

AWI Breech Strike R&D Technical Update
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Breeding for Breech Flystrike Resistance

- **Acknowledgements**

1. John Karlsson – Veterinarian and researcher
2. Tony Schlink – Wool and sheep researcher
3. Nicola Stanwyck - Technician
4. Mt Barker and Katanning research station staff
5. Shimin Liu – UWA researcher
6. French and Chinese students



The problem

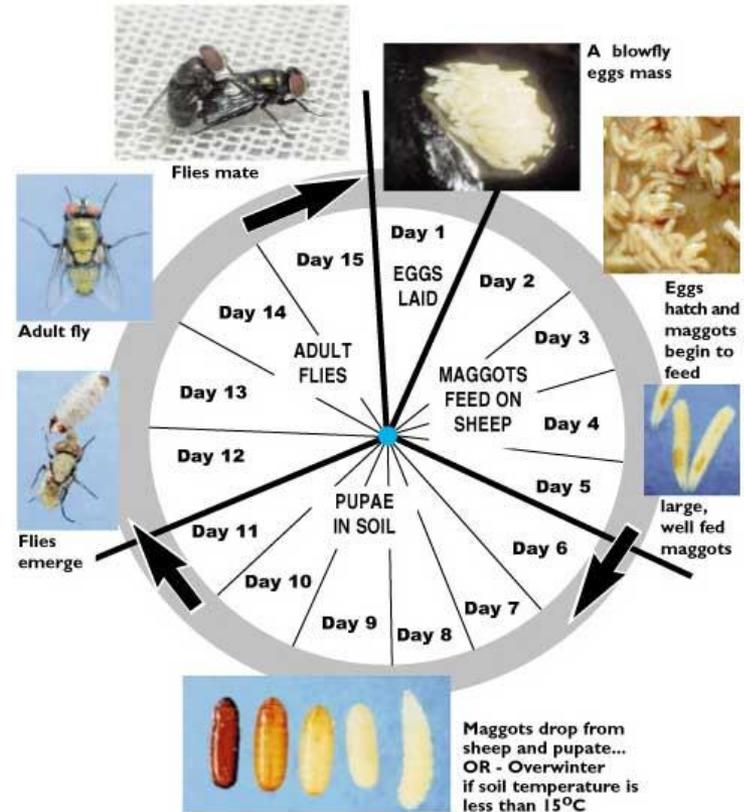


- *Lucilia Cuprina*, the “Australian” Sheep Blowfly.

Introduced to Australia in the early 1900's

The problem

- Needs a source of liquid protein to sustain maggots immediately after hatching
- Damp wool and skin are attractive to flies
- Maggots mature and develop fangs that allow penetration of the skin.



A solution

- Breeding for increased resistance to a same level as under a mulesed environment
- Issues
 - Animals must be challenged
 - Disease traits are threshold traits
 - Need indirect selection criteria without the need to challenge

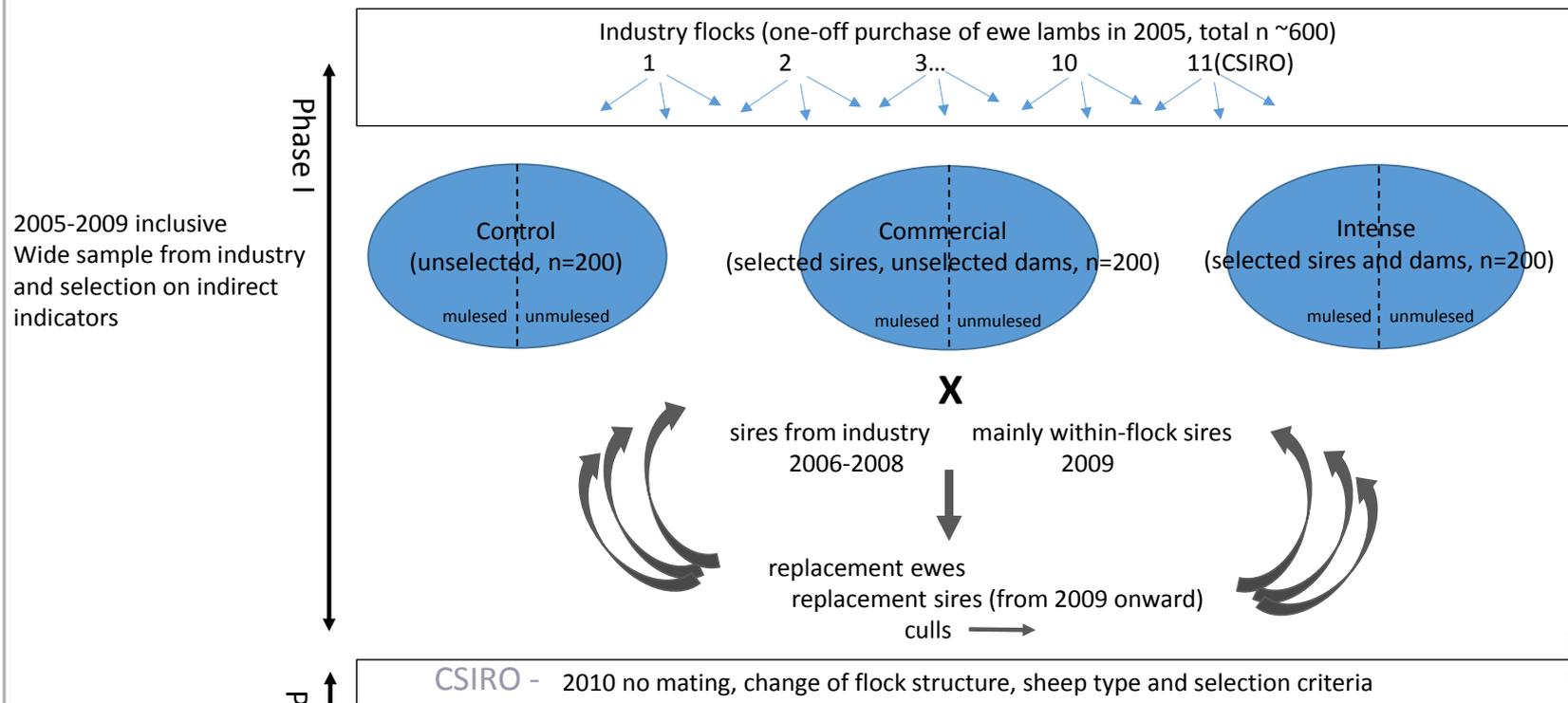


Objectives - Scientific

- How fast can you breed for resistance?
- How does it compare to mulesing?
- To identify and quantify importance of indicator traits for breech strike in un-mulesed sheep in summer and winter rainfall regions
 - Identify potential management solutions
- To estimate genetic parameters of indicator traits to design effective breeding programs
 - Heritability
 - Phenotypic and genetic correlation between traits
- Assist provide industry with ASBVs of indicator traits
- Incorporate in breeding programs

• Design, Phase I (2006 to 2009)

CSIRO, Armidale fine wool sheep, summer rainfall environment
 DAFWA, Mt Barker medium wool sheep, Mediterranean environment



- Design, Phase I WA (2006 to 2009)

600 mature mulesed ewes from Research stations

600 ewe weaners from 10 industry flocks in Eastern and Western Australia

Classed after 1 st yr.	Mulesed	Unmulesed
Selection	100	100
Commercial	100	100
Control	100	100

No crutching between shearing



Acknowledgements

Contributing Flocks

Mount Barker, Western Australia

2005 drop ewe weaners:

- Billandri
- Cherry Tree Estate
- J Coole & Co
- Felspar Pty Ltd
- GSARI
- C D, D N & S H Herbert
- Kilandra Pastoral Co
- Majuba
- I & D Robertson
- W M & V A Webb

Armidale, New South Wales

2005 drop ewe weaners:

- Auchen Dhu Park
- Cressbrook
- Gostwyck
- Goyarra Poll
- Hazeldean
- Mirramoona
- Quambaloo Poll
- Ruby Hills
- Whyworry Park
- Yalgoo

Ewes for 2006 mating:

DAFWA Research Stations:

- Badgingarra
- GSARI
- Mt Barker

Ewes for 2006 mating:

CSIRO Armidale resource flock
(fine wool base)

Sire flocks 2006 mating:

- Calcookara (Cojack)
- Centre Plus
- Cherry Tree Estate
- Cranmore Park
- Rylington Merino
- Toland
- Yeendalong Farm
- GSARI (control)

Sire flocks 2007 mating

- Wallinar
- Margan
- Centre Plus WA
- Calcookara (Garreth)
- Majuba

Sire flocks 2006 mating:

- Calcookara
- Centre Plus
- Cressbrook
- Parkdale
- Quambaloo Poll
- Ruby Hills
- Severn Park
- Toland
- T13 (control)



Experimental ewes were screened on

- Mature ewes (mulesed and from Research stations)
 - Wrinkles
 - Wool colour
 - Urine stain
 - Dags and Faecal consistency
 - Face and legs cover
 - Dermo and Fleece rot
 - Flystrike
- Ewe weaners (at marking from industry)
 - Mainly wrinkles, colour and breech cover

Experimental rams were screened on

- Wrinkles
- Bare breech
- Wool colour
- Urine stain
- Dags
- Face and legs cover
- Dermo and Fleece rot
- Flystrike
- Faecal worm egg counts

Selection of sires used in WA

Rylington Merino



Kojak

Cranmore Park

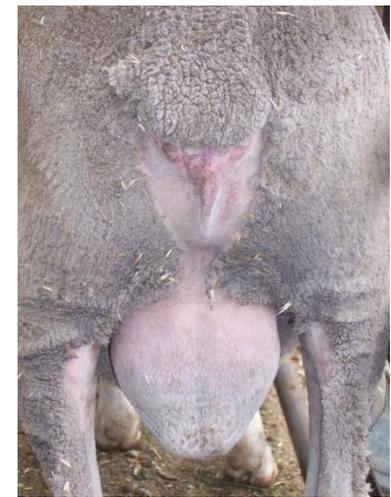


Garreth

Abbot



O'Halloran



Centre Plus

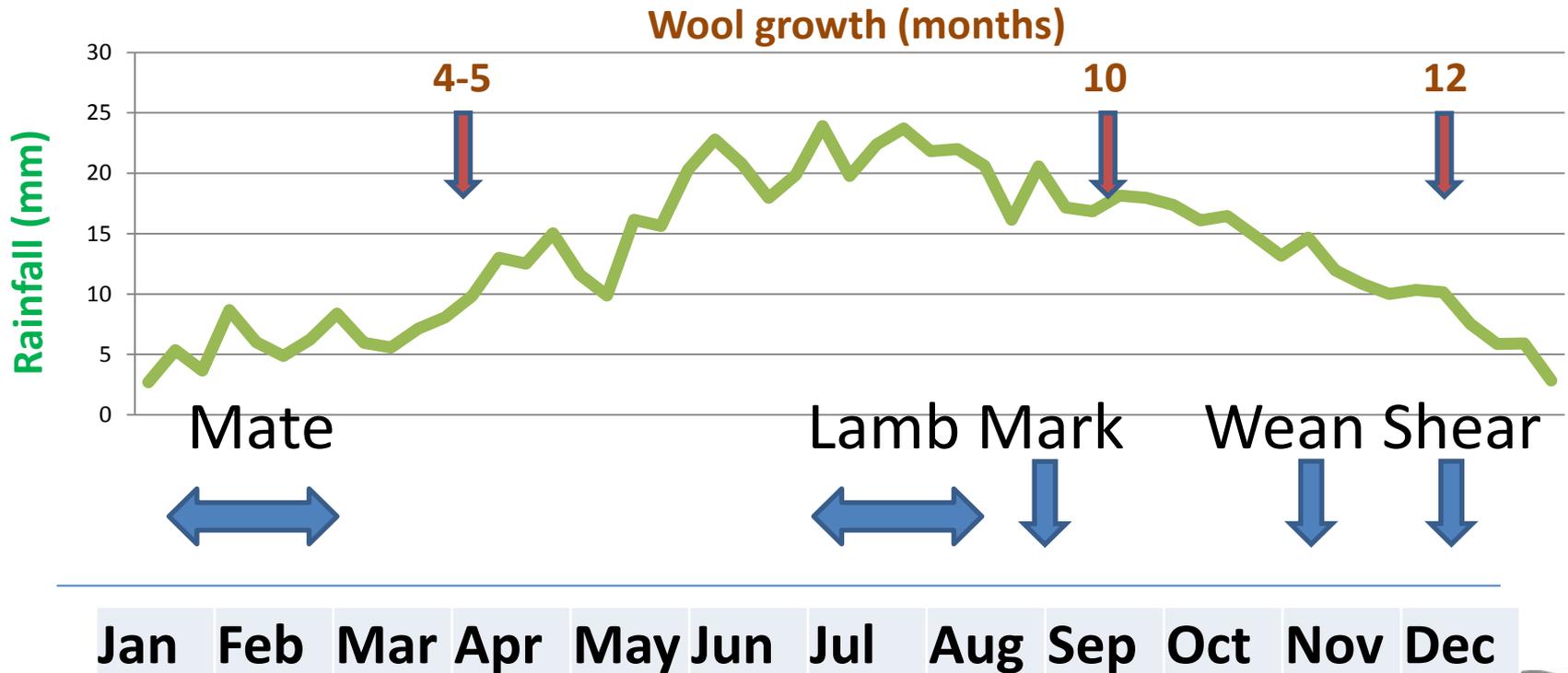


Sites



Mount Barker Research station

Average weekly rainfall (2000 -2015) and annual events



Autumn wool = 4 - 5 months wool
Spring = 9 months wool
Shearing = 12 months wool

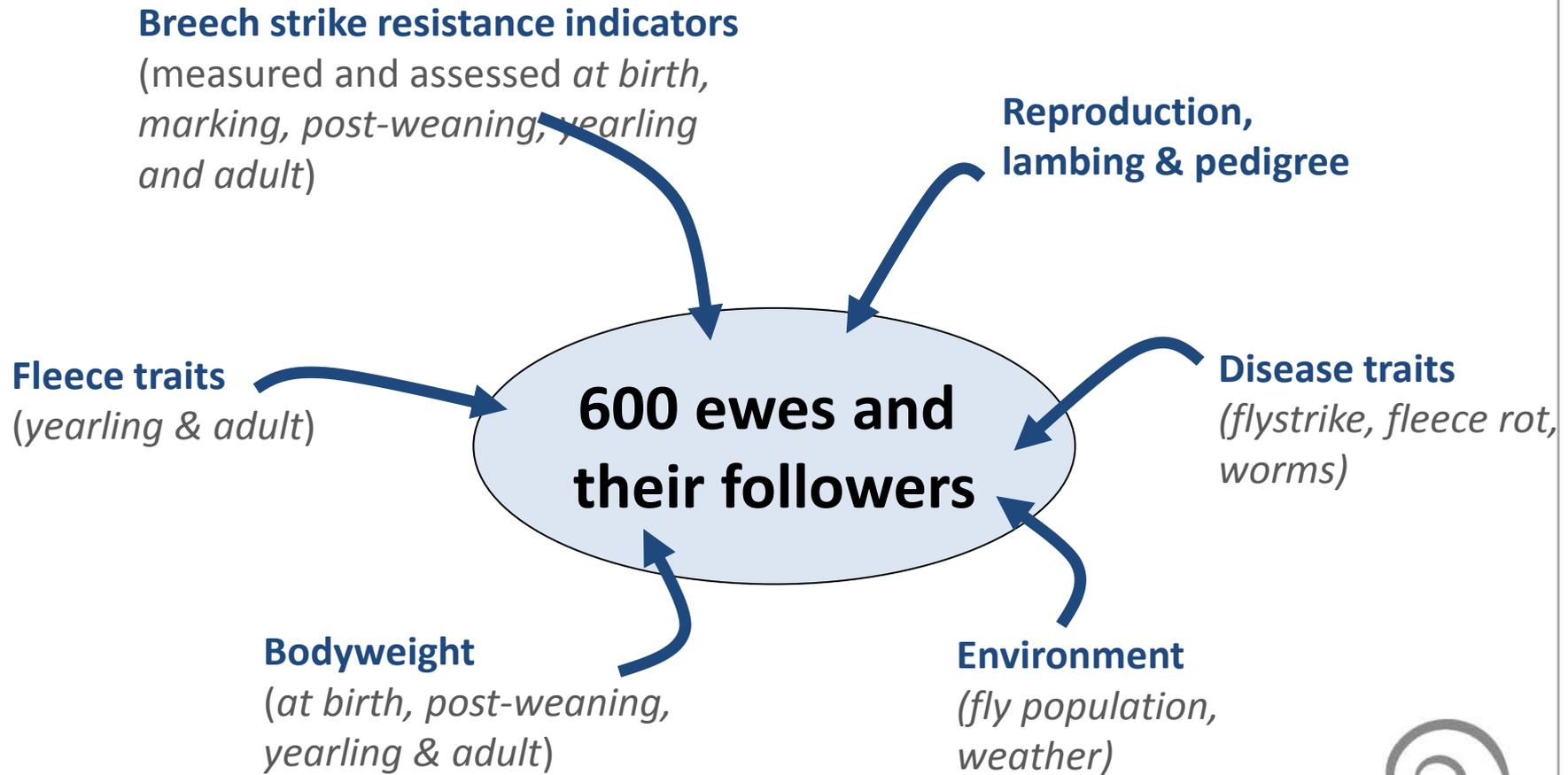
Key indicator traits scored



Wrinkle,
Dags,
Urine Stain
Dermo
Breech Cover
Fleece Rot
Wool Colour



- Phase I- What got recorded



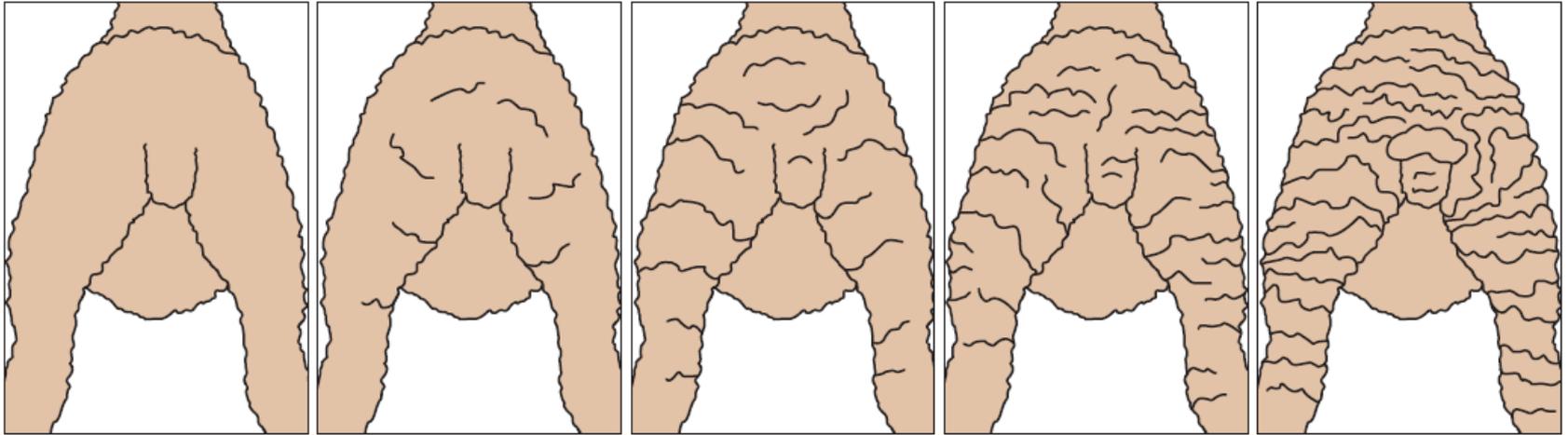
- Flystrike recording
- No 'whole flock' chemical preventative treatment
- Sheep checked at least 3 times per week
- Fly season is governed by temperature (mainly Oct-Dec)
- Body, pizzle, poll strikes recorded separately
- Short acting insecticide used to treat struck animals
- All classes of sheep for as long as they remained in flock

- Weaners, hogget ewes and rams, breeding ewes, sires



W r i n k l e

Breech Wrinkle



Score 1

Score 2

Score 3

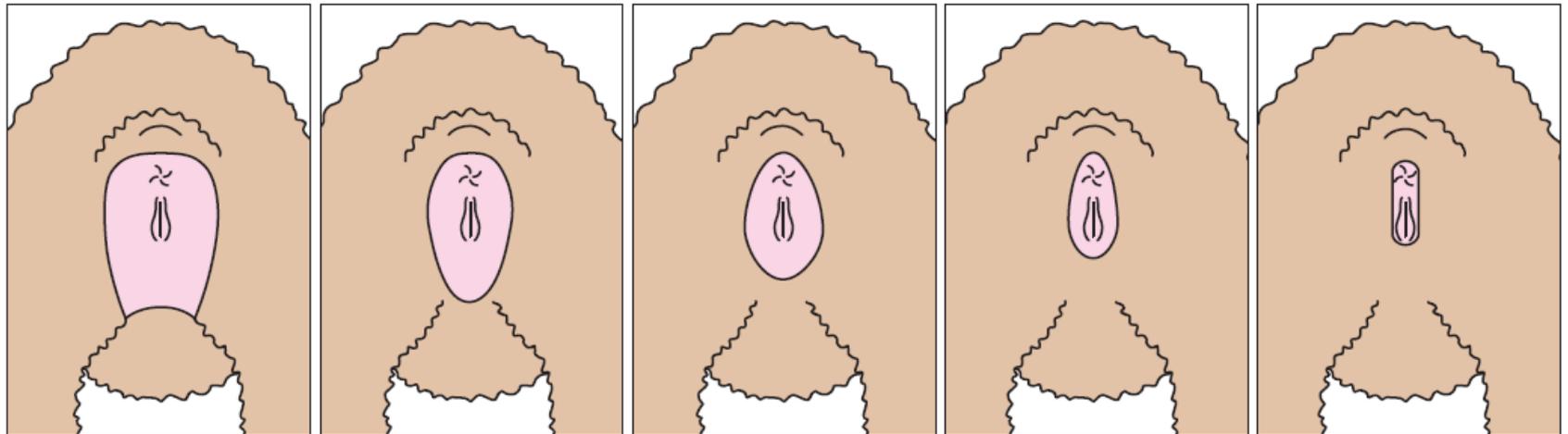
Score 4

Score 5

N e c k , B o d y , R u m p , B r e e c h , T a i l

Breech cover

Breech Cover



Score 1

Score 2

Score 3

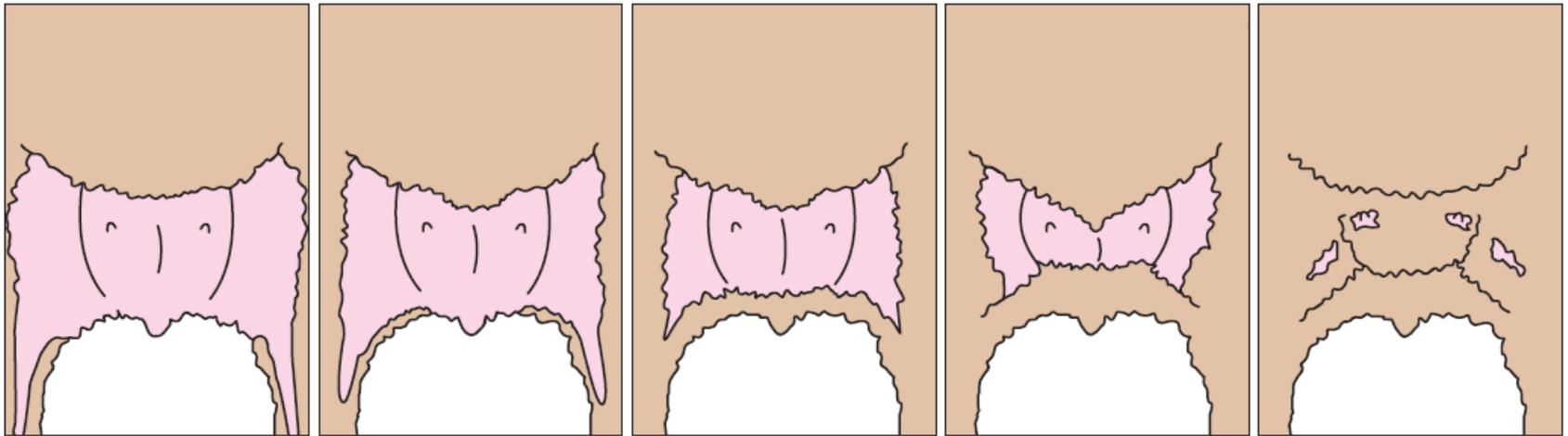
Score 4

Score 5

Face, Legs, Belly

Crutch cover - ewes

Crutch Cover



Score 1

Score 2

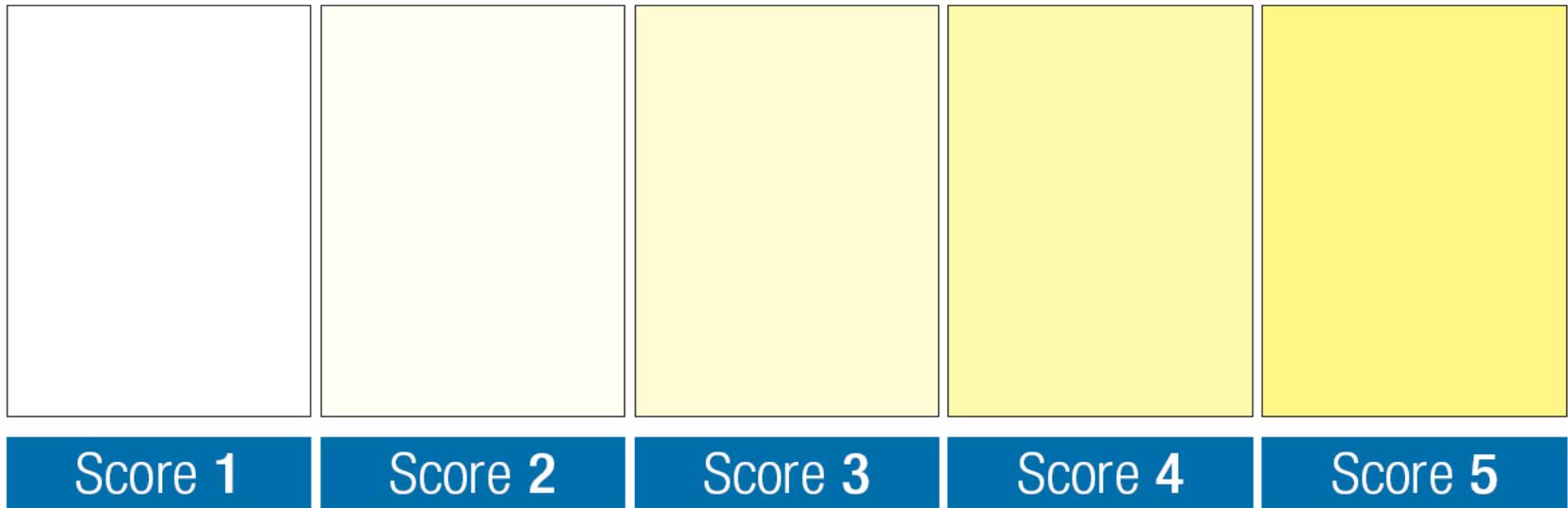
Score 3

Score 4

Score 5

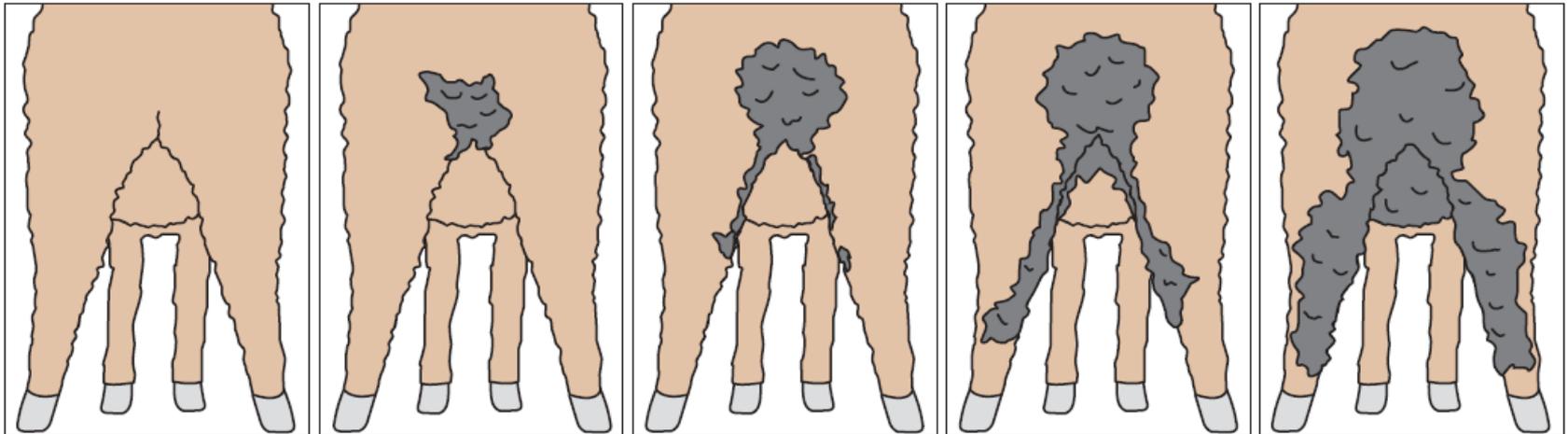
Wool colour

Wool colour



D a g s

Dag



Score 1

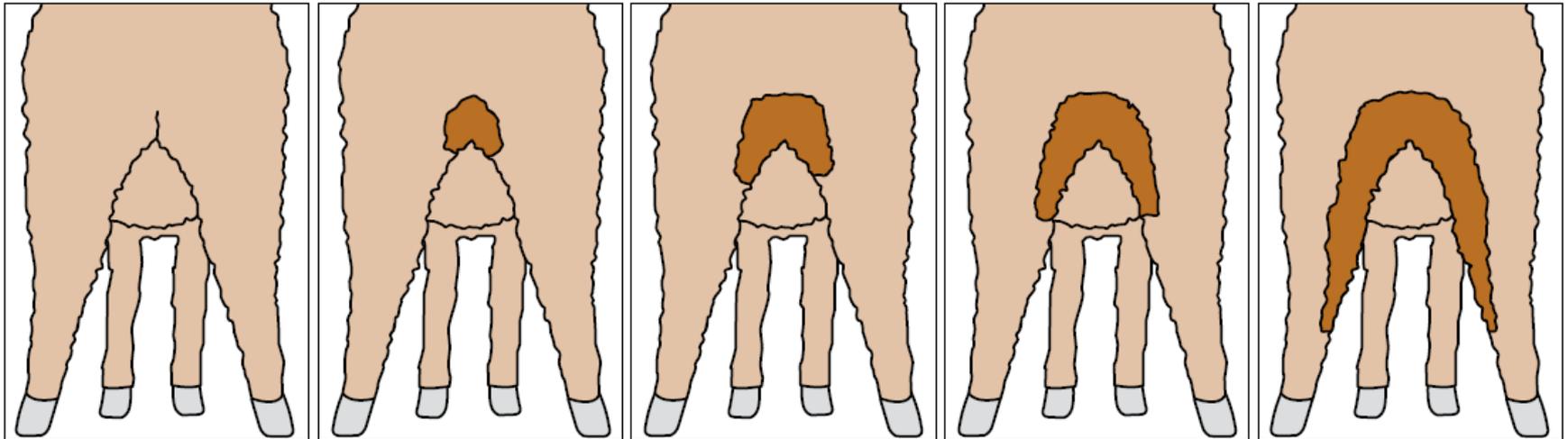
Score 2

Score 3

Score 4

Score 5

U r i n e s t a i n



Score 1

Score 2

Score 3

Score 4

Score 5

A d d i t i o n a l m e a s u r e m e n t s

- B a r e a r e a a r o u n d a n u s
- P l u c k f a c t o r (S h e d d i n g)
- T a i l b a r e n e s s (m a r k i n g)

Results

Phase I 2006 to 2009

Variation between progeny from screened-in sheep

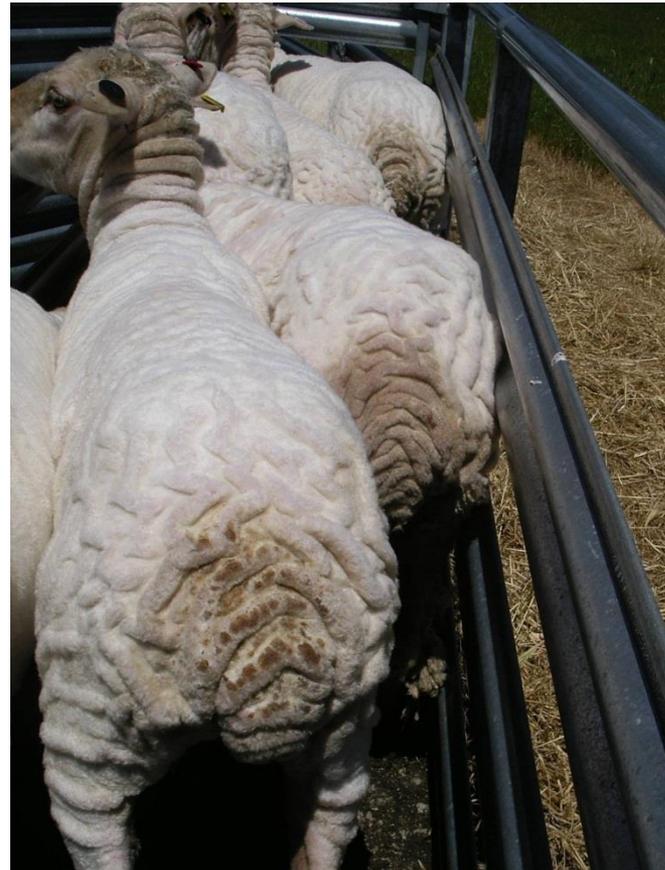


Progeny of screened-in sheep

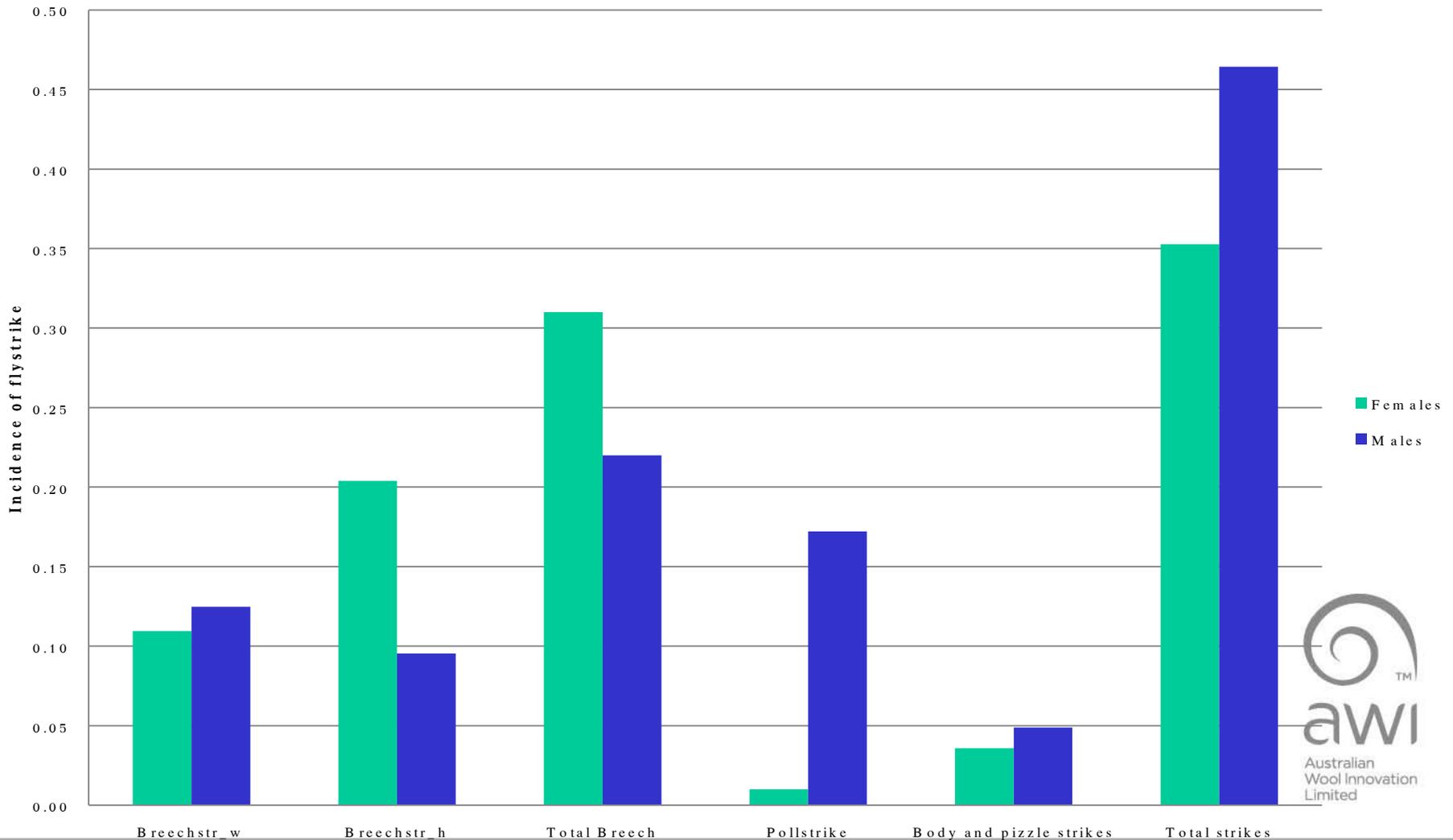
Intense selection



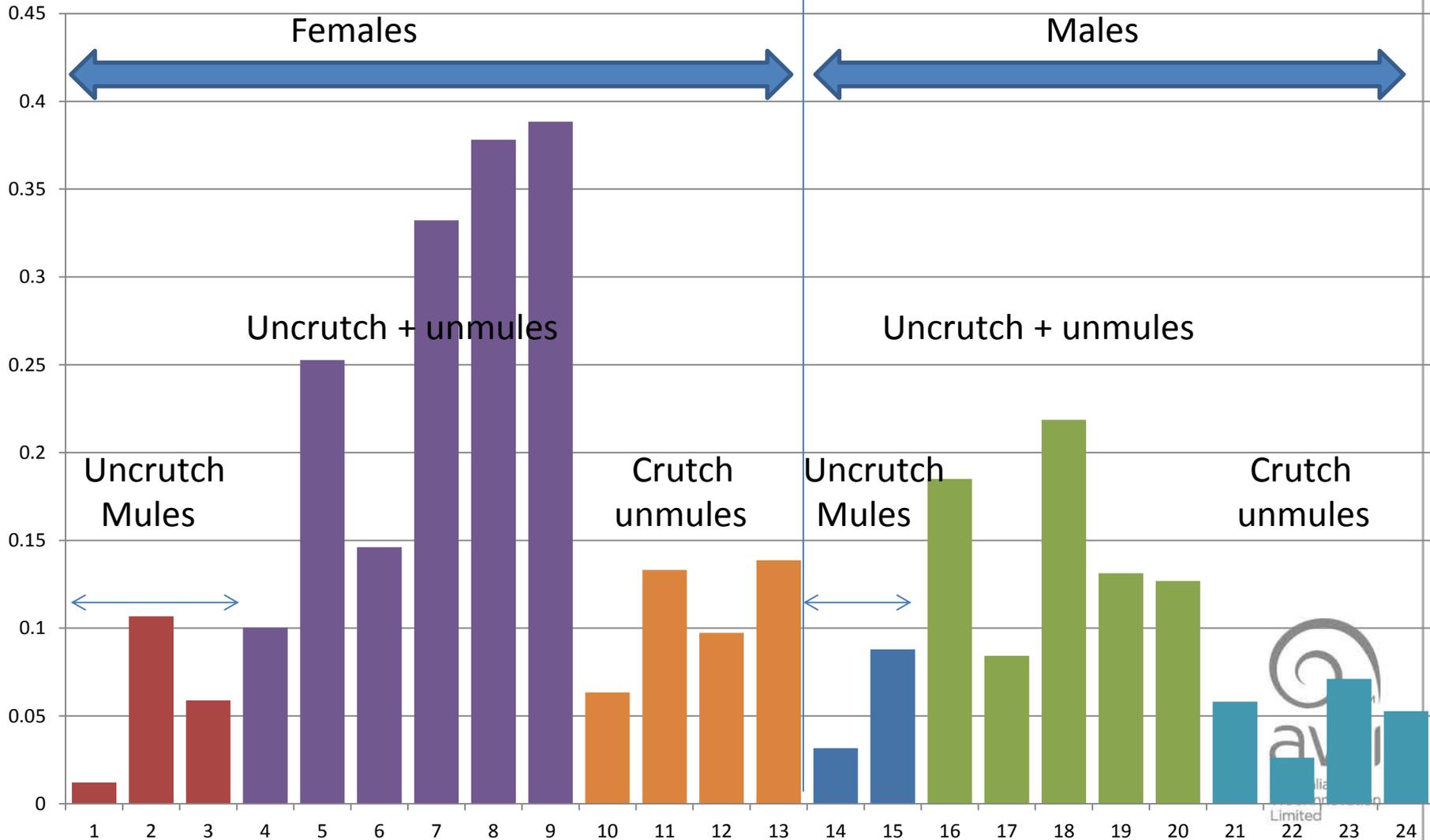
Control



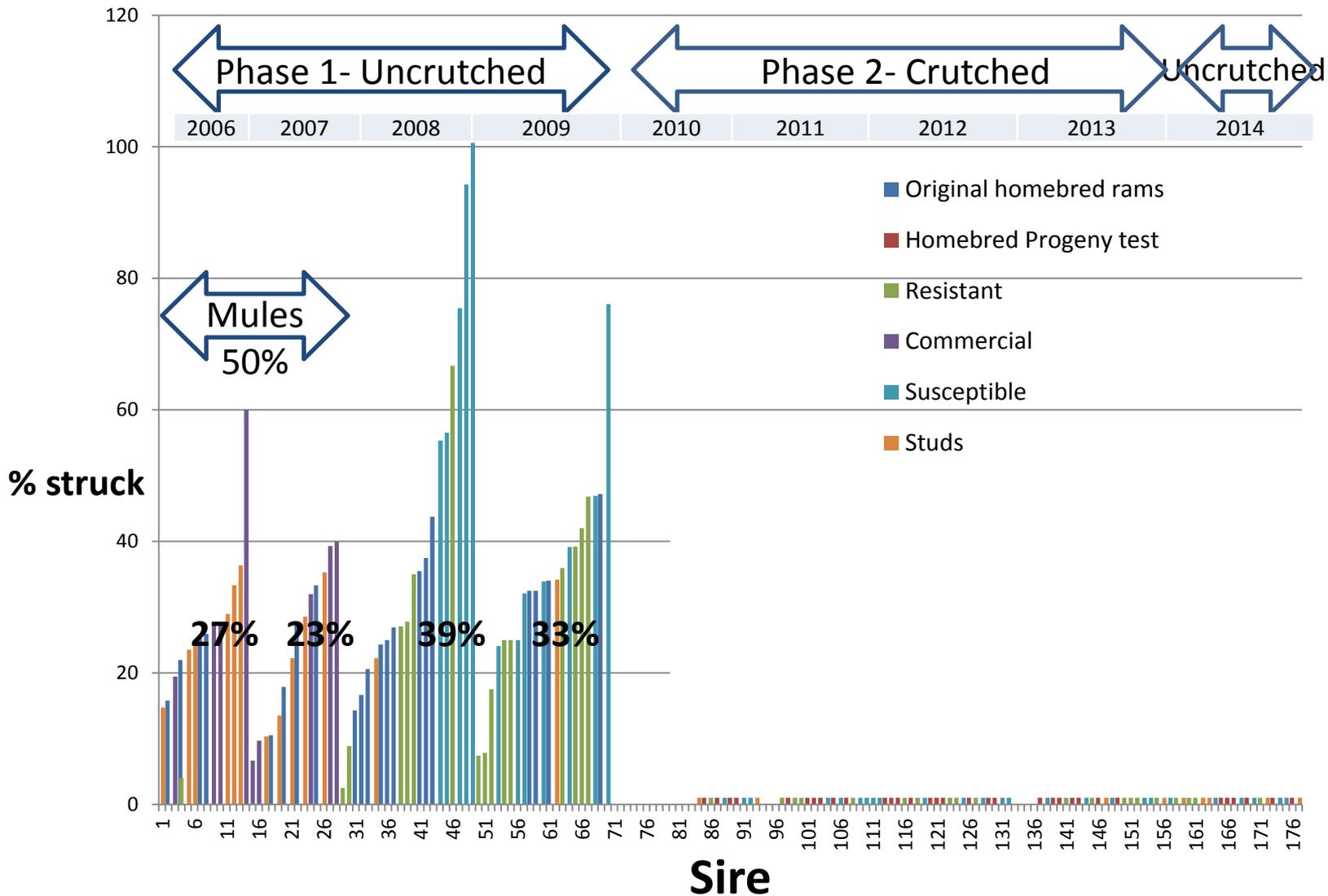
Incidence of flystrike over 5 years in un-mulesed and un-crutched sheep



Differences in breech strike between groups in different years



Differences in breech strike between sire progeny groups – Phase 1



Inheritance of breech strike in un-crutched sheep – Phase I

Trait	V_p	h^2	se
Breech_Total	0.73	0.51	0.10
Breechstr_W	0.55	0.57	0.13
Breechstr_H	0.58	0.57	0.16



Breech strike very heritable in un-crutched sheep

Relationship between weaning and hogget

$$r_g = 0.44$$

Direct selection is not an option

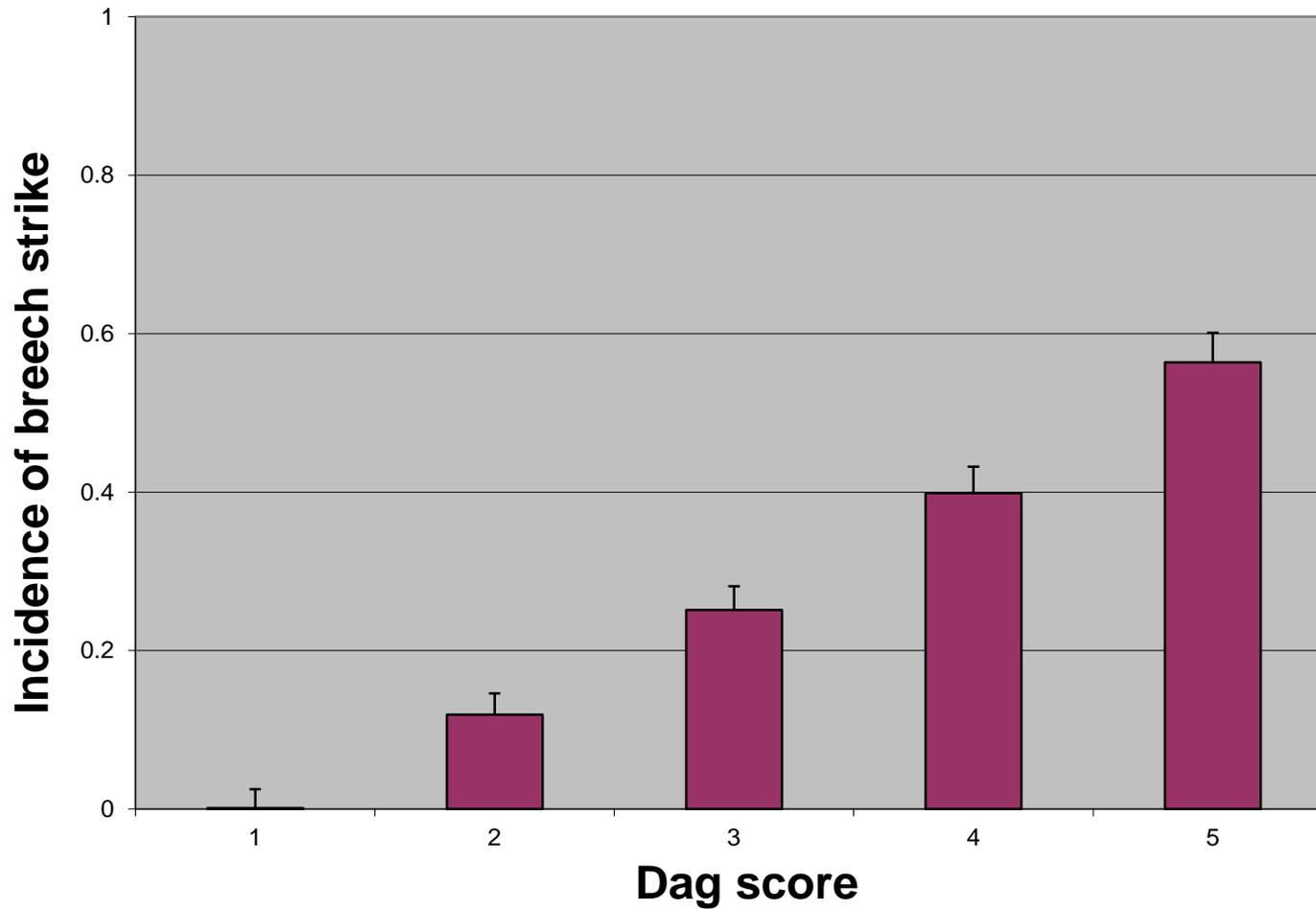
- Animals have to be challenged.
- A reasonable proportion (>0.30) must be struck
- It is painful
- Phenotyping is very labour intensive and therefore expensive
- Challenge to commercial animals – economic loss



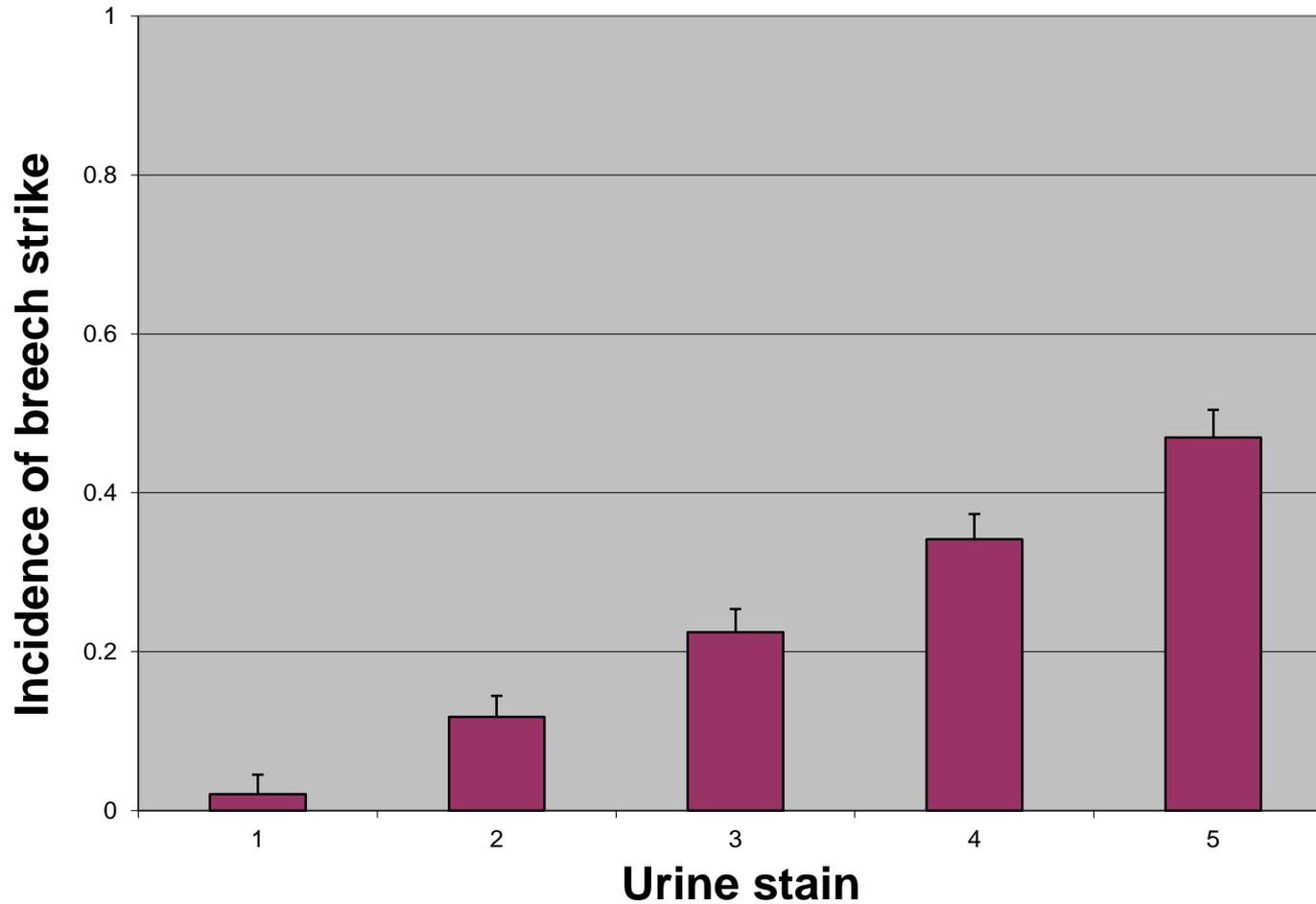
Important to find indirect selection criteria

Winter rainfall region
Indicator traits for Phase I
Un-crutched and un-mulesed

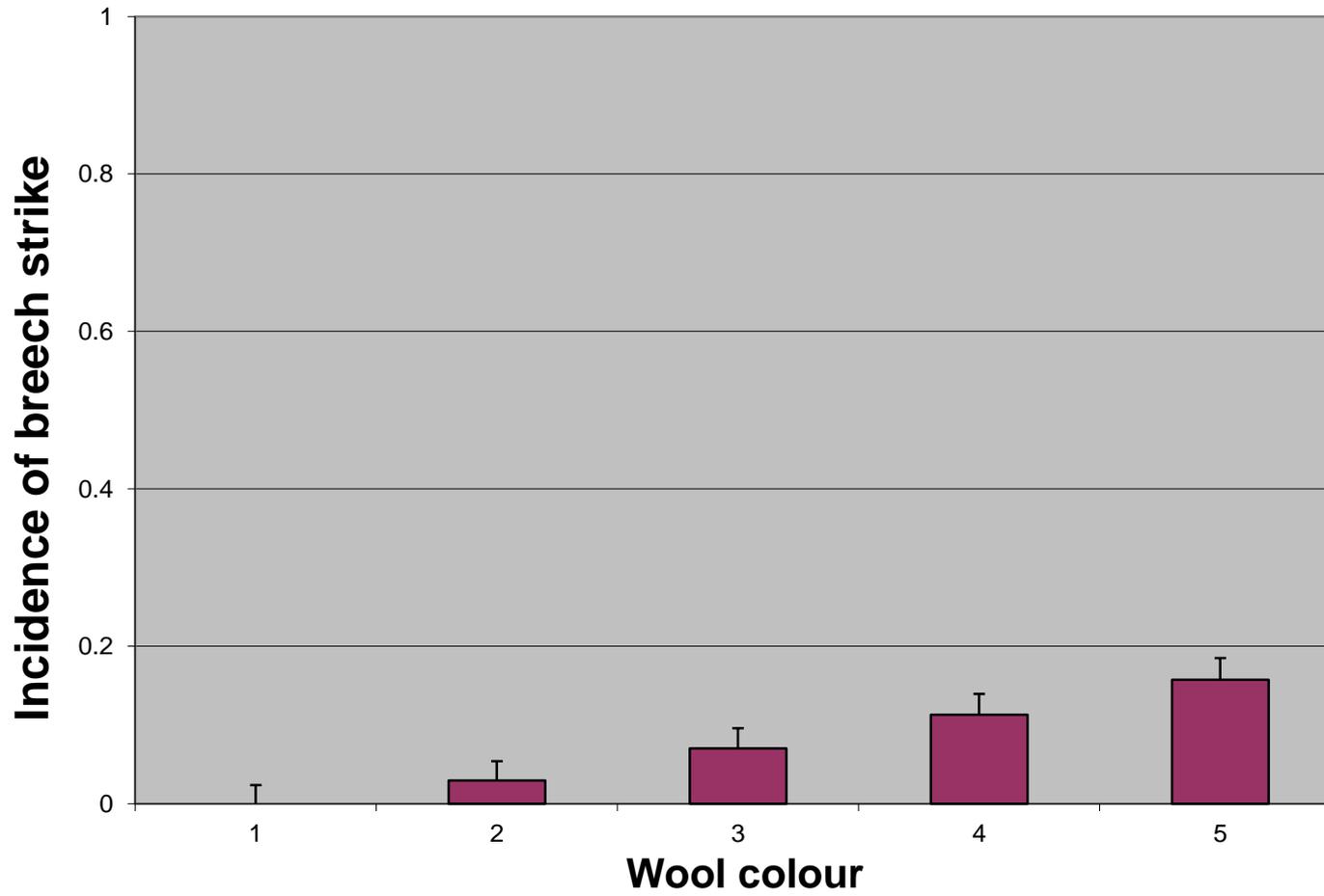
Dags at weaning



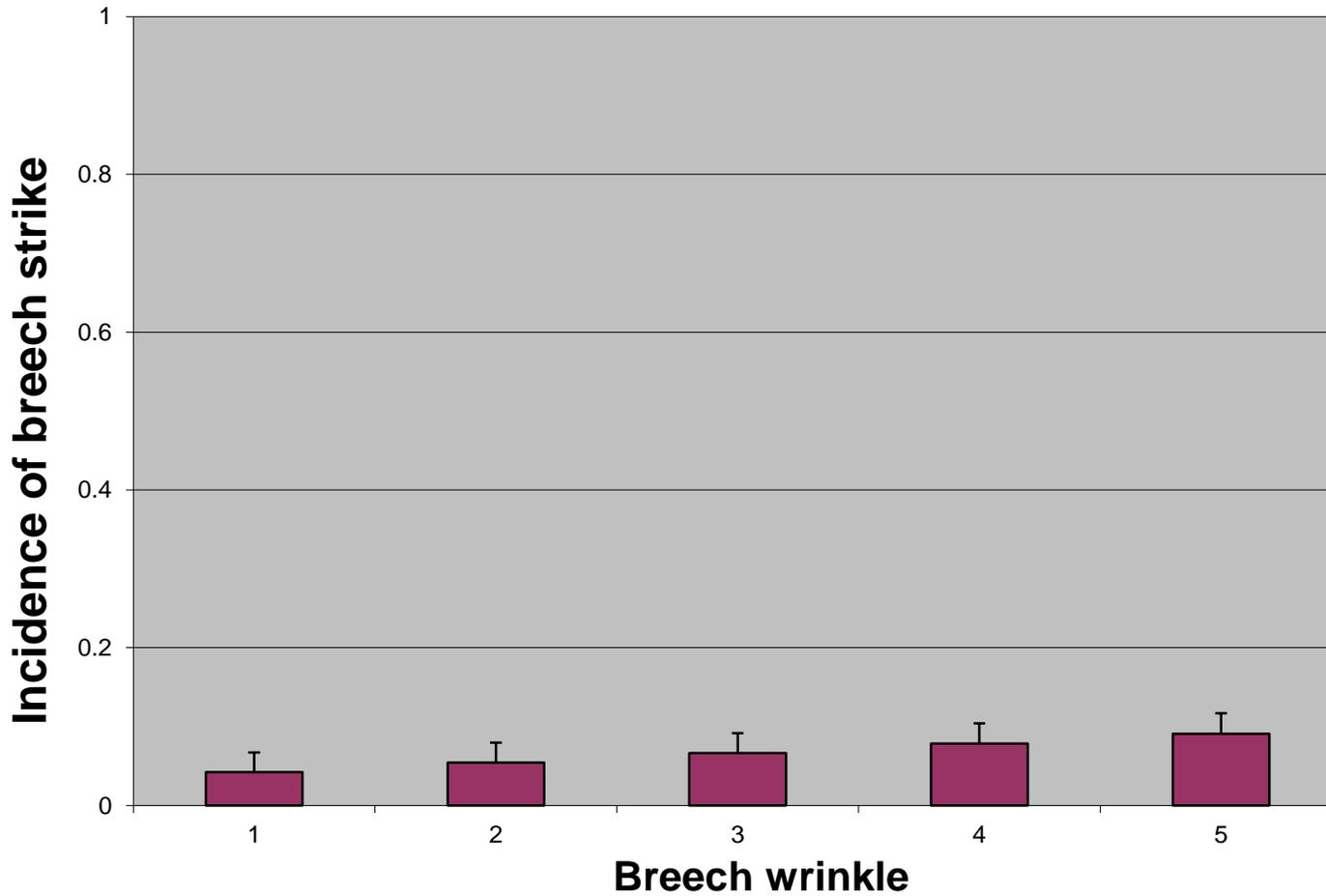
Urine stain at weaning



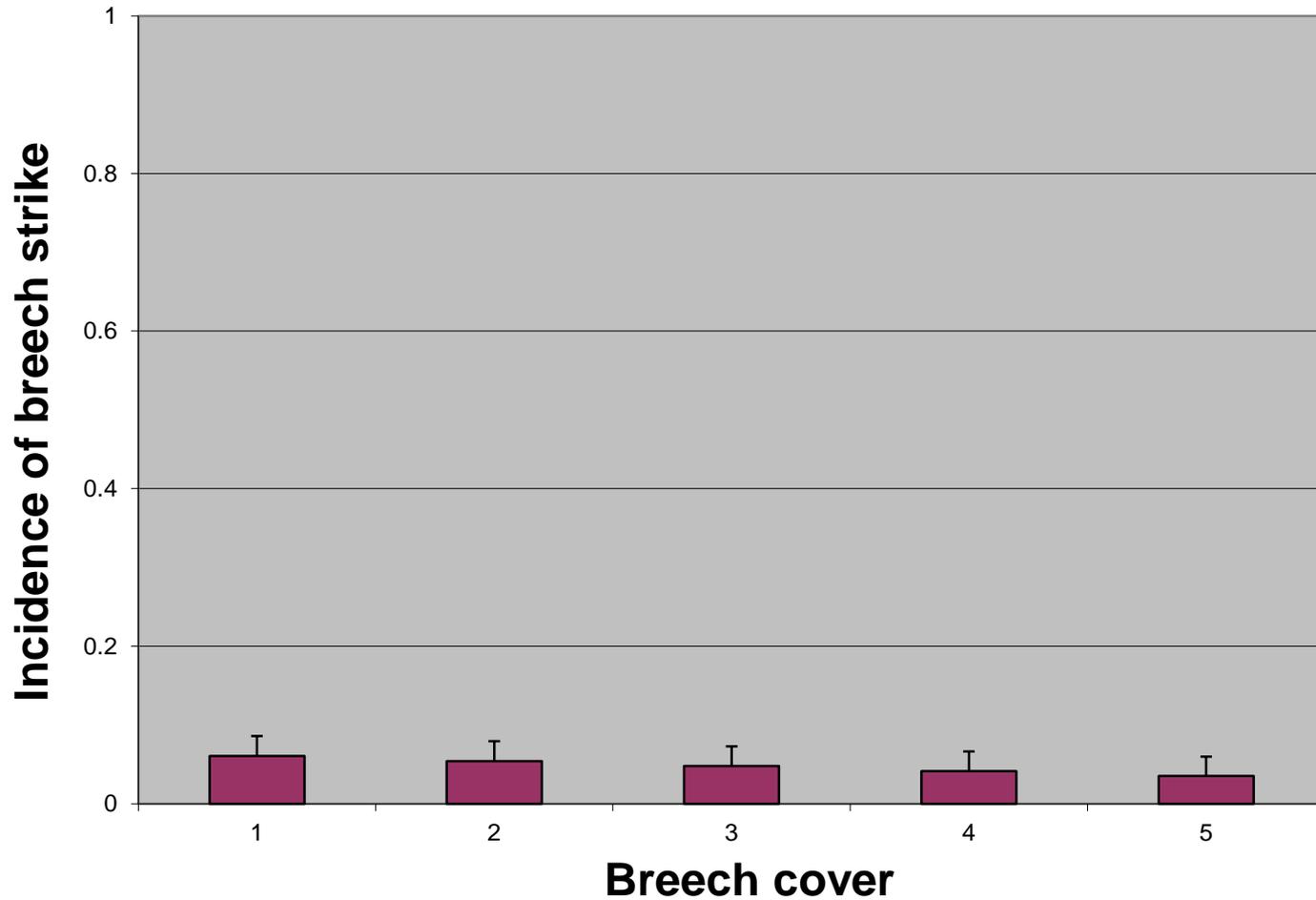
Wool colour at weaning



Breech wrinkle at weaning

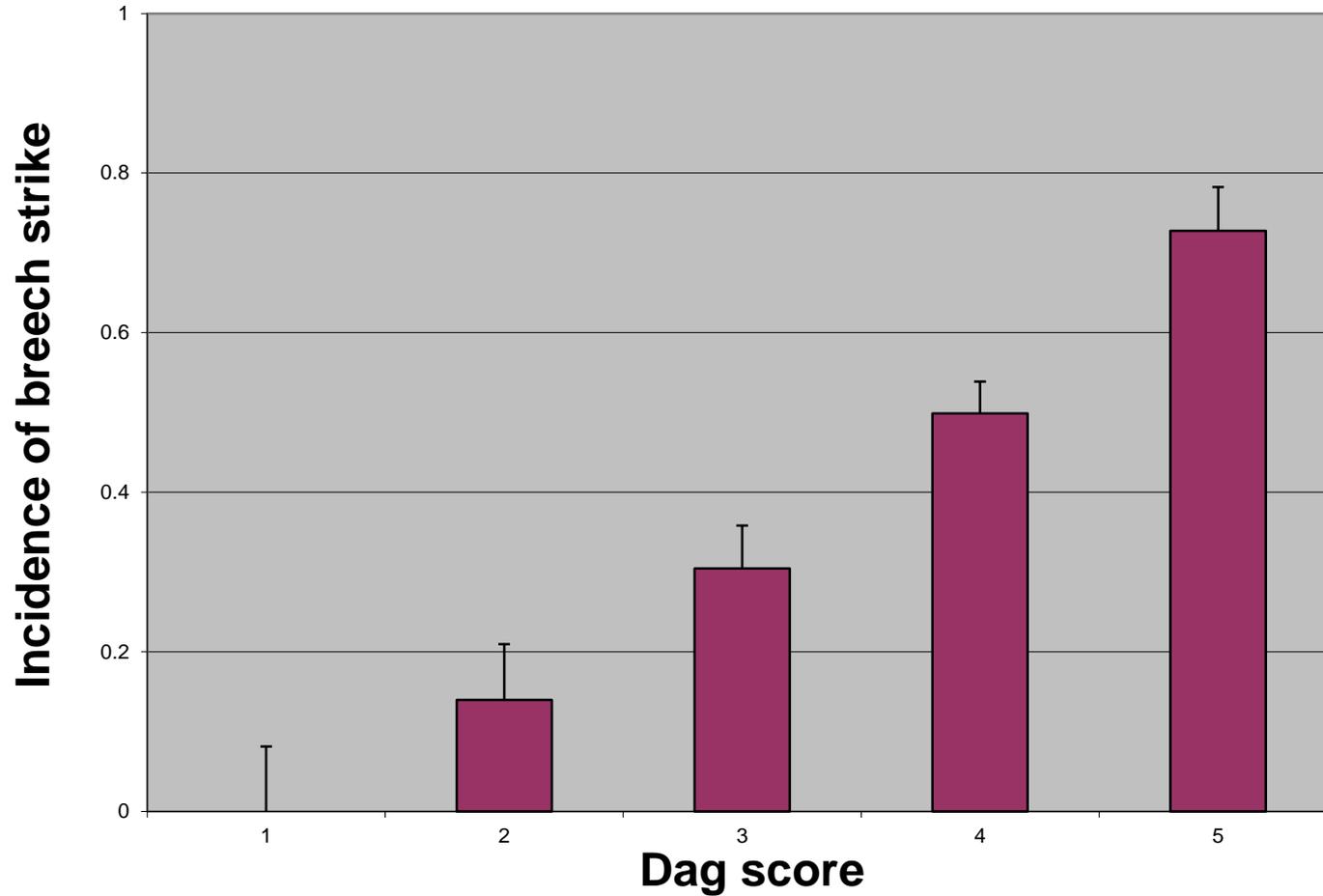


Breech cover at weaning

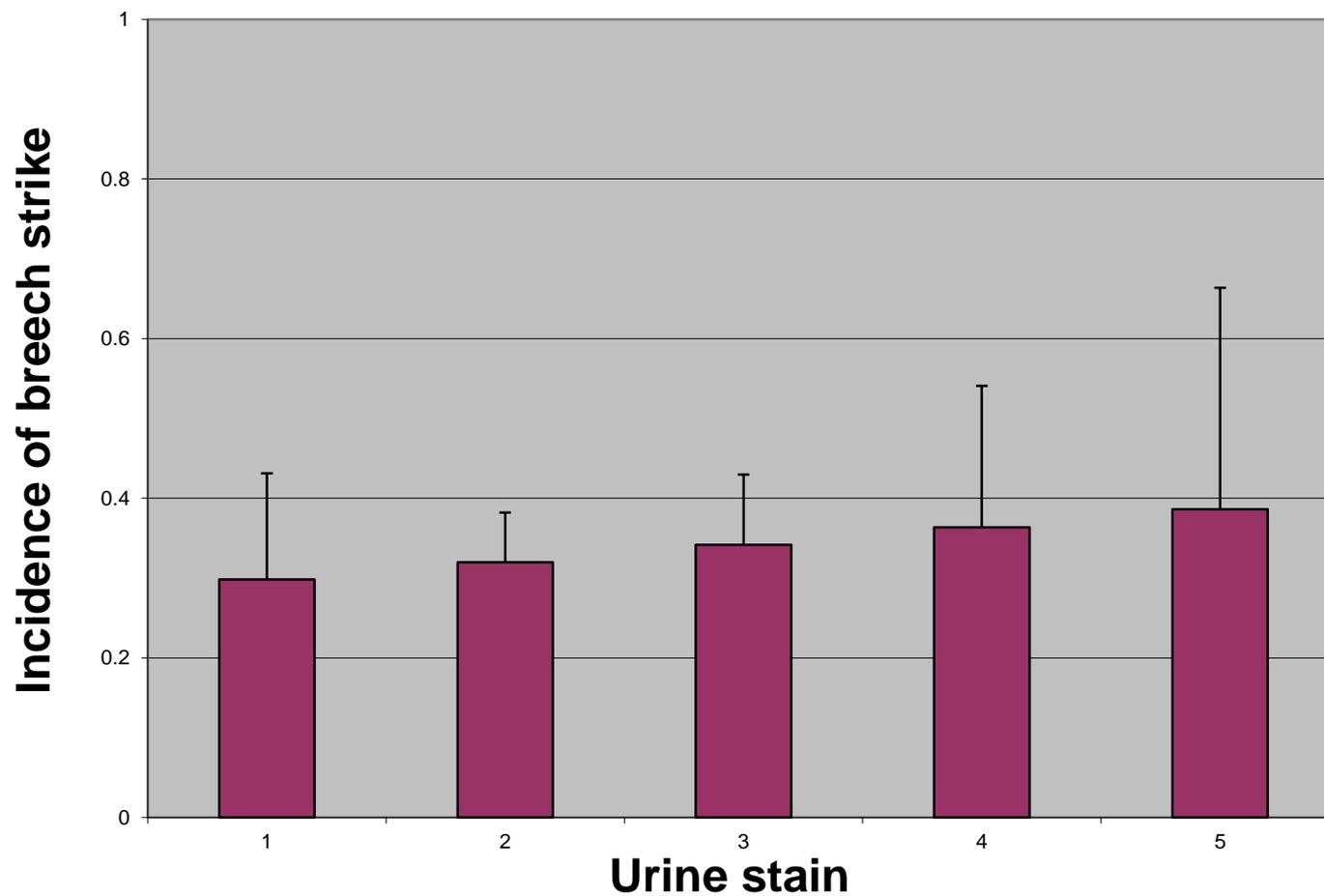


Indicator traits at hogget age

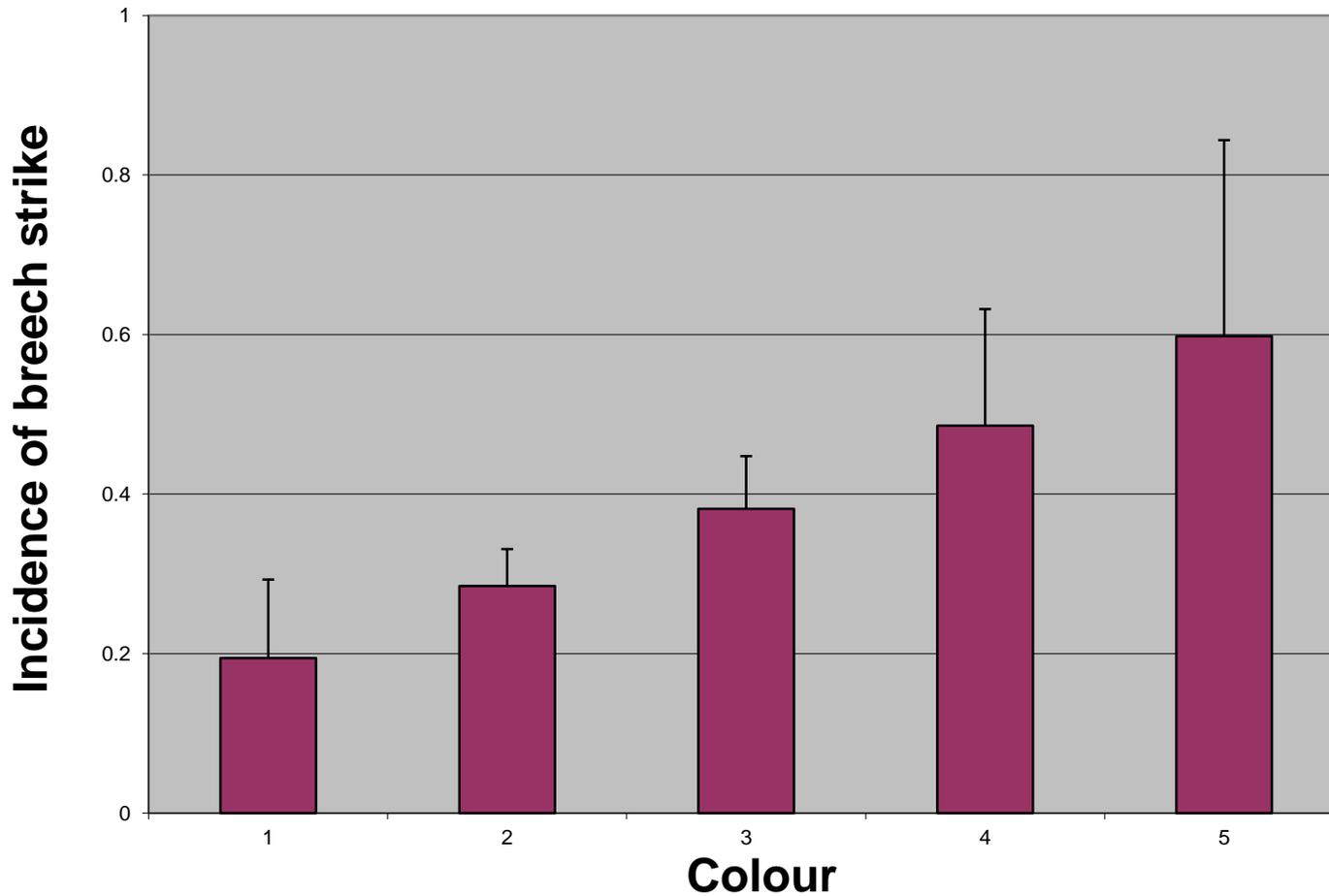
Dags at hogget age



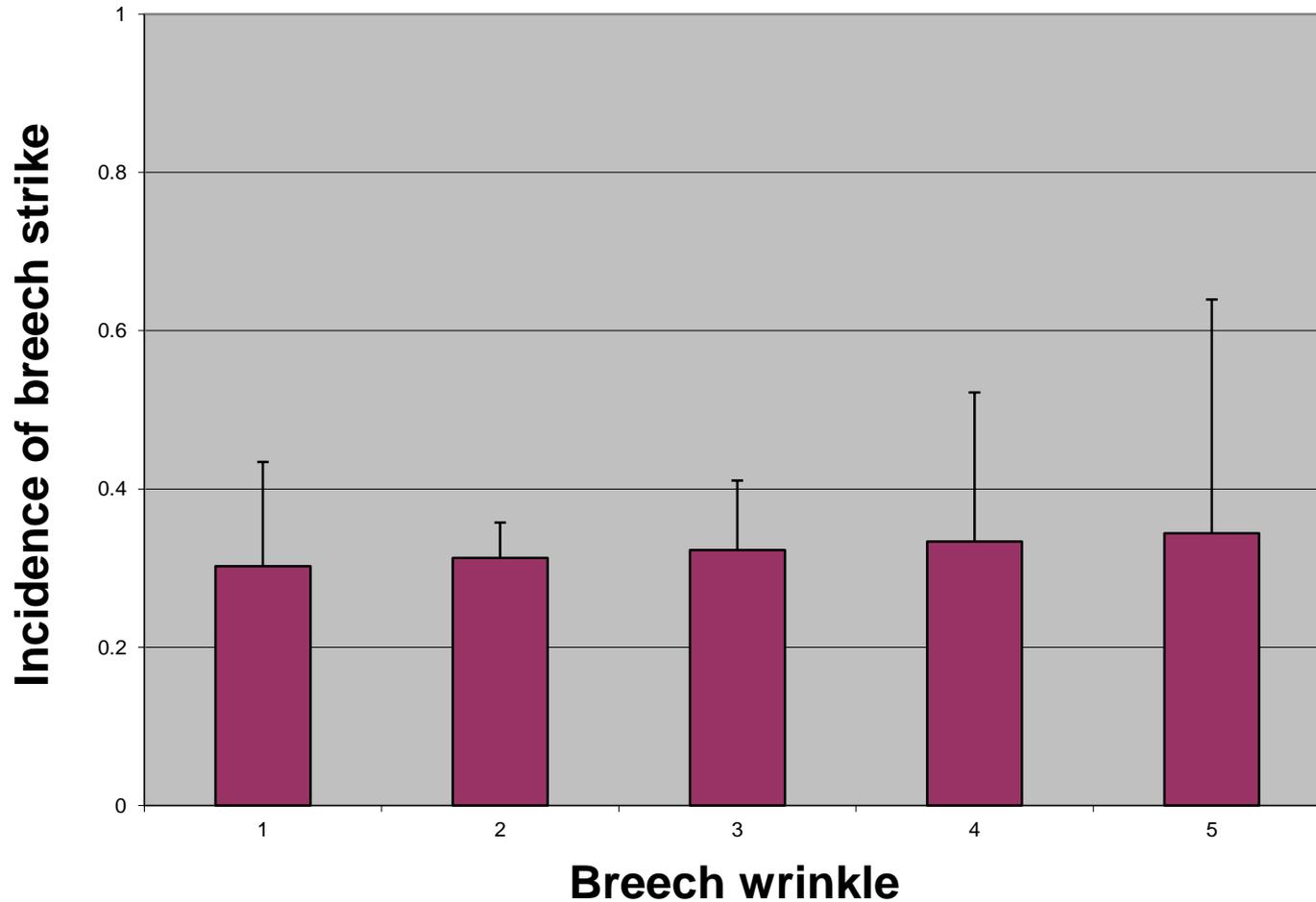
Urine stain at hogget age



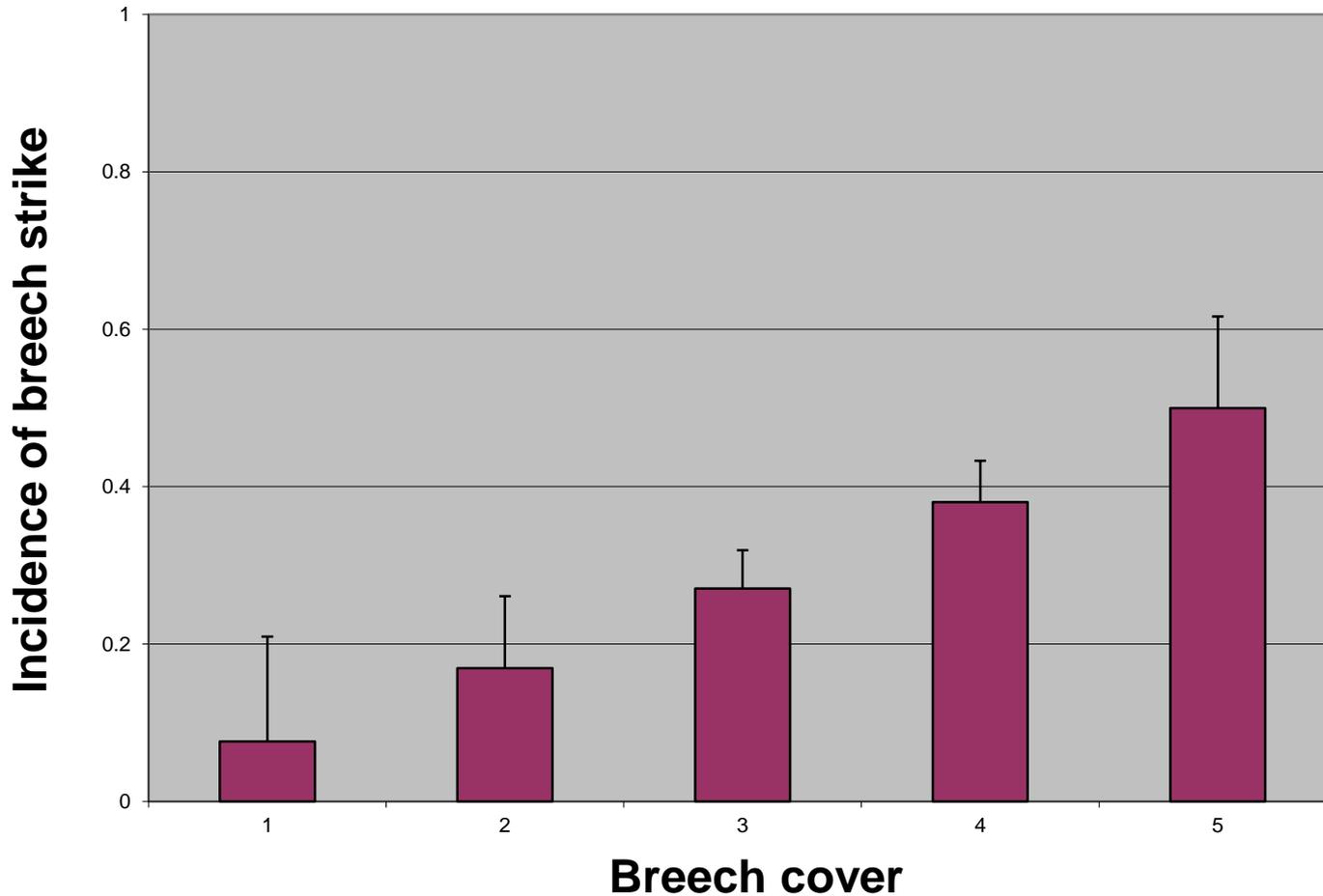
Wool colour at hogget age



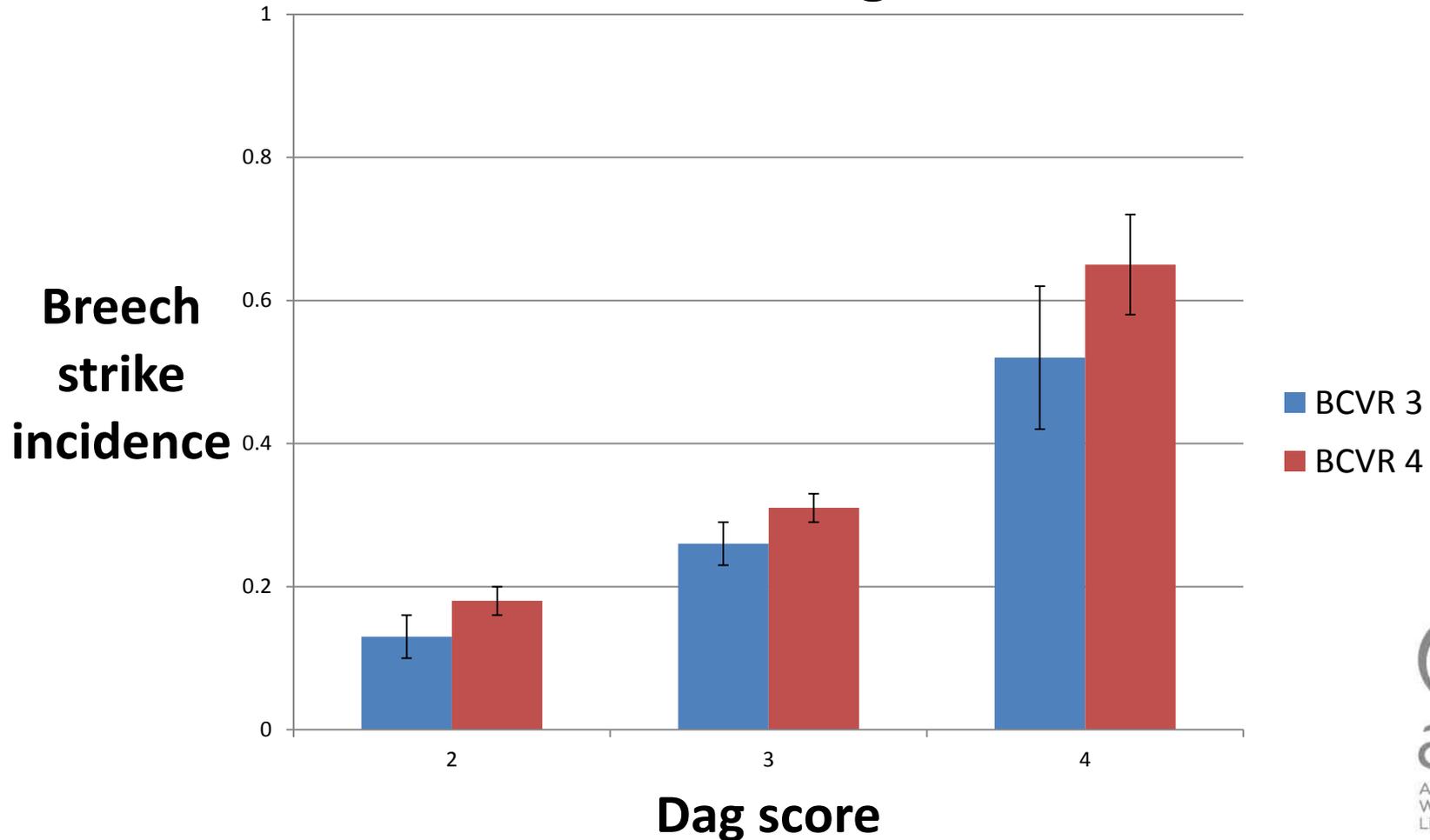
Breech wrinkle at hogget age



Breech cover at hogget age



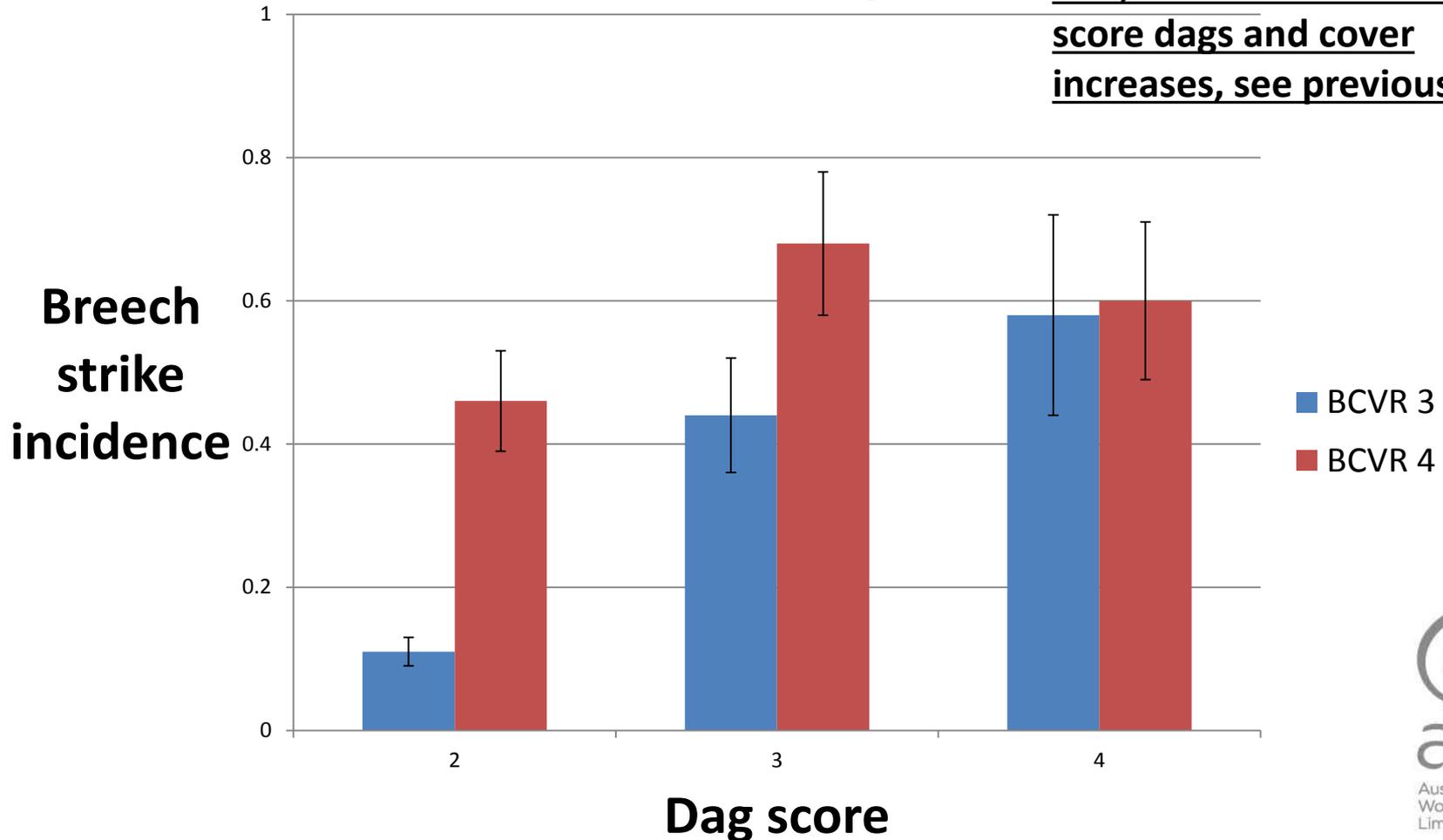
Incidence of breech strike within breech wrinkle score = 1 Winter rainfall region



Incidence of breech strike within breech wrinkle score = 2

Winter rainfall region

As wrinkle increases from 1 to 2; strike due to 2 and 3 score dags and cover increases, see previous slide



Important indicator traits in un-crutched AND un-mulesed sheep on a flock basis

Weaning

Dags

Urine stain

Hogget

Dags

Wool colour

Breech cover

(Wrinkles)

Wrinkles less important in this Phase I

High dags

High % Plain sheep in this flock

Will these traits on a flock basis also be effective to select animals on?

Effective indicators for selection with no crutching

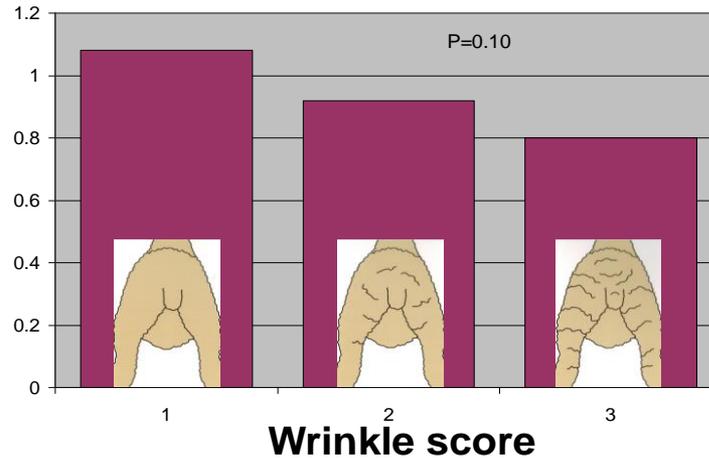
Indirect indicator trait	Heritability	r_g	Correlated Response Relative to Direct Response
Dags pre-hogget shearing	0.37	0.81	0.60
Urine stain at weaning	0.55	0.54	0.59
Dags in spring pre-shearing	0.37	0.77	0.57
Neck wrinkles at marking	0.62	0.38	0.47
Neck wrinkles at post-hogget shearing	0.50	0.46	0.47
Body wrinkle post hogget shearing	0.68	0.34	0.45
Dags post weaning	0.36	0.62	0.45
Dag dry matter content at yearling age	0.63	0.34	0.44
Dags at yearling age	0.63	0.34	0.44
Face cover at weaning	0.79	0.28	0.44
Dag dry matter content pre hogget shearing	0.24	0.85	0.41
Face cover at yearling age	0.73	0.27	0.39
Breech wrinkle at yearling age	0.73	0.27	0.39
Dag dry matter content in spring	0.25	0.73	0.37
Dags at weaning	0.28	0.64	0.36
Dags at marking	0.34	0.50	0.34
Neck wrinkles post weaner shearing	0.64	0.26	0.34

Key indicator traits for selection in a winter rainfall environment with no crutching

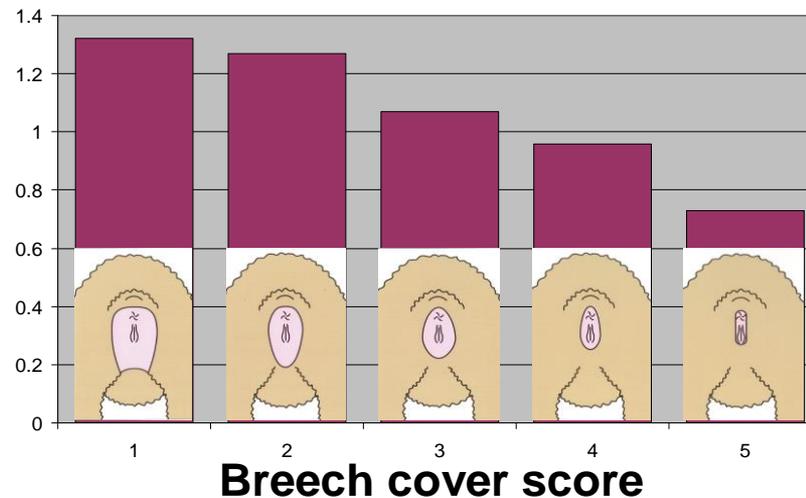
1. Breech strike (early)
2. Dags
3. Urine stain
4. Skin wrinkle
5. Face cover

Effect of indicator traits on number of lambs weaned per ewe joined during phase I

Lambs weaned per ewe joined



Lambs weaned per ewe joined



Phase II

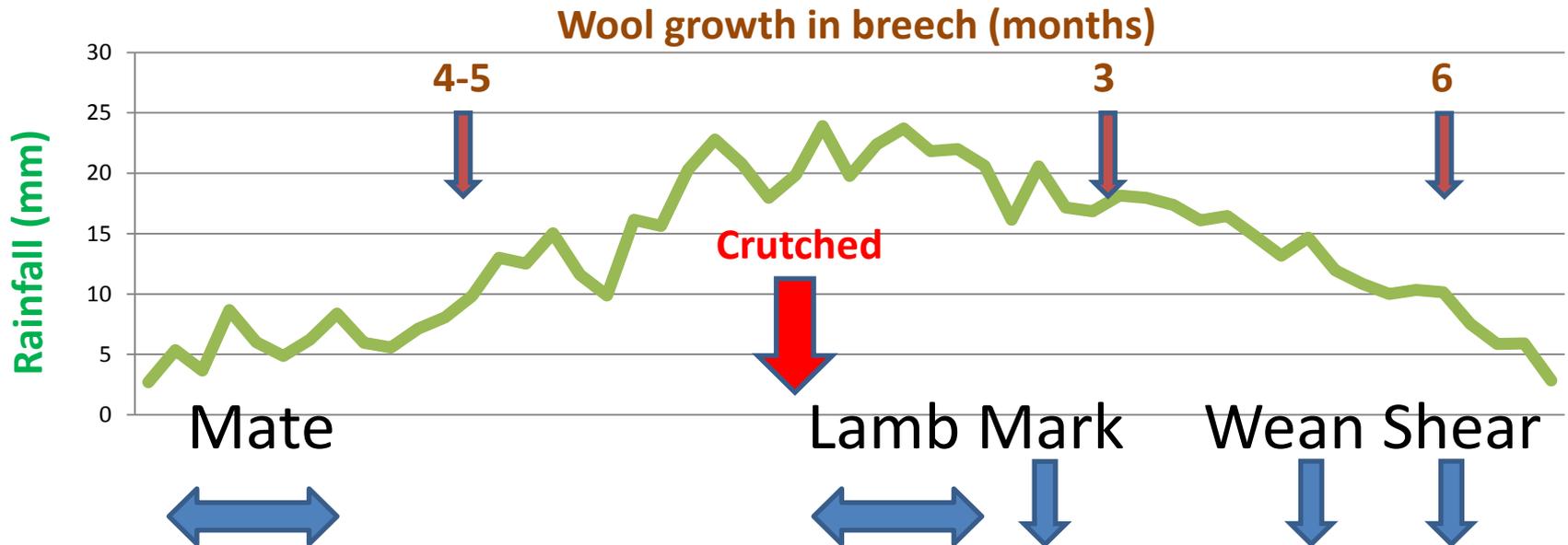
How accurate can we identify genetically resistant individuals where animals are crutched??

Which indicator traits would then be important?

2010 -2013

Mount Barker Research station

Average Rainfall (2000 -2015) and annual events



Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec

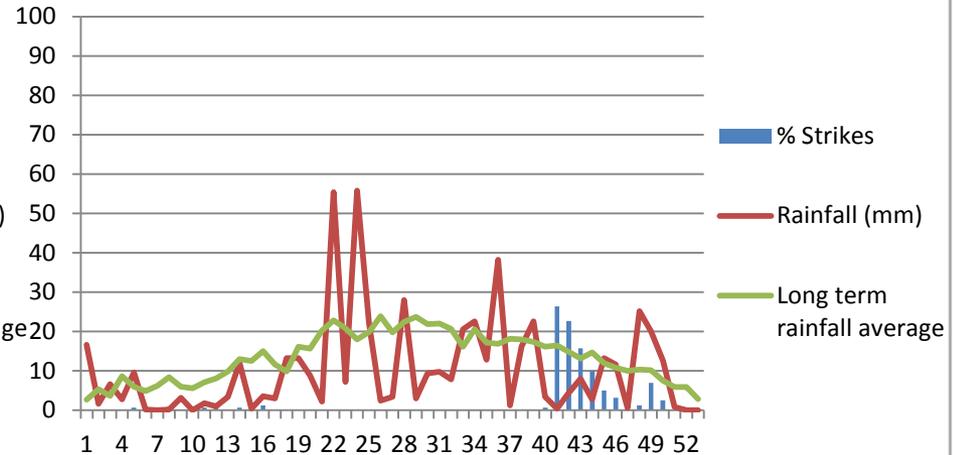
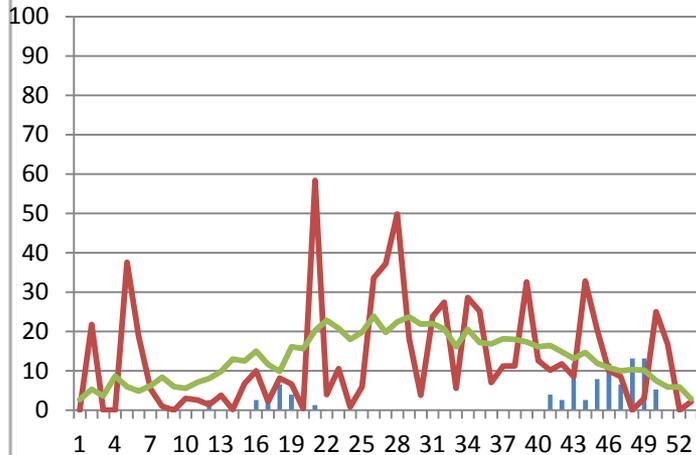
Autumn wool = 4 - 5 months wool
Spring = 9 months wool
Shearing = 12 months wool

Weekly rainfall and flystrike trends

2011 season

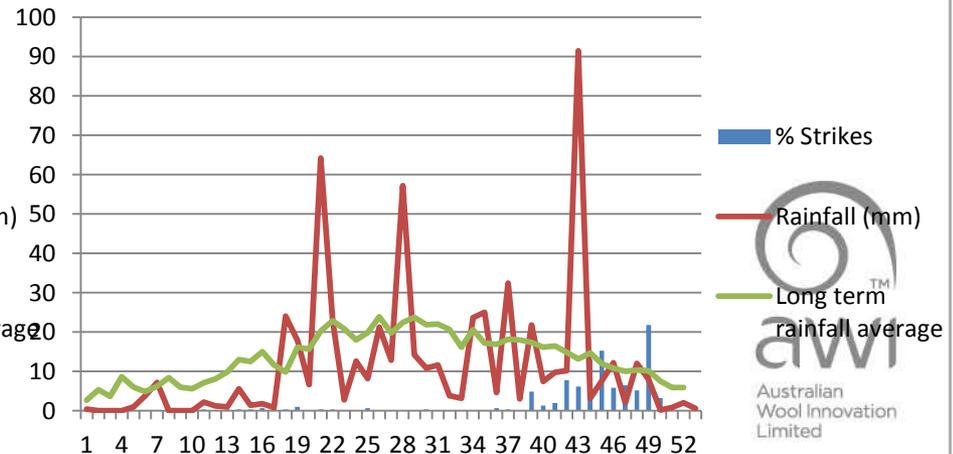
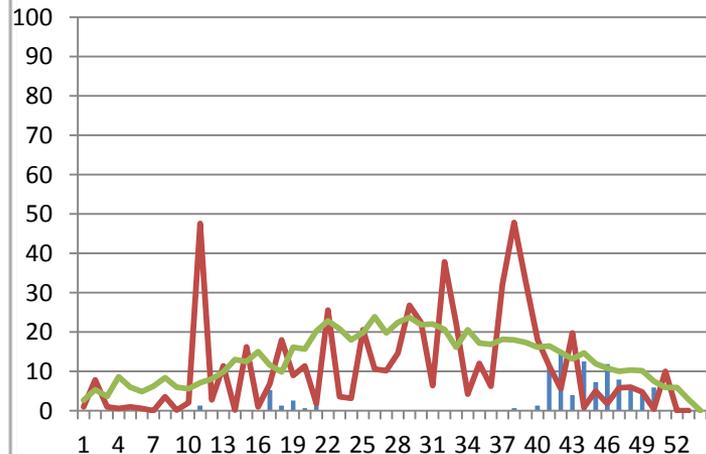
Spring strike dominant

2012 season



2013 season

2014 season



Rams from the resistant vs control lines

Resistant



Control



2012 Drop hoggets in Winter rainfall region

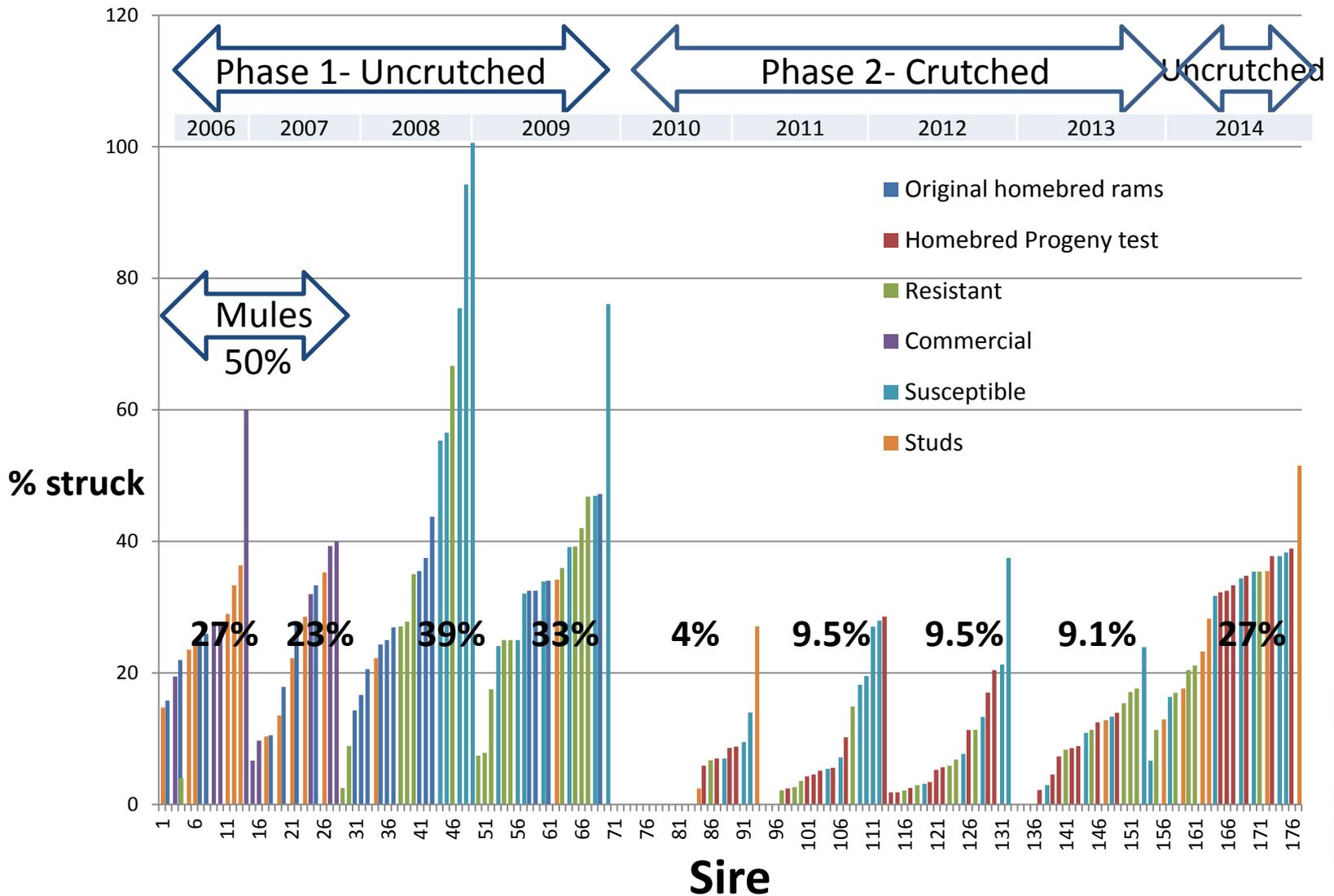
Control



Resistant



Differences in breech strike between sire progeny groups



Inheritance of breech strike in crutched sheep

Trait	V_p	h^2	se
Breech_Total (birth-hogget) <small>2010-2014</small>	0.07	0.12	0.02
Breechstr_W (2010-2014)	0.03	0.10	0.02
Breechstr_W (2006-2014)	0.07	0.21	0.03
Breechstr_H (2010-2014)	0.07	0.11	0.02

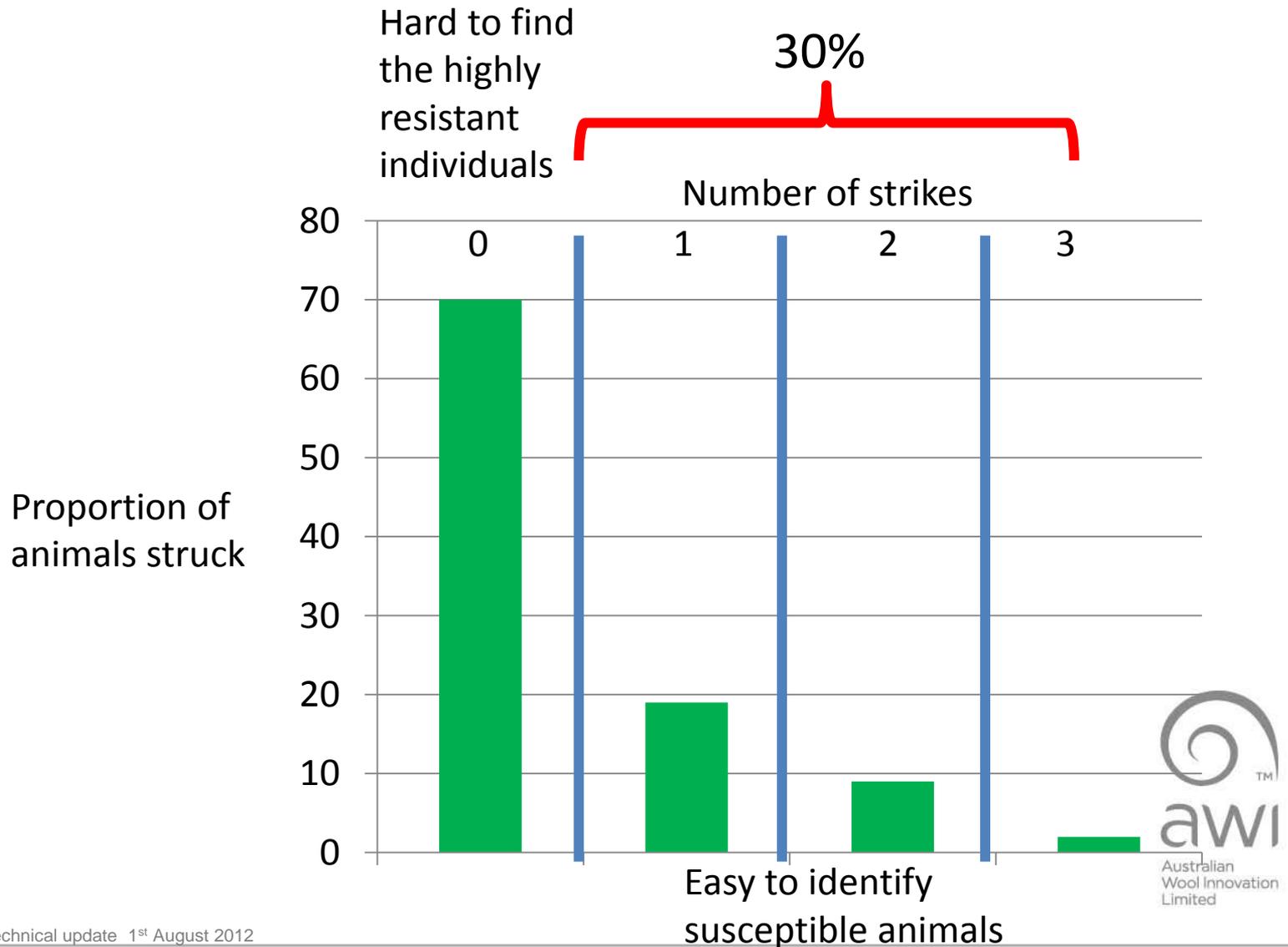


Breech strike has a low heritability when crutched

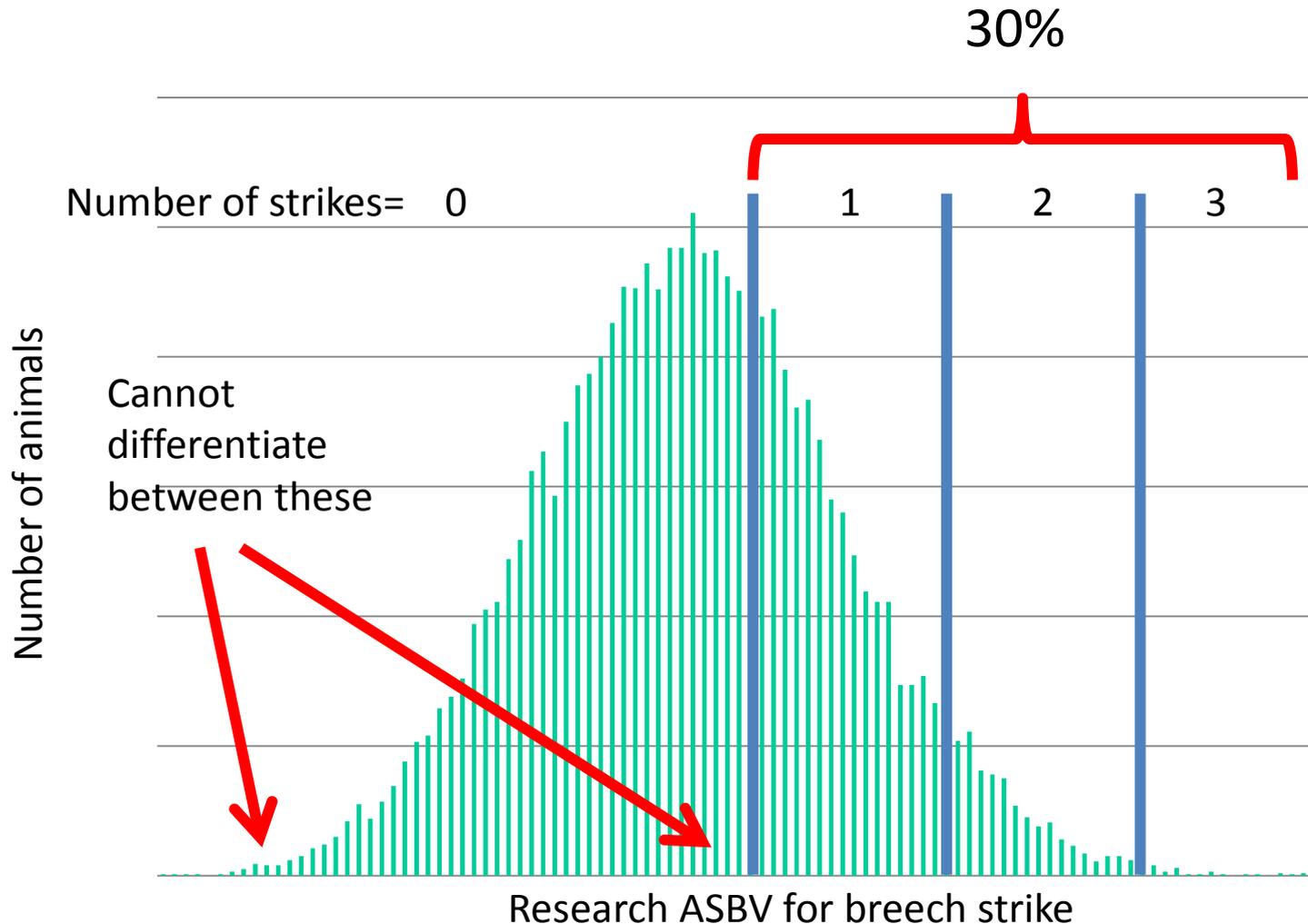
Relationship between weaning and hogget

$$r_g = 0.26 \text{ (SE=0.41)}$$

Breech strike is a threshold trait, either no or yes

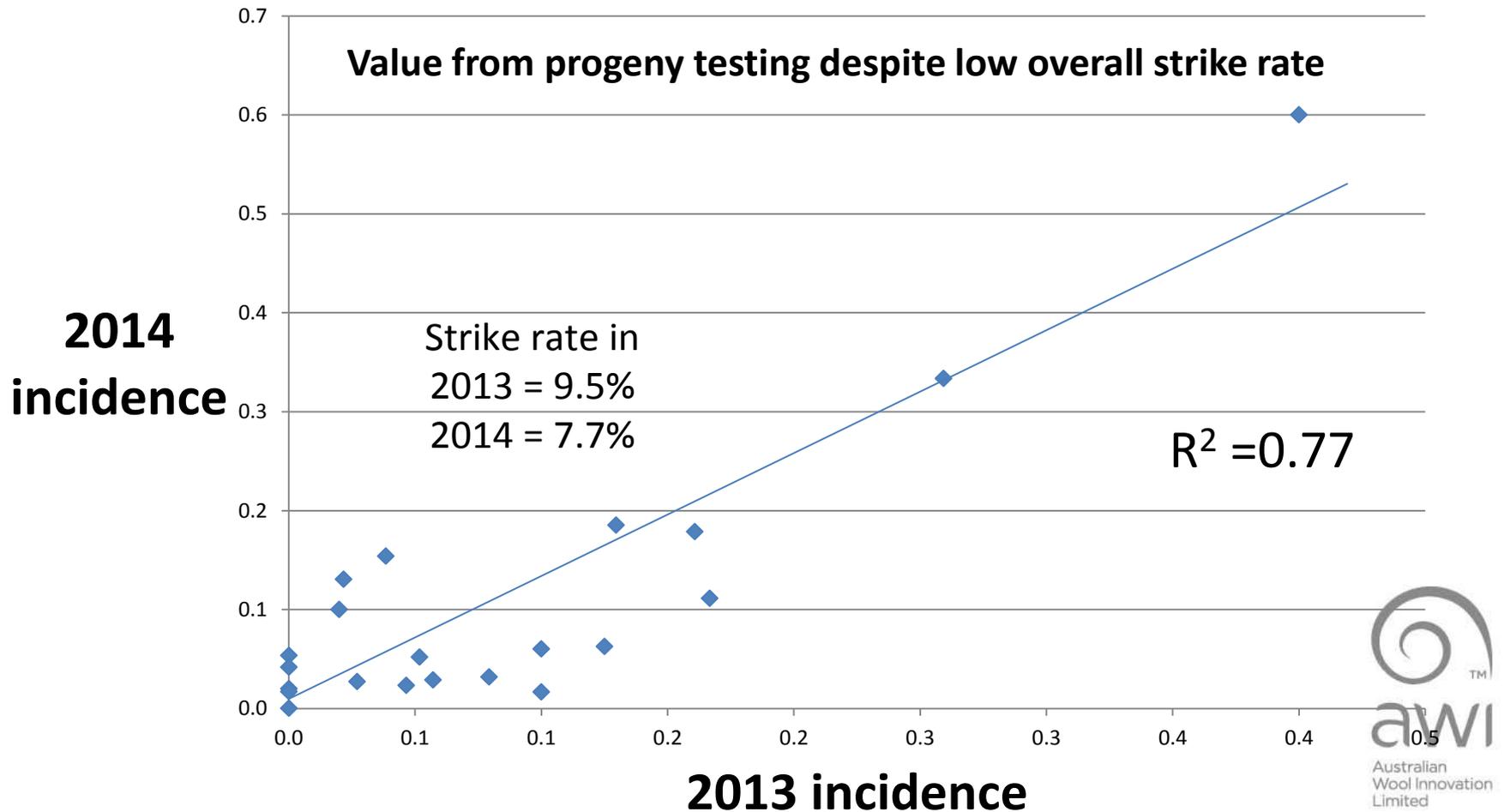


- **Breech strike is a threshold trait but with an underlying continuous distribution**



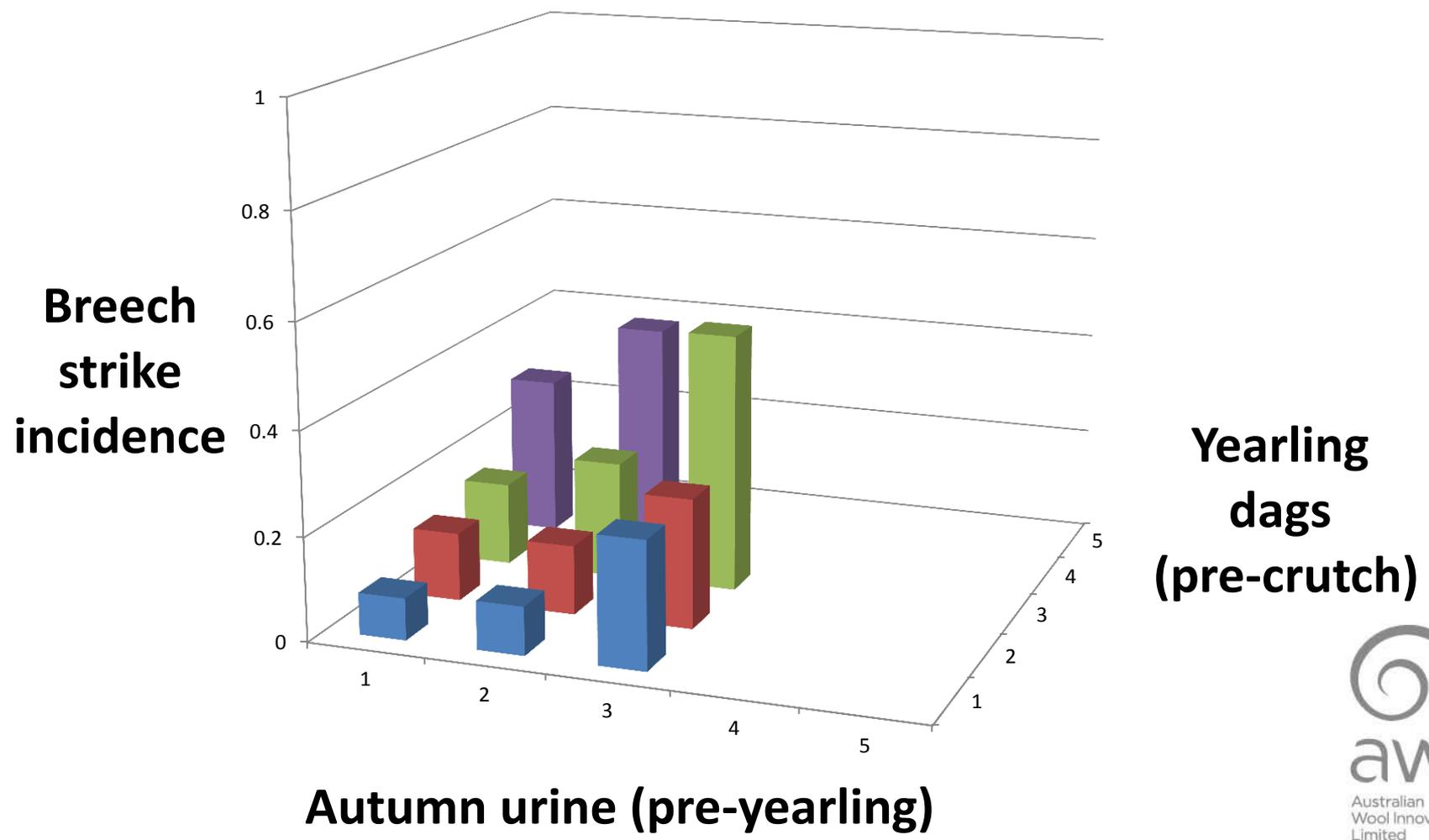
How accurate is progeny testing under an unmulesed and a crutching regime??

Average breech strike of the 2012 sire progeny groups in 2014 regressed against their average in their 2013 season

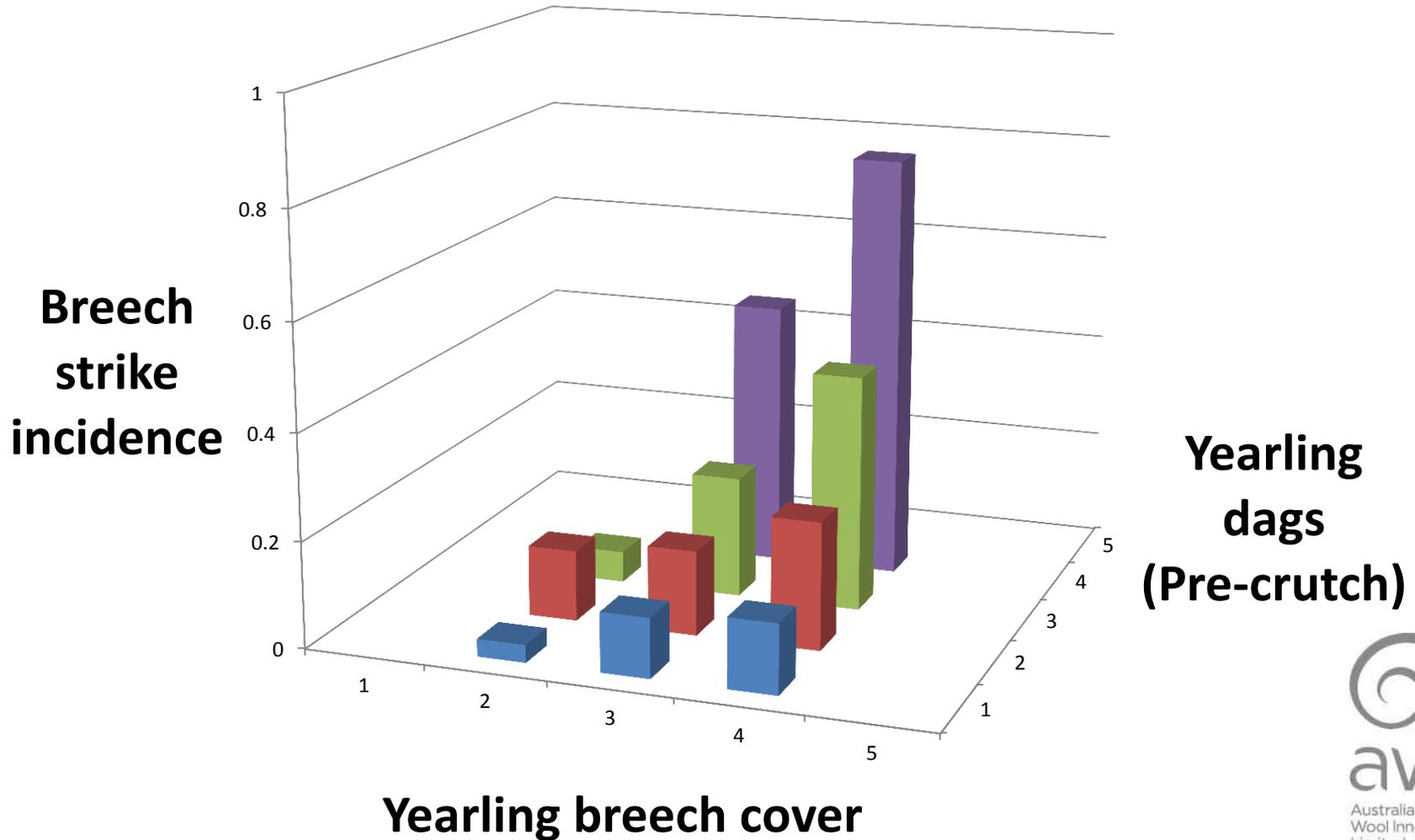


Which indicator traits are important on a flock basis where animals are un-mulesed and crutched?

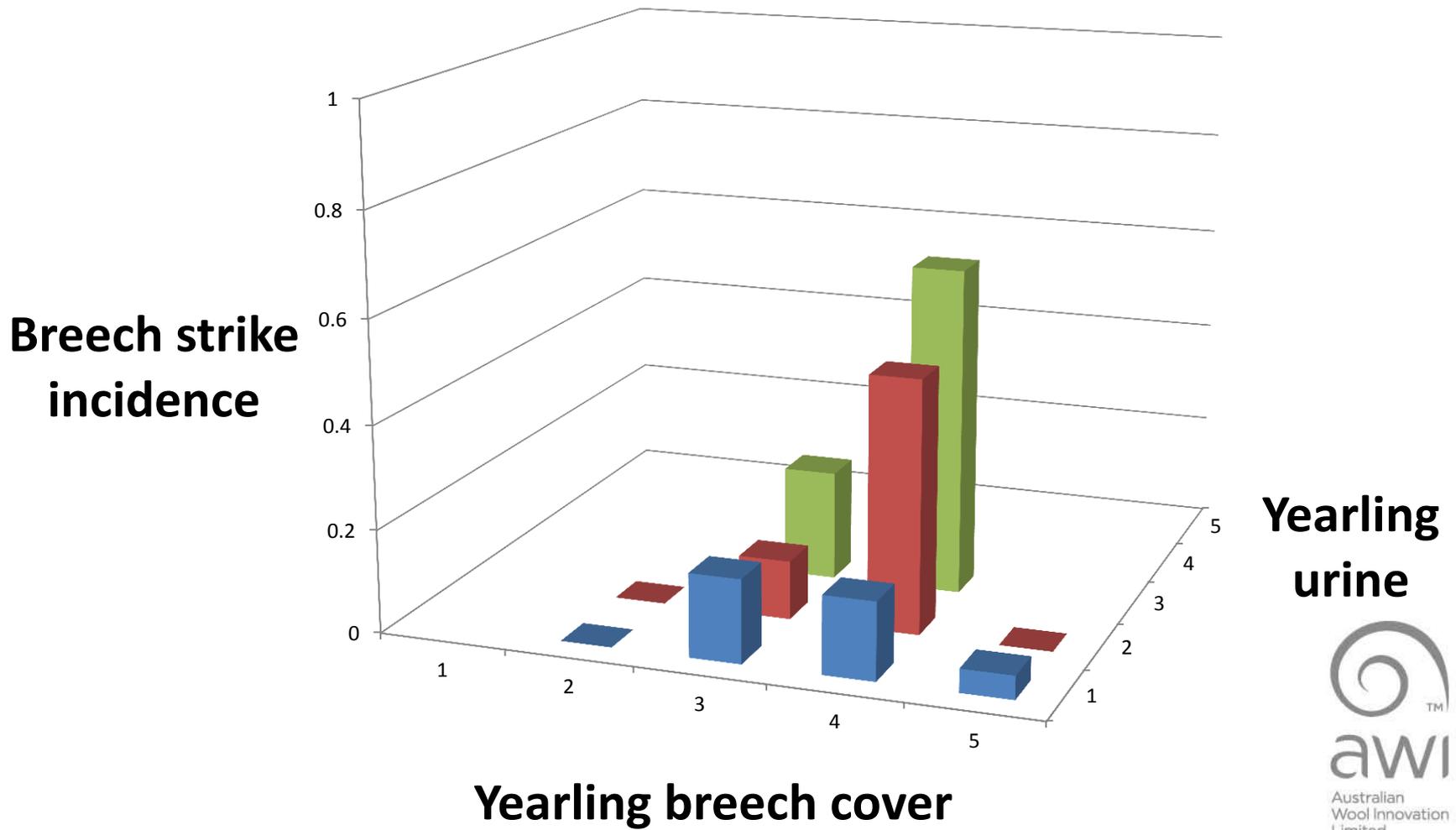
Breech strike incidence from birth to hogget shearing in females that were crutched



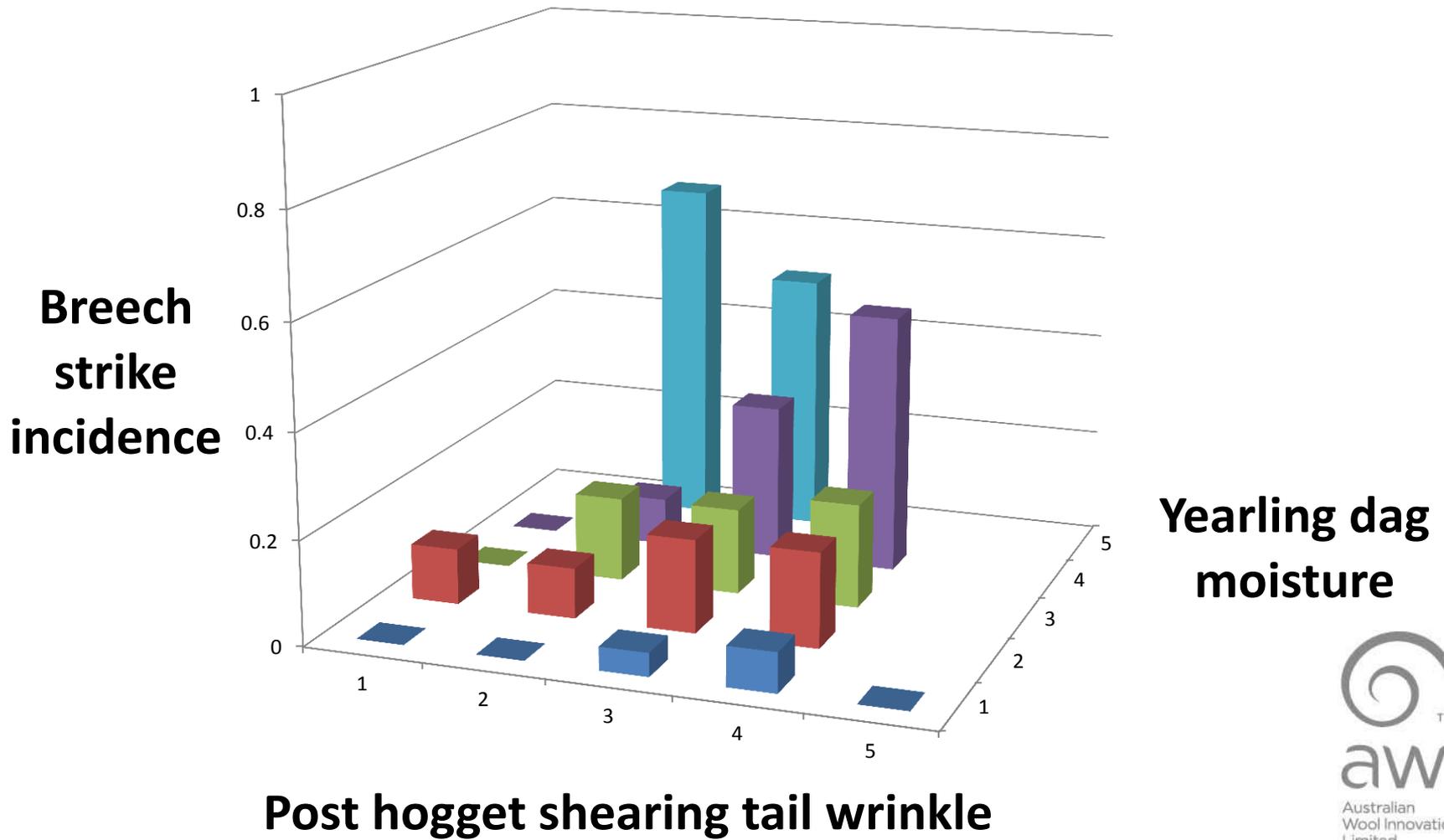
Breech strike incidence from birth to hogget shearing in females that were crutched



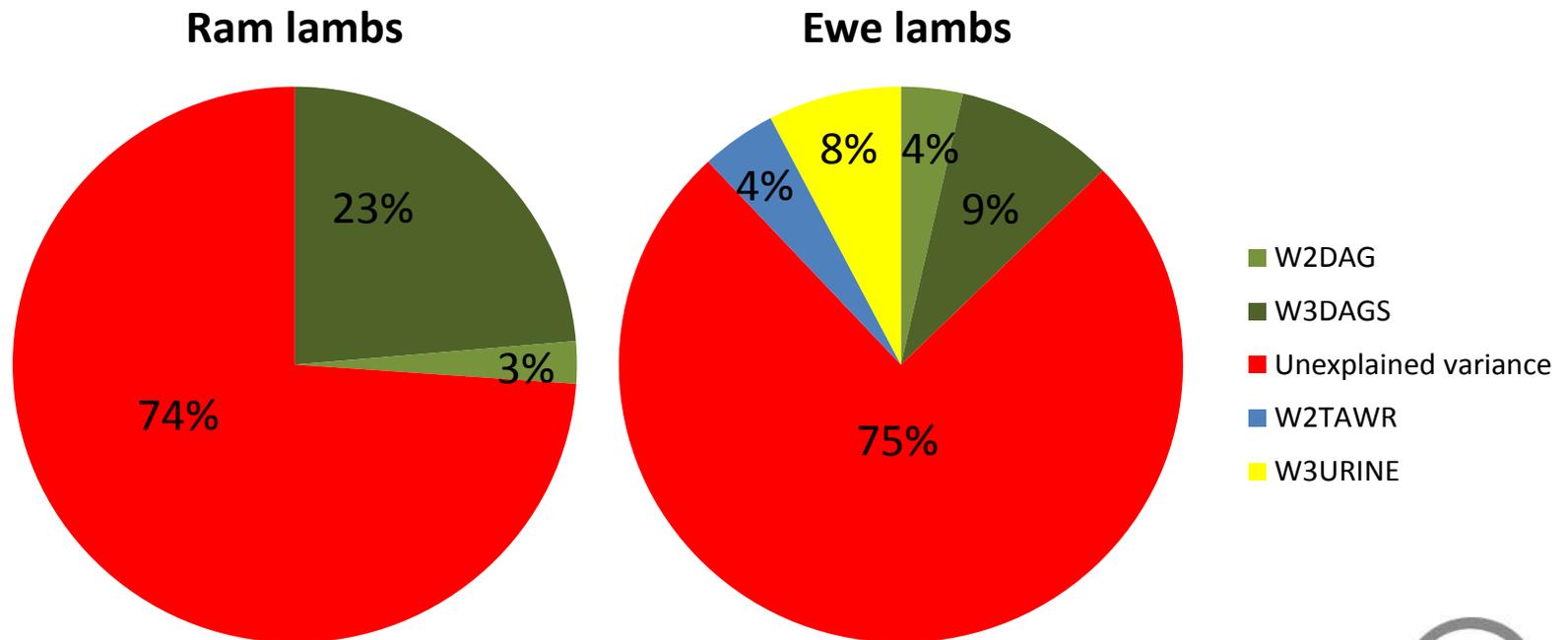
Breech strike incidence from birth to hogget shearing in females that were crutched



Breech strike incidence from birth to hogget shearing in females that were crutched



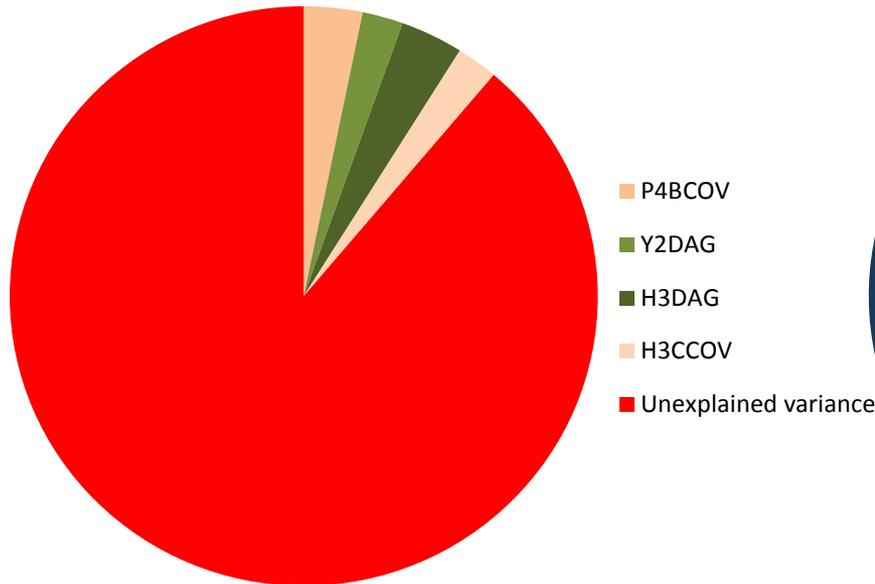
Factors explaining the variation in breech strike on individual sheep at Weaning (2010-2013)



Factors explaining the variation in breech strike on individual sheep from Weaning to Hogget age in crutched sheep (2010-2013)

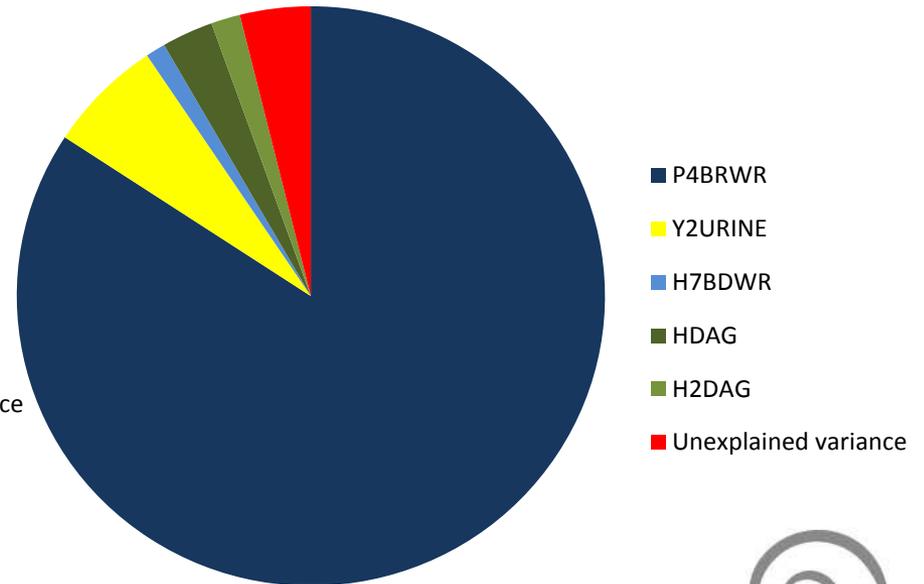
Large difference between rams and ewes

Rams



Unexplained

Ewes



Wrinkle



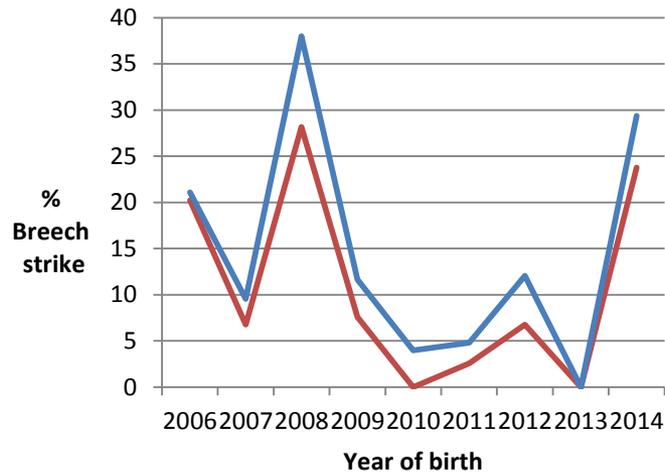
Effective indicators for selection when crutched

Indicator trait	Heritability	r_g	Correlated Response relative to Direct Response
Body wrinkle at birth	0.33	0.34	1.63
Neck wrinkle at marking	0.57	0.42	1.55
Urine stain at weaning	0.37	0.51	1.49
Neck wrinkle post weaning	0.53	0.33	1.29
Neck wrinkle post weaning	0.40	0.46	1.27
Tail wrinkle at marking	0.56	0.38	1.05
Dags post weaning	0.07	0.80	1.04
Body wrinkle at marking	0.54	0.36	1.02
Dags at weaning	0.31	0.60	1.00
Urine stain at weaning2	0.26	0.50	0.99
Tail wrinkle post weaning	0.46	0.49	0.98
Tail wrinkle post weaning	0.39	0.44	0.93
Wool colour post weaning	0.48	0.30	0.86
Body wrinkle post weaning	0.35	0.53	0.82
Body wrinkle post weaning	0.57	0.45	0.76
Crutch cover post weaning	0.49	0.36	0.75
Face cover post weaning	0.60	0.23	0.70
Dag moisture at weaning	0.28	0.17	0.68
Neck wrinkle at weaning	0.34	0.24	0.67
Breech cover post weaning	0.16	0.61	0.66

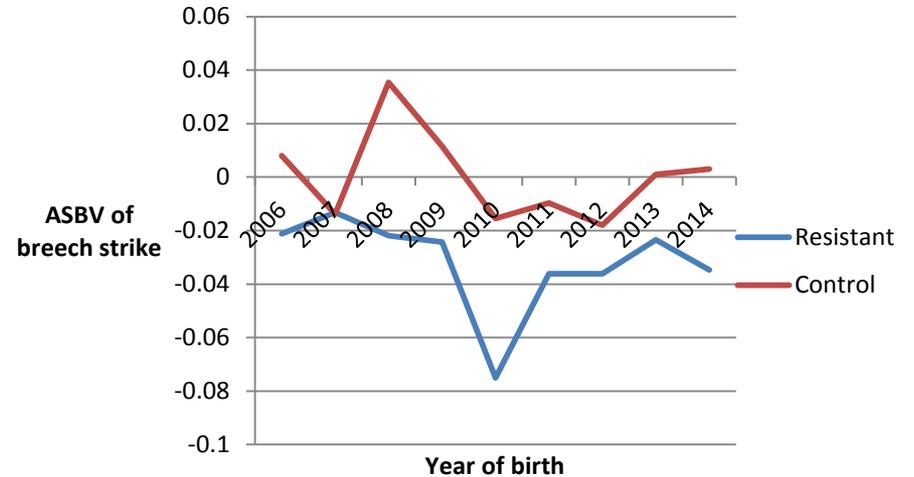
Genetic changes in Mount Barker flock

Selection mostly on own breech strike performance

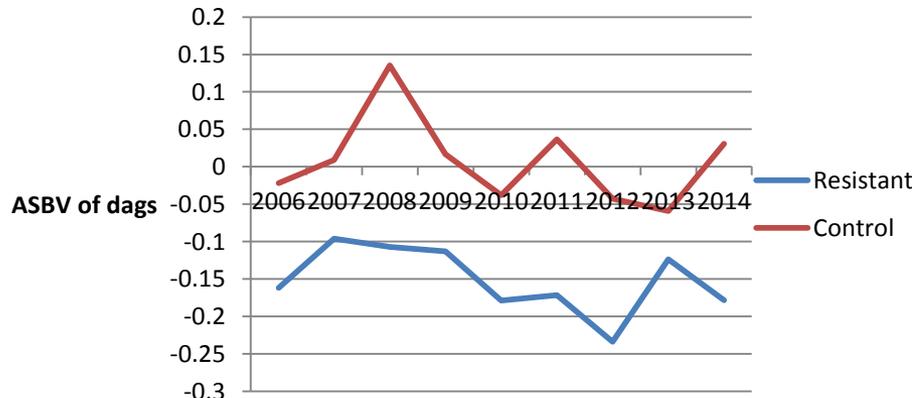
Phenotypic trend of breech strike lines



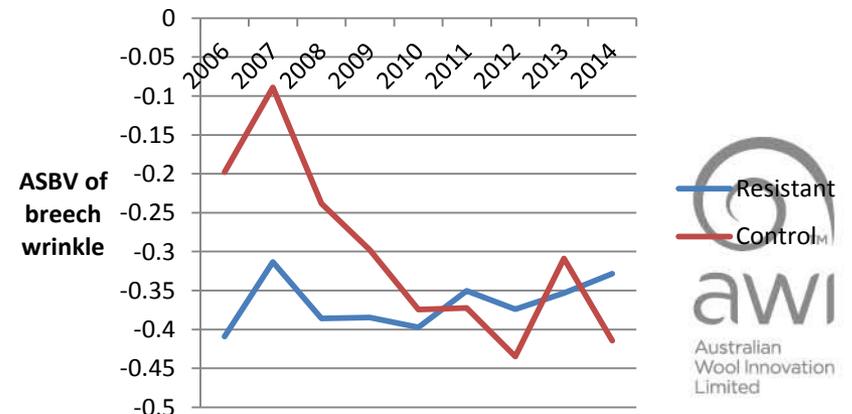
Genetic trend of breech strike



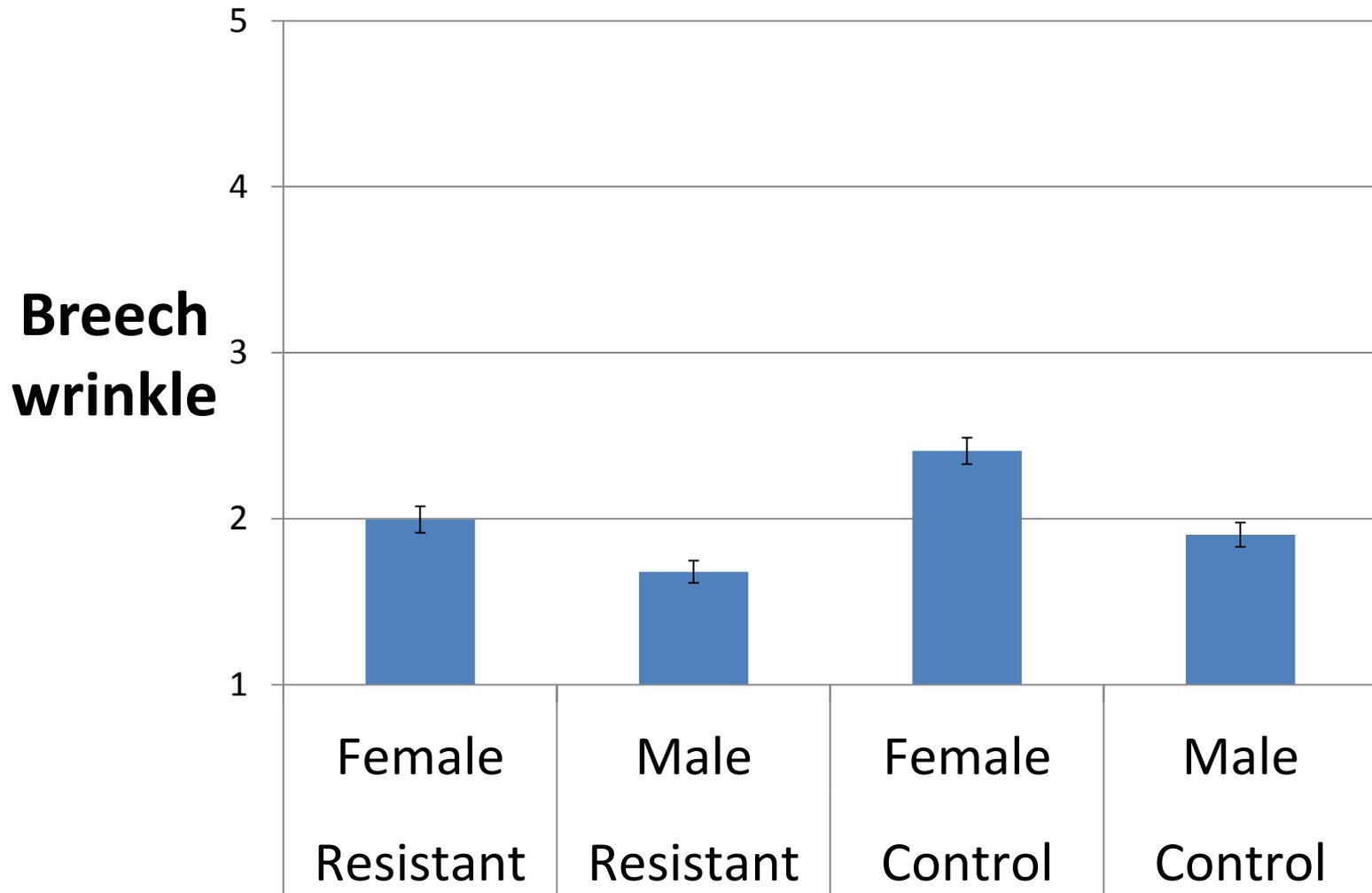
Dags



Breech wrinkle



Phenotypic differences in breech wrinkle between lines after crutching at yearling age



Key indicator traits for selection in winter rainfall environment where animals are crutched

1. Wrinkle
2. Dags
3. Urine stain
4. Breech cover



Take home message from winter rainfall region

1. Remove dags and urine stained wool
2. Cull all struck sheep
3. Reduce wrinkles and breech cover in a flock
4. Use the ASBVs for
 1. breech wrinkle
 2. dags
 3. breech cover
5. Can progeny test sires for breech strike resistance





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