



Genetic parameters for survival at birth in meat sheep breeds

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Introduction

- About 10 000 flocks in Denmark - 500 participate in the intensive registration system
- 30 breeds – Texel and Shropshire the most common
- BV estimated for 29 traits combined into 8 sub-indexes and a total merit index
- Genetic evaluations are mainly based on values from the literature

- Genetic parameters have to be estimated for important traits involved in breeding programs
- Lamb survival is the crucial factor for sheep productivity
- The greatest number of losses is reported especially within the first day after birth

Objective

Estimation of heritabilities and genetic correlations between survival at birth and birth weight including both direct and maternal genetic effects in the main sheep breed populations in Denmark

Materials and methods

- Data from 1992 to 2006
- Pedigrees were traced back to 1962

	Texel	Shropshire
Animals in pedigree	85 880	63 052
Animals with data	61 953	46 159
Animals in flock-year	35	29
Offspring per sire	34	38

- Statistical analyses of fixed effects carried out using generalized linear model
- Genetical analyses carried out with bivariate animal models
- Application of logistic link function
- ASREML package (*Gilmour et al., 1998*)

$$\log\left(\frac{\pi_{ijklmnop}}{1 - \pi_{ijklmnop}}\right) = \varphi + S_i + L_j + D_k + P_l + FYS_m + adir_n + amat_o + c_p$$

$\pi_{ijklmnop}$ = Probability of lamb survival

φ = Overall mean effect

S_i = Sex

L_j = Litter size

D_k = Lambing difficulty

P_l = Parity

FYS_m = Flock-year-season

$adir_n$ = Direct additive genetic effect

$amat_o$ = Maternal additive genetic effect

c_p = Common litter effect

Fixed

Random

$$BW_{ijklmno} = S_i + L_j + P_k + FYS_l + adir_m + amat_n + c_o + e_{ijklmno}$$

$BW_{ijklmno}$ = Birth weight

S_i = Sex

L_j = Litter size

P_k = Parity

FYS_l = Flock-year-season

$adir_m$ = Direct additive genetic effect

$amat_n$ = Maternal additive genetic effect

c_o = Common litter effect

$e_{ijklmno}$ = Residual

Fixed

Random

Results

Means (SD) of analysed traits

	Survival at birth (%)	Birth weight (kg)
Texel	92.5 (26.4)	4.5 (0.9)
Shropshire	91.7 (27.6)	4.2 (0.9)

(Co)variance components for Survival at birth

	Texel	Shropshire
σ^2_a	0.23	0.25
σ^2_m	0.25	0.33

σ^2_a – direct additive genetic variance, σ^2_m – maternal additive genetic variance

(Co)variance components for Survival at birth

	Texel	Shropshire
σ^2_a	0.23	0.25
σ^2_m	0.25	0.33
σ_{a-m}	-0.13	-0.23
σ^2_c	0.59	0.62

σ^2_a – direct additive genetic variance, σ^2_m – maternal additive genetic variance,
 σ_{a-m} – direct-maternal genetic covariance, σ^2_c – common litter variance

Heritabilities: Survival at birth (SB)

	SB_{direct}	SB_{maternal}	BW_{direct}	BW_{maternal}
SB_{direct}	0.05			
SB_{maternal}		0.06		Texel
BW_{direct}				
BW_{maternal}				
SB_{direct}	0.06			
SB_{maternal}		0.08		Shropshire
BW_{direct}				
BW_{maternal}				

Standard errors: 0.02

Heritabilities: Birth weight (BW)

	SB _{direct}	SB _{maternal}	BW _{direct}	BW _{maternal}
SB _{direct}	0.05			
SB _{maternal}		0.06		Texel
BW _{direct}			0.18	
BW _{maternal}				0.26
SB _{direct}	0.06			
SB _{maternal}		0.08		Shropshire
BW _{direct}			0.14	
BW _{maternal}				0.25

Standard errors: 0.01 - 0.02

Direct-maternal genetic correlations

	SB _{direct}	SB _{maternal}	BW _{direct}	BW _{maternal}
SB _{direct}	0.05			
SB _{maternal}	-0.53	0.06		Texel
BW _{direct}			0.18	
BW _{maternal}			-0.22	0.26
SB _{direct}	0.06			
SB _{maternal}	-0.80	0.08		Shropshire
BW _{direct}			0.14	
BW _{maternal}			-0.05	0.25

Standard errors: 0.04 - 0.21

Genetic correlations: SB-BW

	SB _{direct}	SB _{maternal}	BW _{direct}	BW _{maternal}
SB _{direct}	0.05			
SB _{maternal}	-0.53	0.06		Texel
BW _{direct}	-0.08		0.18	
BW _{maternal}		0.39	-0.22	0.26
SB _{direct}	0.06			
SB _{maternal}	-0.80	0.08		Shropshire
BW _{direct}	-0.25		0.14	
BW _{maternal}		0.43	-0.05	0.25

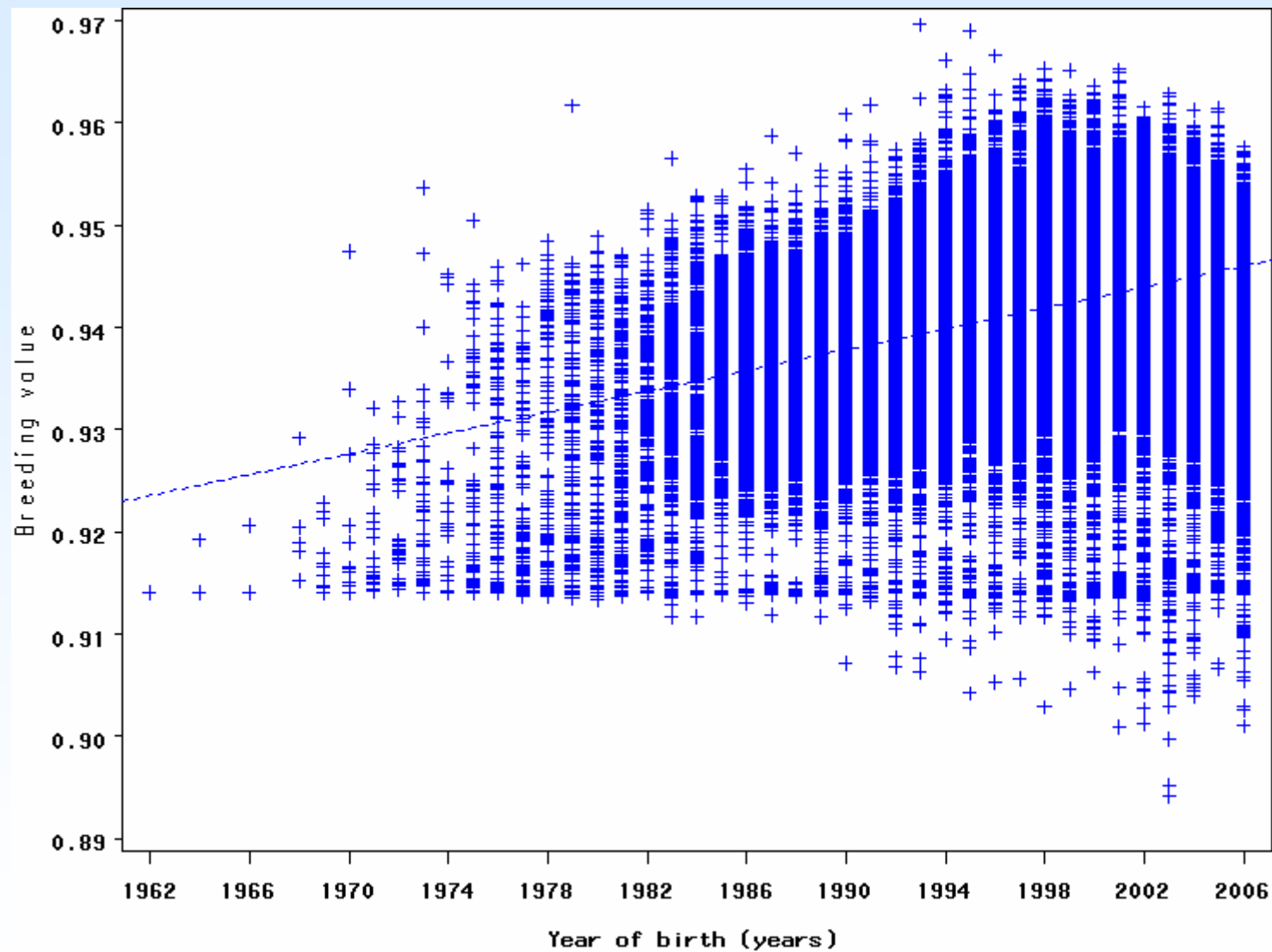
Standard errors: 0.10 - 0.16

Genetic correlations: SB-BW

	SB _{direct}	SB _{maternal}	BW _{direct}	BW _{maternal}
SB _{direct}	0.05			
SB _{maternal}	-0.53	0.06		Texel
BW _{direct}	-0.08	0.02	0.18	
BW _{maternal}	-0.41	0.39	-0.22	0.26
SB _{direct}	0.06			
SB _{maternal}	-0.80	0.08		Shropshire
BW _{direct}	-0.25	0.21	0.14	
BW _{maternal}	-0.15	0.43	-0.05	0.25

Standard errors: 0.14 - 0.17

Genetic trend in Survival at birth



Conclusions

- Maternal h^2 for Survival at birth slightly higher than direct h^2
=> importance of both, genetic merit of animal and its dam
- Possible improvement of survival at birth including both direct and maternal effects in breeding programs
=> negative direct-maternal genetic correlations

- Positive maternal genetic correlations between Survival at birth and Birth weight
- Negative direct genetic correlations between Survival at birth and Birth weight

Thank you for your attention!