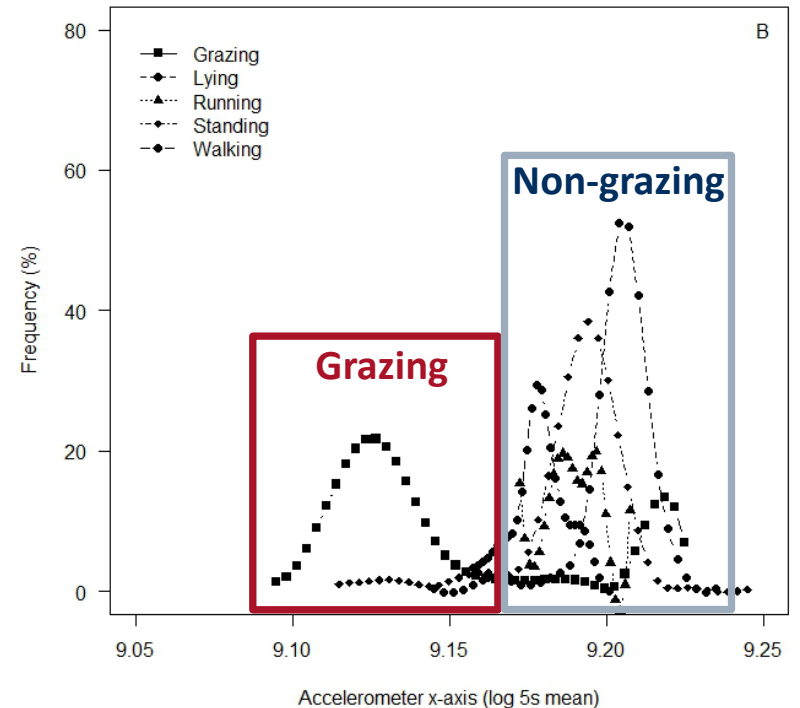
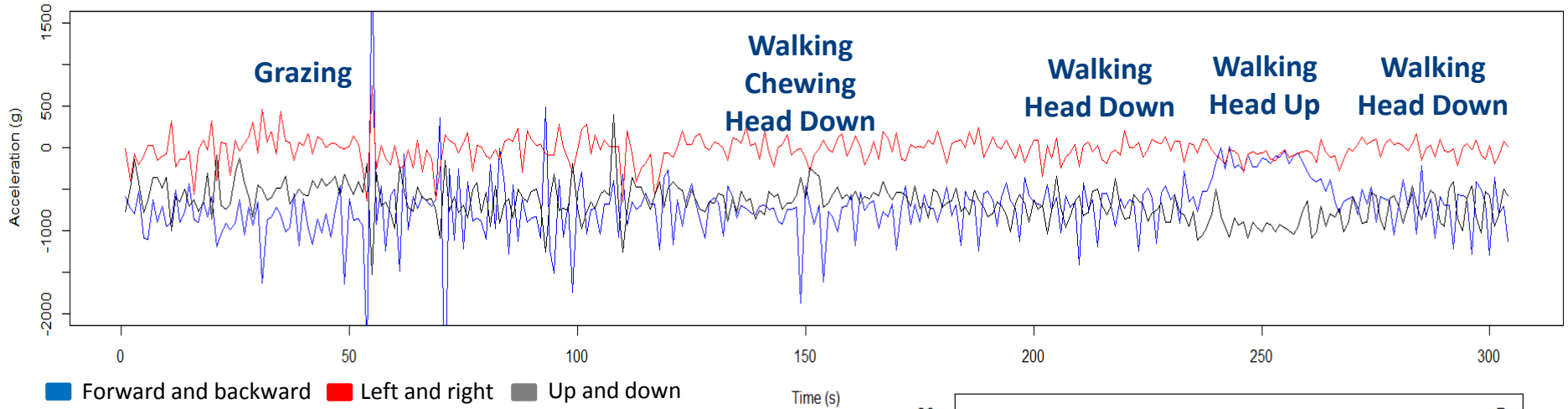
Accelerometers



- Measure jaw movements
 - biting, chewing, regurgitation, chewing, nothing
- Quantify rumination behaviour



Behaviour at pasture



Spatial paddock use

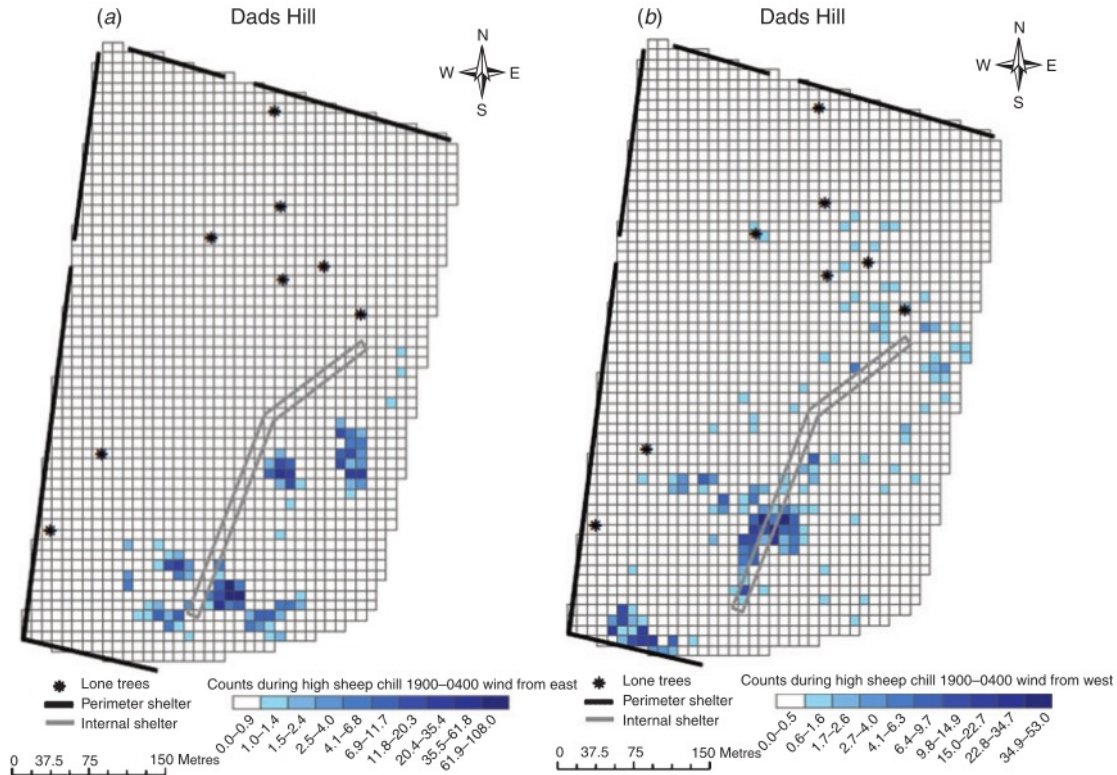
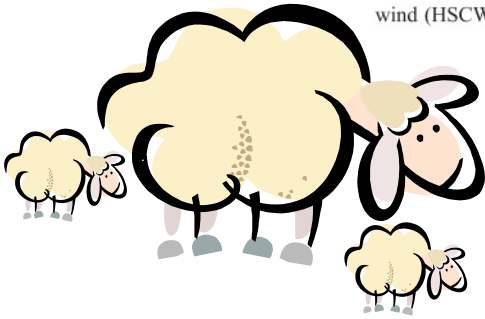


Fig. 3. Sheep distribution in Dads Hill paddock at night during (a) high sheep chill east wind (HSCE) and (b) high sheep chill west wind (HSCW).

Source: Taylor et al. (2011)



GPS & faecal egg counts

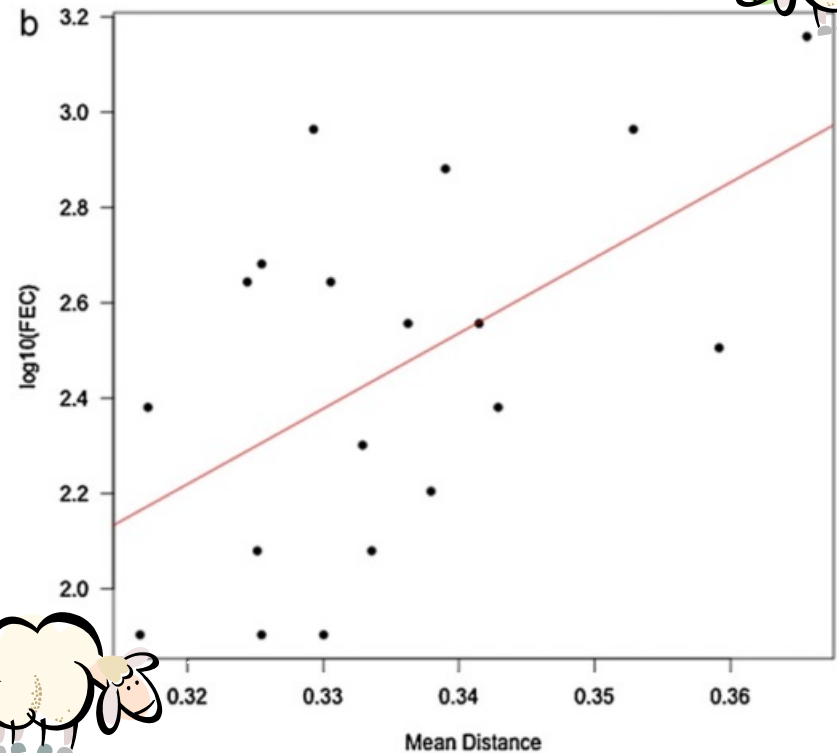
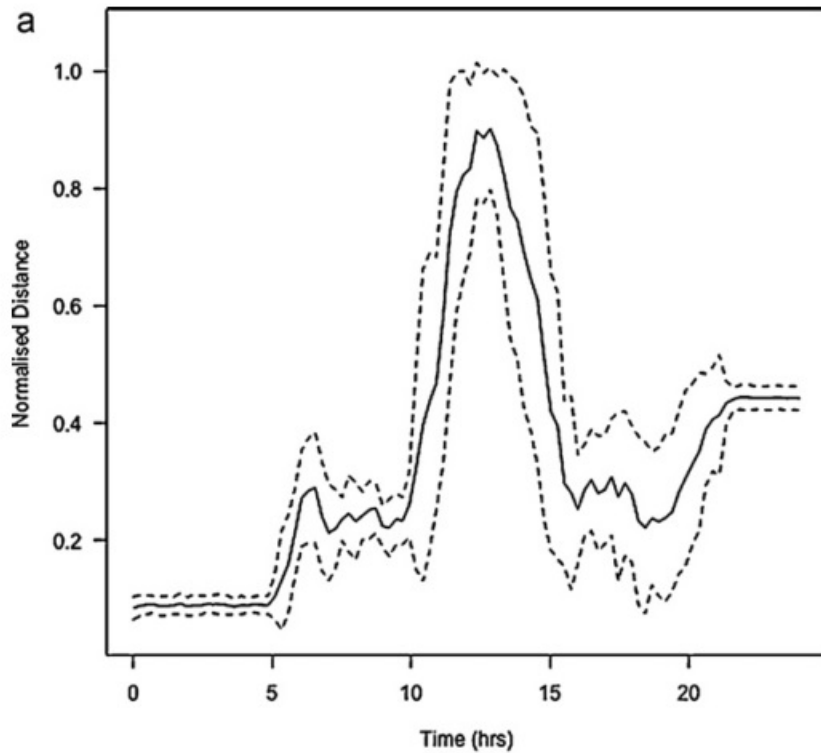
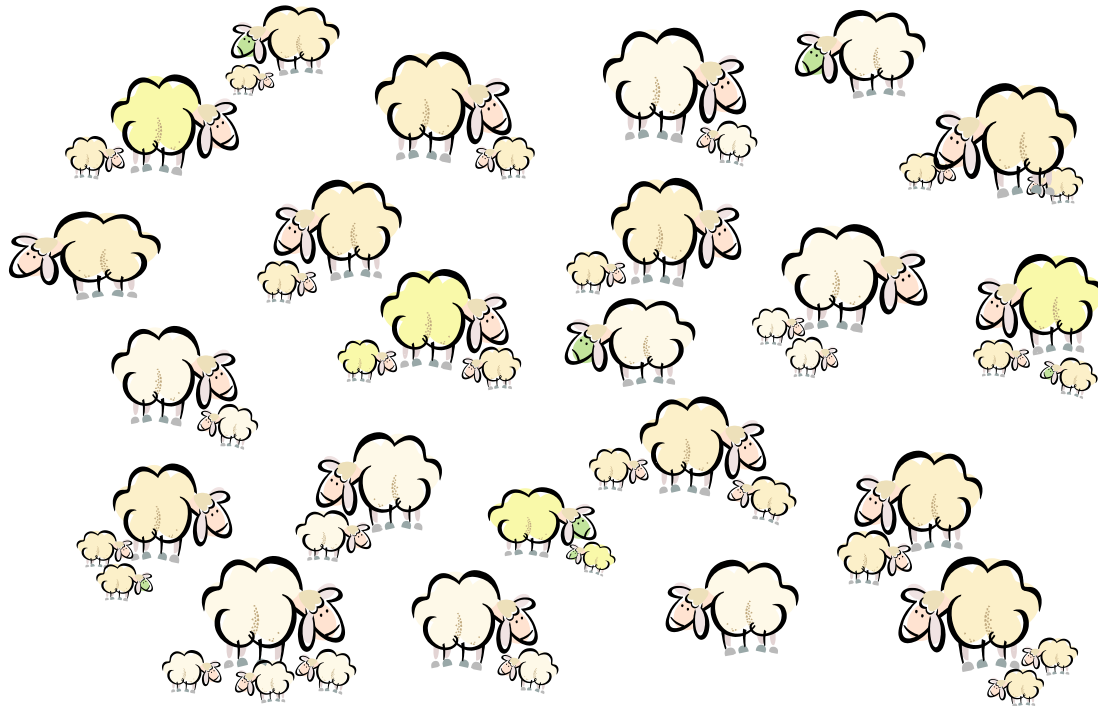


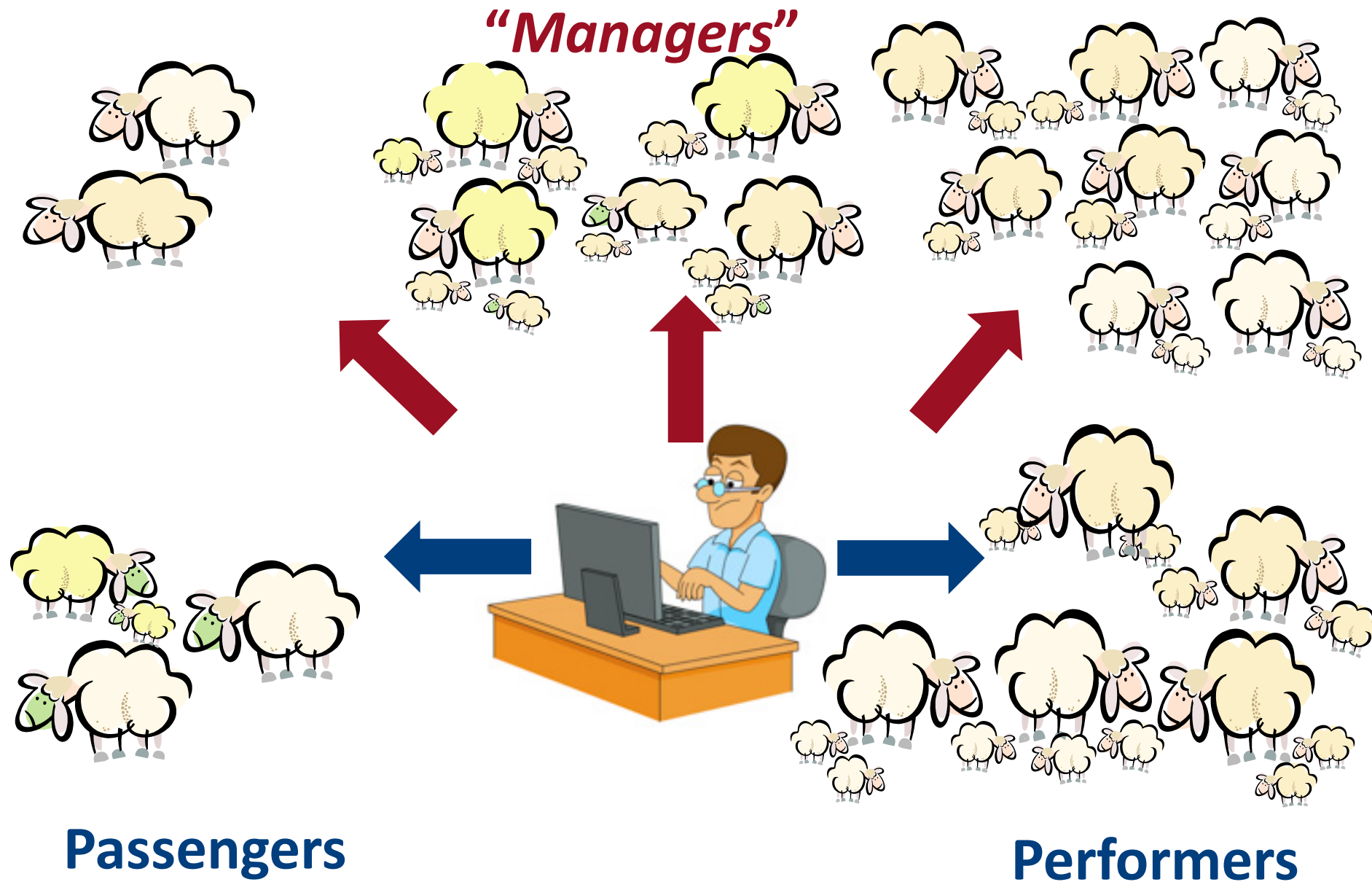
Fig. 1. GPS monitoring of sheep movements: (a) normalised distance travelled as a function of time – solid line average, dotted lines plus or minus one standard deviation, (b) regression of $\log_{10}(\text{FEC})$ with mean of distance (in km) per time step.

Source: Falzon et al. (2013)

The future....



Performers, passengers & managers...





Thank you!