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Maternal components affect the genetic variation of meat production in reindeer

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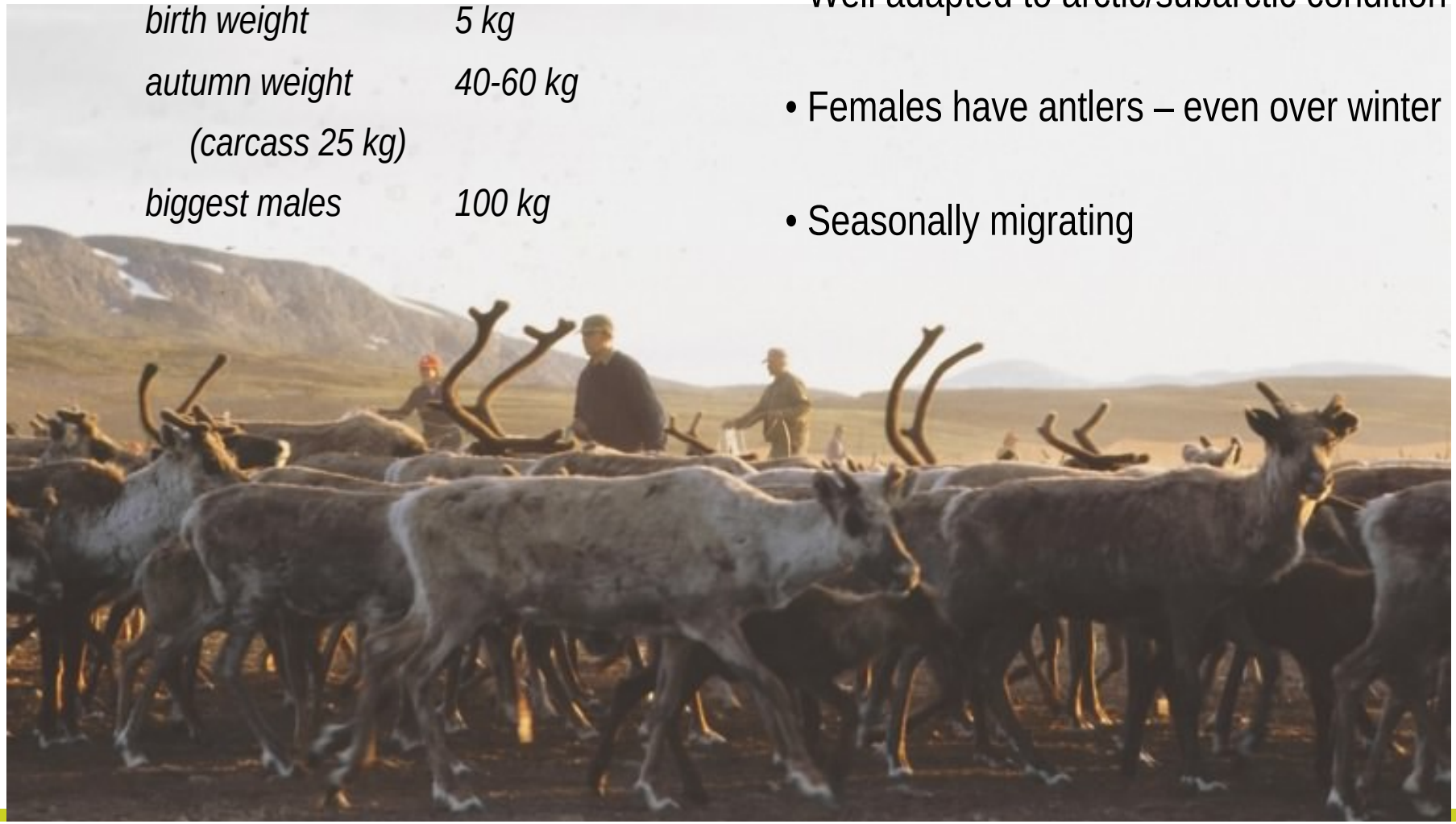
Reindeer

- A middle-sized domesticated deer
- Weight comparable to a heavy sheep breed

birth weight	*5 kg*
autumn weight	*40-60 kg*
(carcass 25 kg)	
biggest males	*100 kg*

- Unique ability to digest lichen
- Well adapted to arctic/subarctic condition
- Females have antlers – even over winter
- Seasonally migrating



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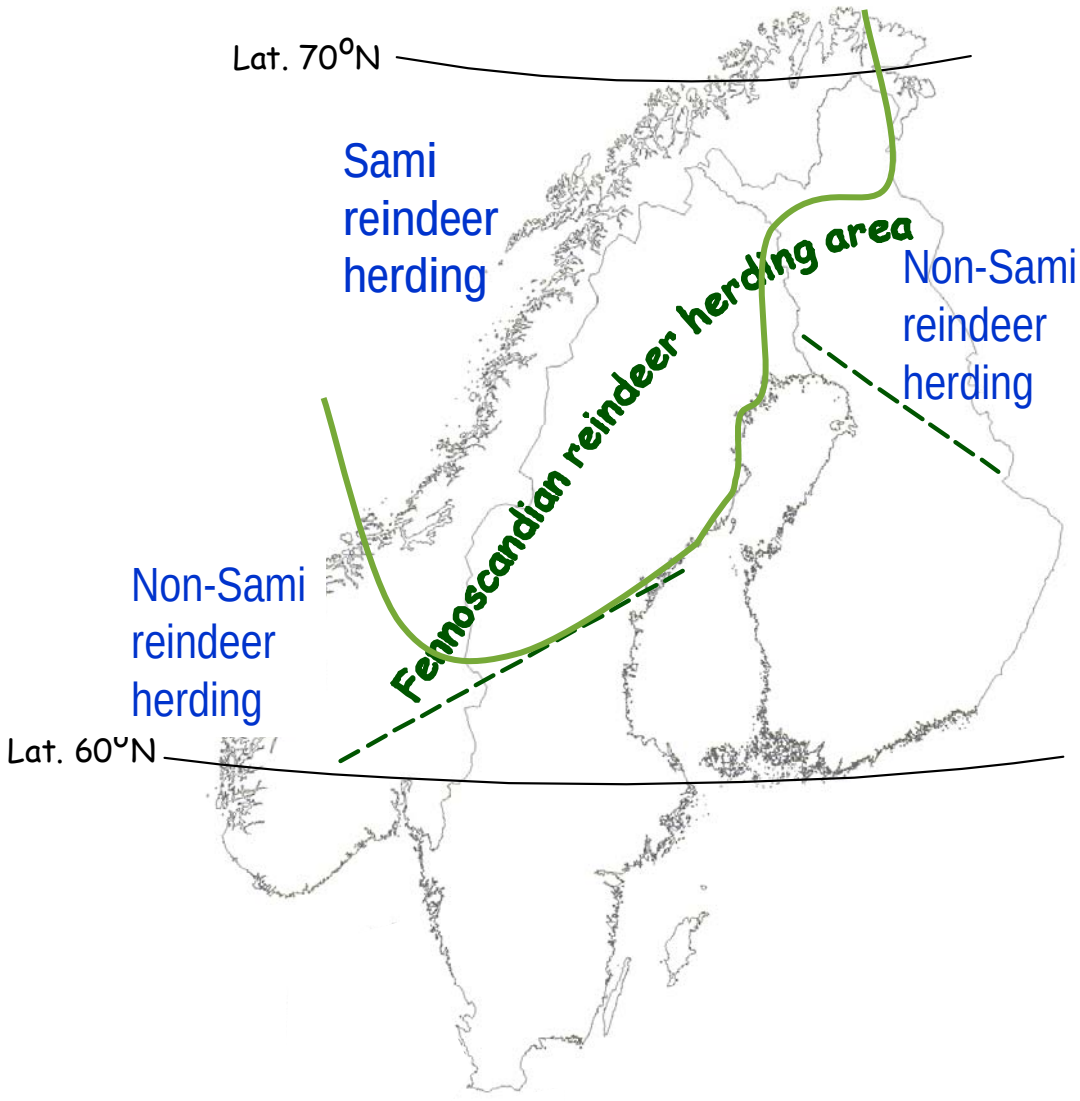
The Fennoscandian reindeer herding area



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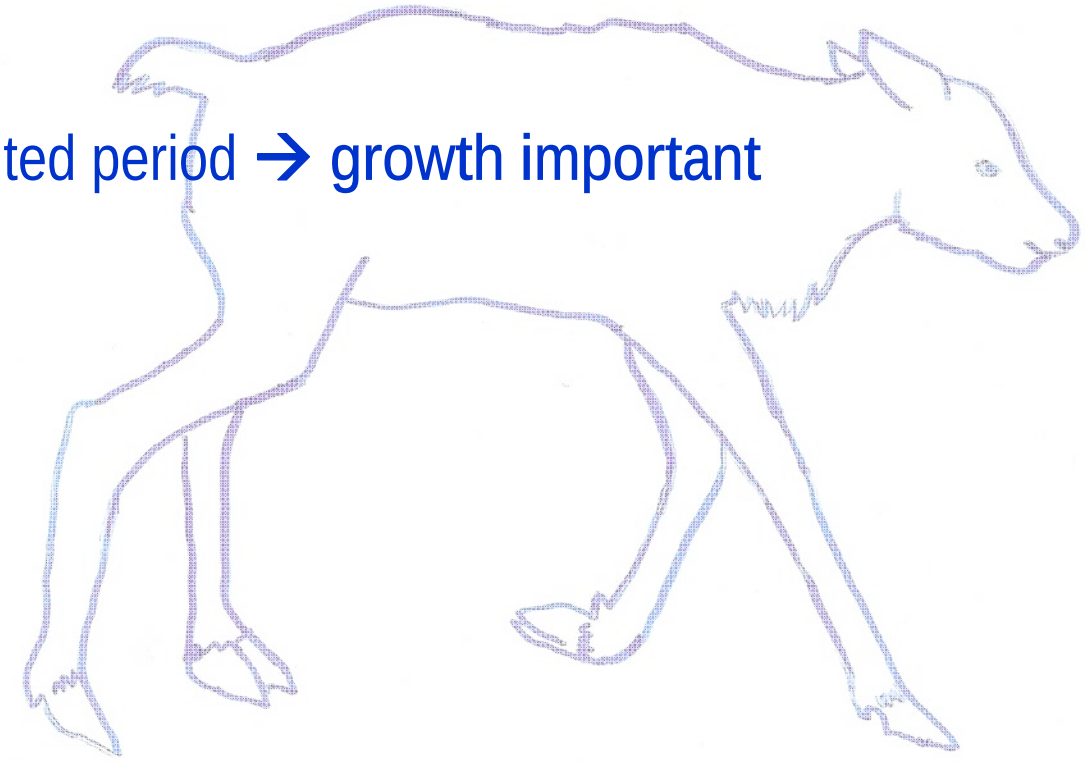
If meat production is to be improved, the selected traits would be

- calf survival

- *calf weight*

Calves grow over a limited period → growth important



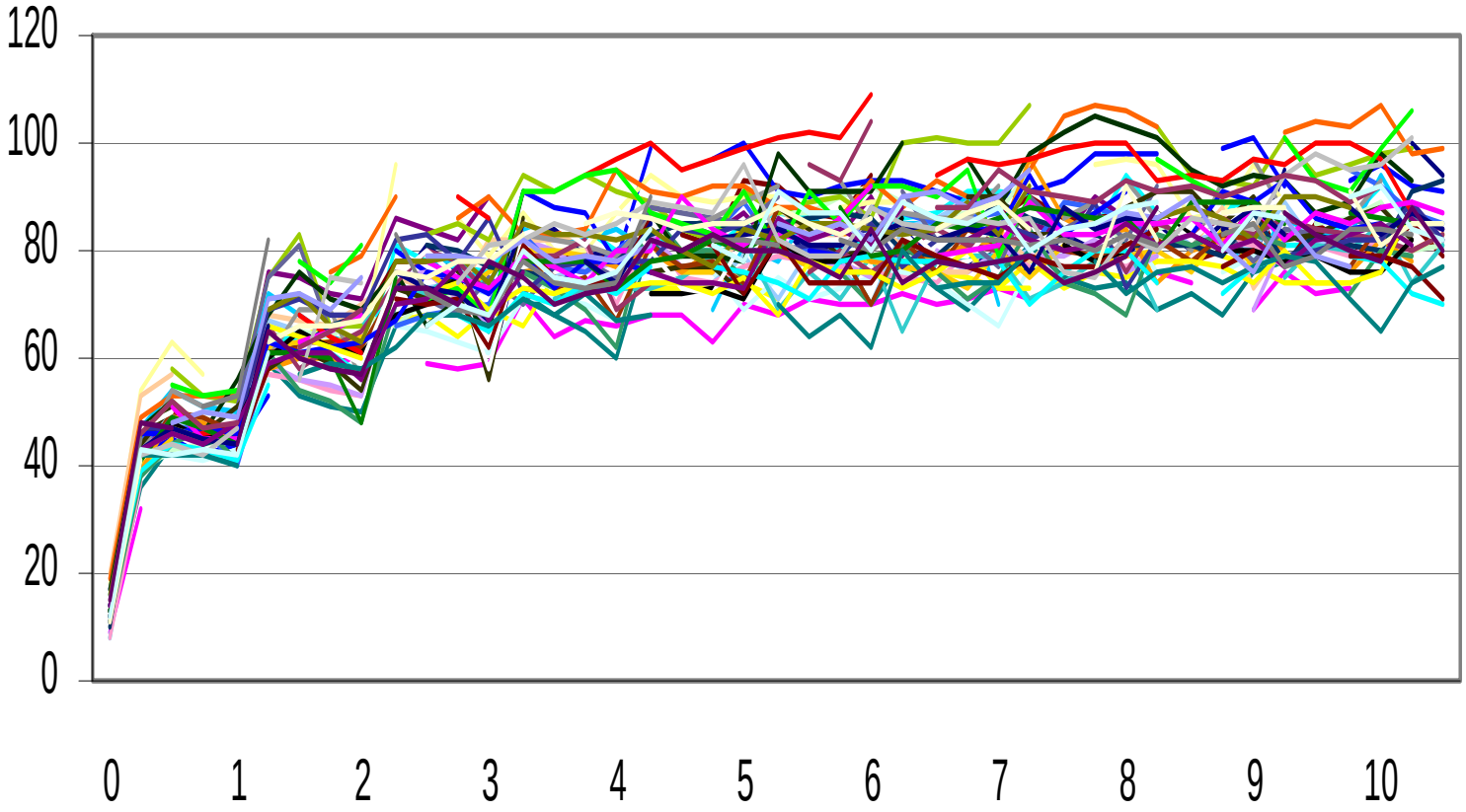
Before selection, understanding of genetic variation

Research data from Reindeer Herders' experimental herd (Kutuharju), collected by Fish and Game Research Institute

Records on reindeer born over the period 1987-2009, altogether 1709 individuals

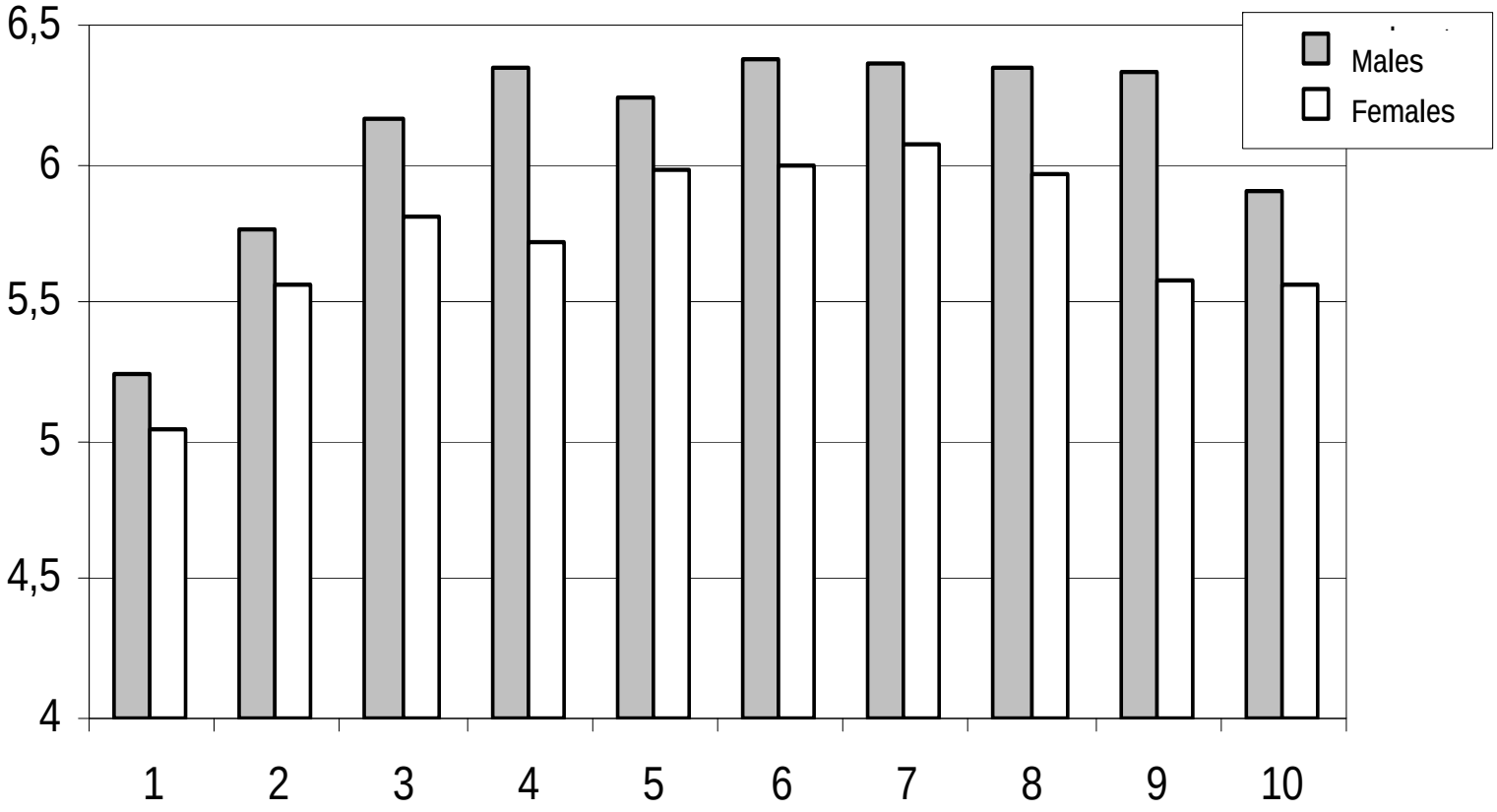
Weight has lots of variation, influenced also by non-genetic factors.

Kutuharju reindeer – individual growth (kg) by age (y)



fast growth in the summer – weight changes little or rather decreases in the winter

Parity effect on birth weight (kg)



Fixed effects

birth weight and growth rate

- sex (2 classes)
- birth year (23 classes)
- parity (small no. records → only three classes: parities 1–2, 3–8, 9–)

calving time in spring (two periods with varying cut point over years) for birth weight

autumn weights not corrected for the age at weighing.

Kutuharju data is unique because

1) sires of individuals are also known -

Norwegian research on male reindeer's reproductive research

Oystein Holand's group

research done at Kutuharju

microsatellite typing for sire assignment

→ *possible to separate maternal effects*

2) birth weights are recorded

Number of weighed animals and of their known dams and sires in the data of the period 1987 – 2009 (purchased animals' parents outside the pedigree)

	number born	sires unknown, dam known	both sire and dam known	purchased animals
no. animals	1706	871	835	48
no. known parents		289 dams	245 dams 71 sires	

In addition to the recorded individuals, pedigree information is available from 3096 individuals

Annually no.sires, 3-5 on average (max 13), no. dams 57-94

Models

Calf's direct effect

Calf's direct effect + maternal effect

Calf's direrct effect + maternal genetic and perm environmental effect

Estimates of direct (h^2_a) and maternal (h^2_m) heritabilities, proportion of dam's permanent environmental variance over phenotypic variance (c^2) and direct-maternal correlations (r_{am}) in reindeer birth weight and growth rate.

Trait	model	h^2_a	h^2_m	c^2	r_{am}
BW	a	0.50±0.05			
BW	a+m	0.30±0.10	0.29±0.06	-	-0.19±0.08
BW	a+m+p	0.30±0.11	0.19±0.11	0.07±0.06	-0.18±0.08
GR	a	0.32±0.06			
GR	a+m	0.36±0.08	0.24±0.05		-0.71±0.20
GR	a+m+p	0.35±0.13	0.22±0.12	0.02±0.02	-0.75±0.19

Estimates of direct (h^2_a) and maternal (h^2_m) heritabilities, proportion of dam's permanent environmental variance over phenotypic variance (c^2) and direct-maternal correlations (r_{am}) in reindeer birth weight and growth rate.

Trait	model	h^2_a	h^2_m	c^2	r_{am}
BW	a	0.50±0.05			
BW	a+m	0.30±0.10	0.29±0.06	-	-0.19±0.08
BW	a+m+p	0.30±0.11	0.19±0.11	0.07±0.06	-0.18±0.08
GR	a	0.32±0.06			
GR	a+m	0.36±0.08	0.24±0.05		-0.71±0.20
GR	a+m+p	0.35±0.13	0.22±0.12	0.02±0.02	-0.75±0.19

Dam affects calf’s growth and survival in many ways

- calving time (depends on dam’s fitness)

- milk production

- guidance over the first winter

Conclusions

- further analysis of maternal effect
  - -jointly with other traits

- more traits: yearling weight, calving time, survival (summer, winter)

- more data needed
  - Swedish records, high numbers but unknown sires
  - use of records from ordinary herds
  - SNP typing to construct pedigrees?

- analysis of herder interviews on selection practices

Acknowledgements

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