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New genetic evaluation of fertility in Swiss Brown Swiss

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Background

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- Impaired fertility is the main reason for involuntary culling in Brown Swiss cattle
- 28 % of all cullings are due to poor fertility (Alder, 2011)
- Many countries have improved genetic evaluations of fertility in the last ten years

Genetic evaluation of fertility in Brown Swiss in Switzerland

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- Fertility breeding values were implemented in 2003
- Traits: Non return rate 56 cows (NRC) and days to first service (DFS)
- All first inseminations and natural services since January 1994 are included
- Official publication of EBV: r^2 >= 65% for DFS
- Heritabilities: NRC: 0.012
  DFS: 0.039
- Genetic correlation between NRC and DFS: 0.16
- No EBV for male fertility
- AI centre swissgenetics publishes direct NR for bulls corrected for main environmental factors

Female fertility at Interbull

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- Genetic evaluation for female fertility at Interbull
  - Trait 1: Maiden heifer‘s ability to conceive
  - Trait 2: Lactating cow‘s ability to start cycling
  - Trait 3: Lactating cow‘s ability to conceive 1
  - Trait 4: Lactating cow‘s ability to conceive 2
  - Trait 5: Lactating cow‘s interval calving - conception

New traits for the genetic evaluation

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- Distinguish between heifer and cow fertility

- Traits analysed:
  - NR 56 in heifers (NRH)
  - Interval between 1st and last insemination in heifers (IFLH)
  - NR 56 in cows (NRC)
  - Interval between 1st and last insemination in cows (IFLC)
  - DFS

Estimation of variance components

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- Data editing:
  - Valid birth and calving dates
  - Only information on inseminations dated back > 56 days prior to evaluation is included
  - Age at first insemination between 245 and 915 days
  - DFS: 30 – 200 Tage
  - IFL: 0 – 300 Tage
  - Lactations > 8 are grouped in one class
  - ...

Estimation of variance components

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- Several bi- und multivariate runs
- Animal model using REMLF90 (Misztal, 2002)
- Several data sets
  - 44,126 records (13,531 heifers, 30,595 cows)
  - 88,444 records (27,352 heifers, 61,092 cows)

Effects in the model

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Effect	Type	Trait
Herd * Year	random	All
Month * Year Insemination	fix	NRH, NRC, IFLH
Month * Year Calving	fix	IFLC, DFS
Lactation	fix	NRC, IFLC, DFS
Age at first service	fix	NRH, IFLH
Service sire * semen batch	random	NRH, NRC
Inseminator * Year	random	NRH, NRC
Testbull or proven bull	fix	NRH, NRC
additiv genet. effect of animal	random	All
Permanent environment	random	NRC, IFLC, DFS
Residual	random	All

Heritabilities and genetic correlations

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Trait	NRH	IFLH	NRC	IFLC	DFS
NRH	0.016				
IFLH	-0.51	0.015			
NRC	0.48	-0.51	0.018		
IFLC	-0.42	0.49	-0.62	0.041	
DFS	0.41	0.28	0.38	0.22	0.063

Breeding value estimation

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- Comparison of three different breeding value estimations:
  1) Routine run August 2013
  2) Routine run August 2013 with application of new genetic parameters for NRC and DFS
  3) New model including 5 fertility traits

- The main question was:
  - **Can we increase the reliability of DFS and NRC using the new model?**

Breeding value estimation

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- Multiple trait animal model
- BLUPF90 (Misztal, 2008)
- Same effects as in variance component estimation were included in the model

Data

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Data characteristics	
No. records August 2013	3,228,306
No. Records new model	4,190,225
No. heifer records	1,041,918
No. cow records	3,148,307
average NRH (%)	78.3
average IFLH (d)	24.6
average NRC (%)	68.4
average IFLC (d)	33.7
average DFS (d)	74.9

Increase in no. of daughters for bulls born in 2007

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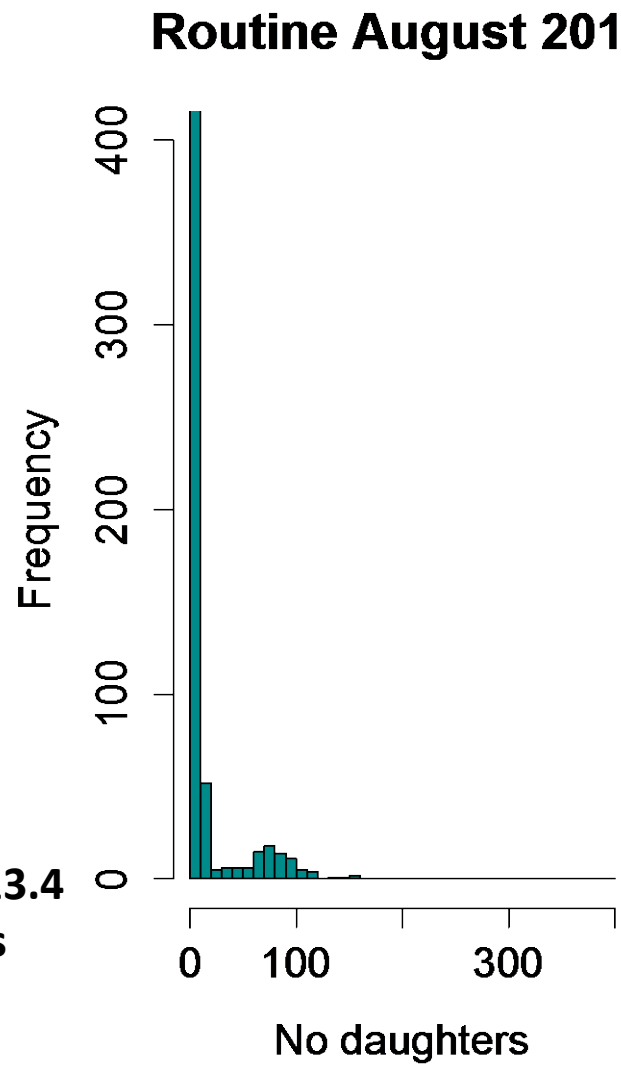
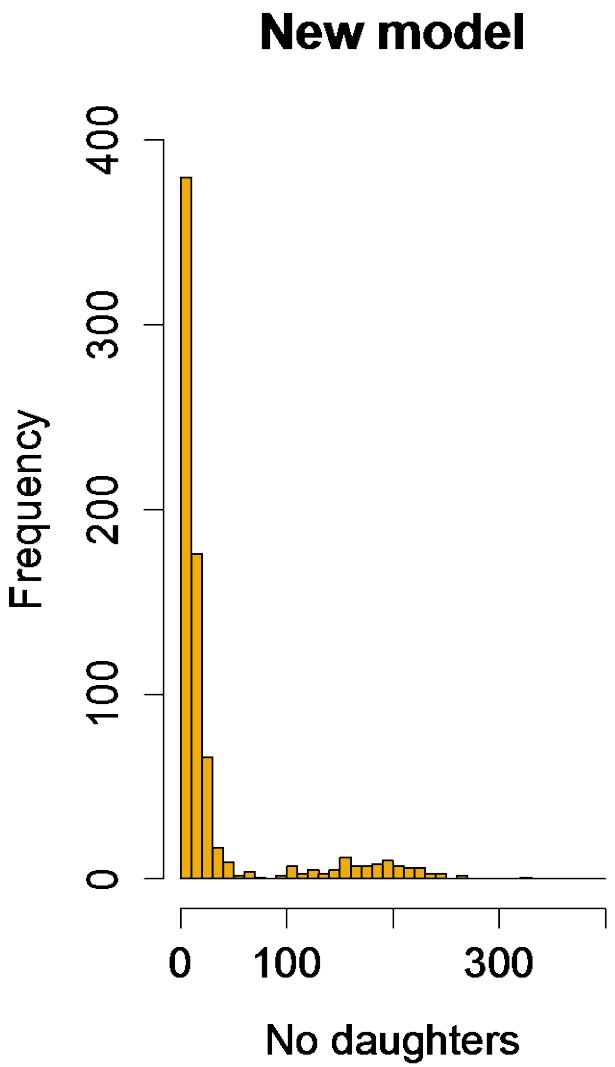


Average 13.4 daughters per bull



Average 33.1 daughters per bull

Increase in r^2 of bulls for NRC

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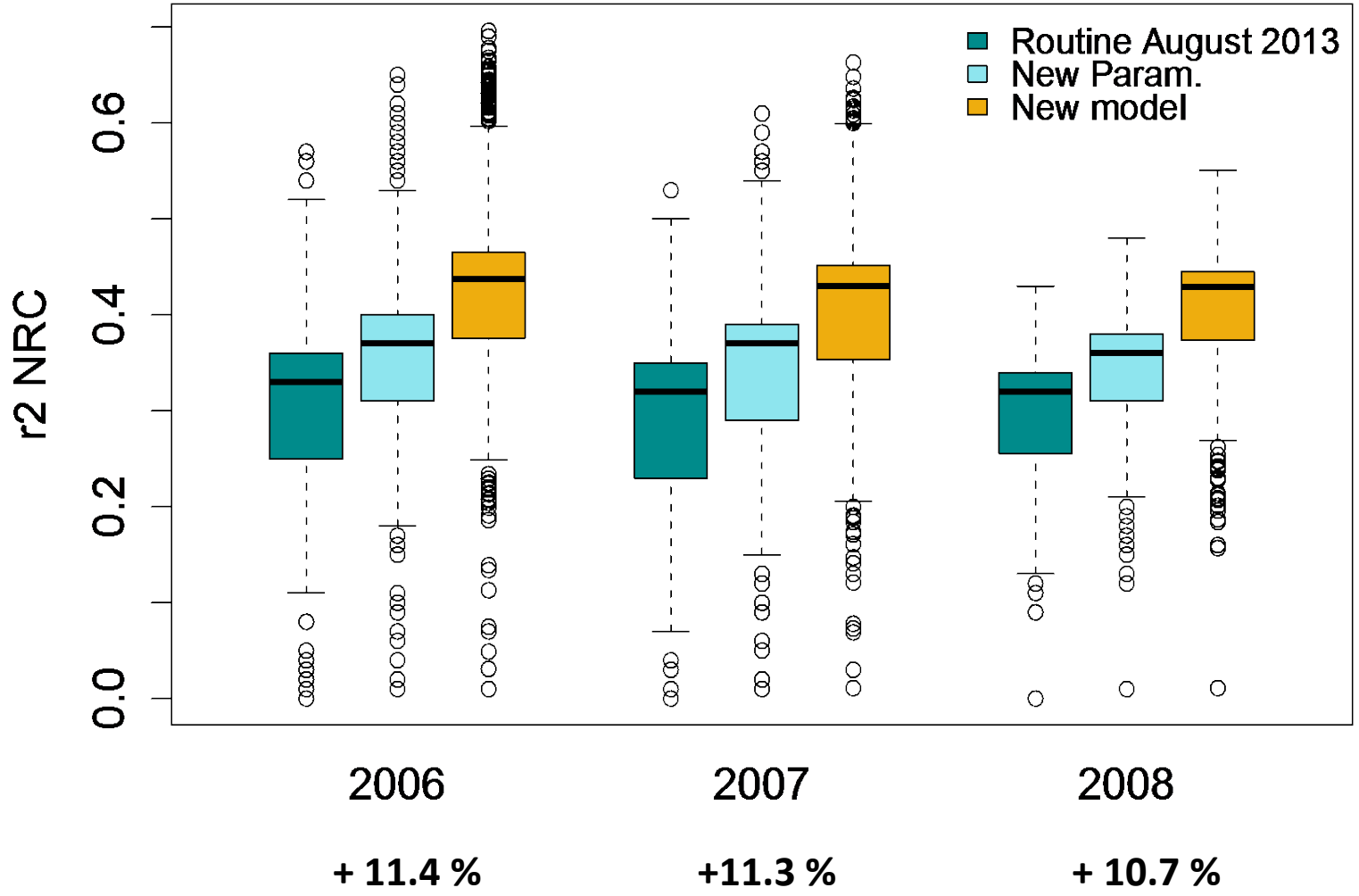

Increase in r^2 of bulls for DFS

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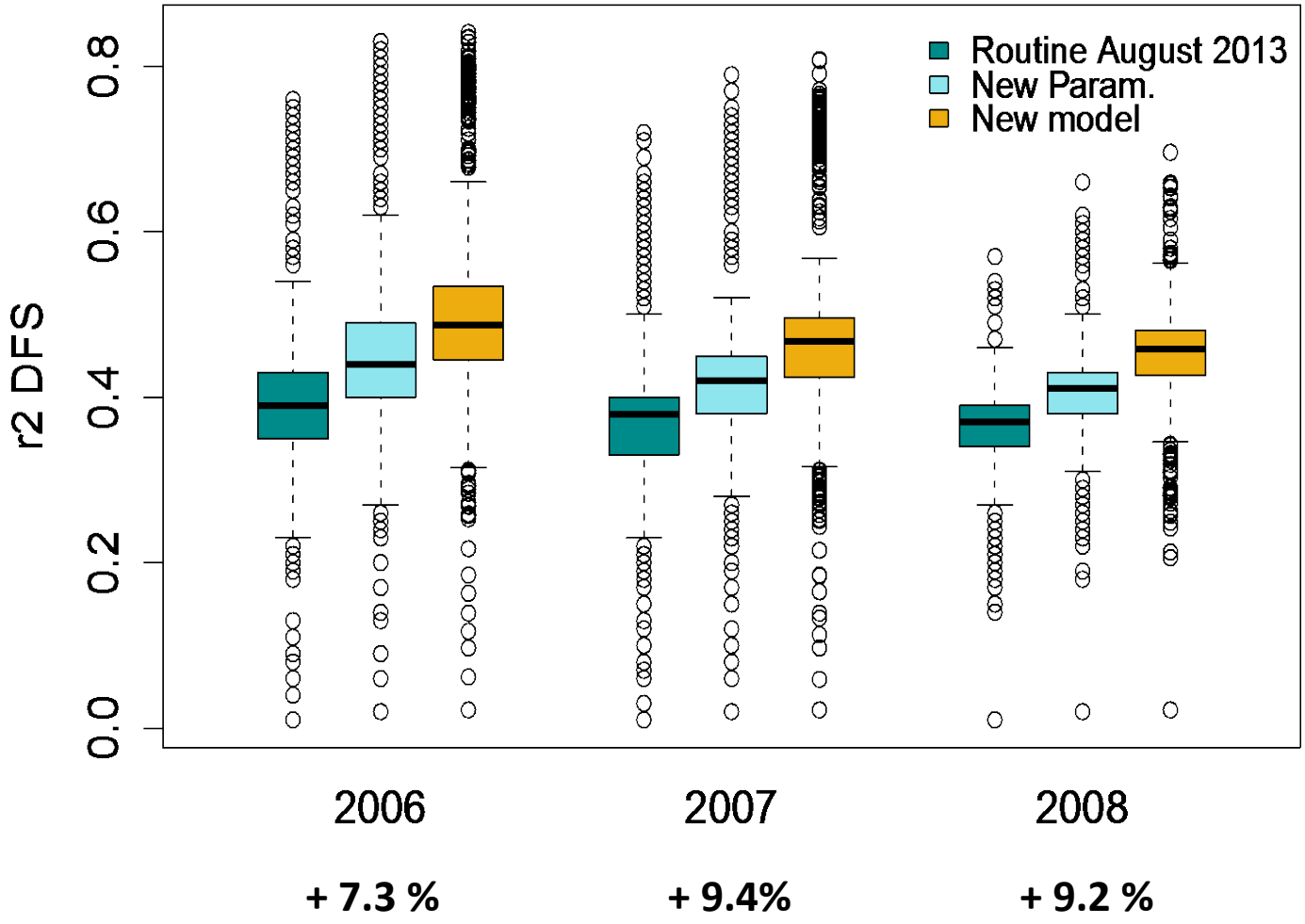

Increase in no. of bulls born in 2007 passing publication criteria

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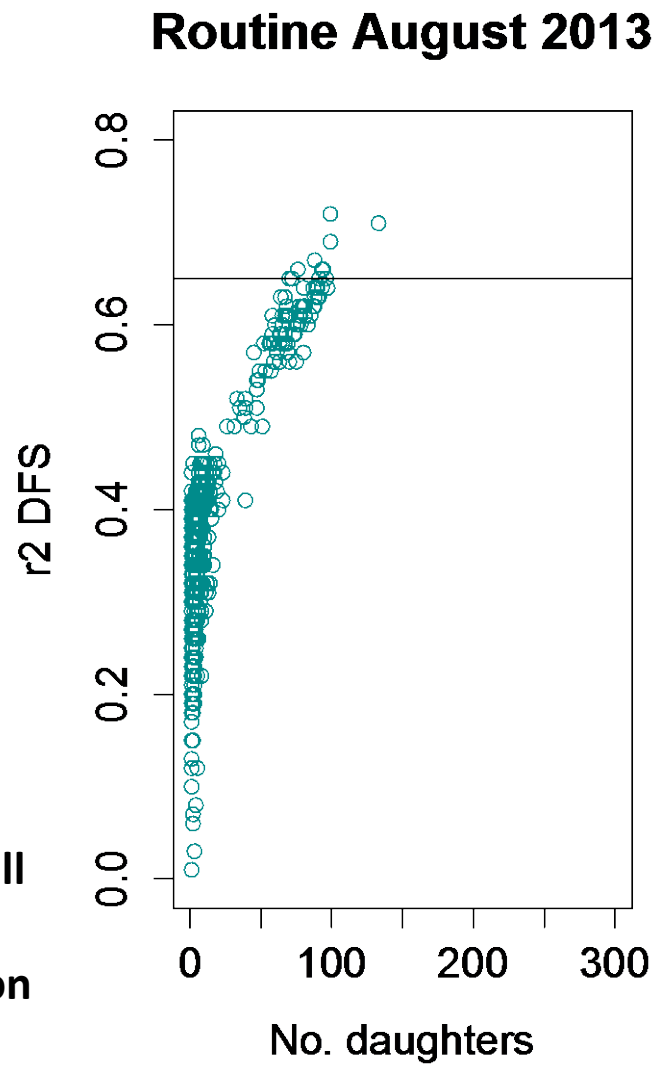
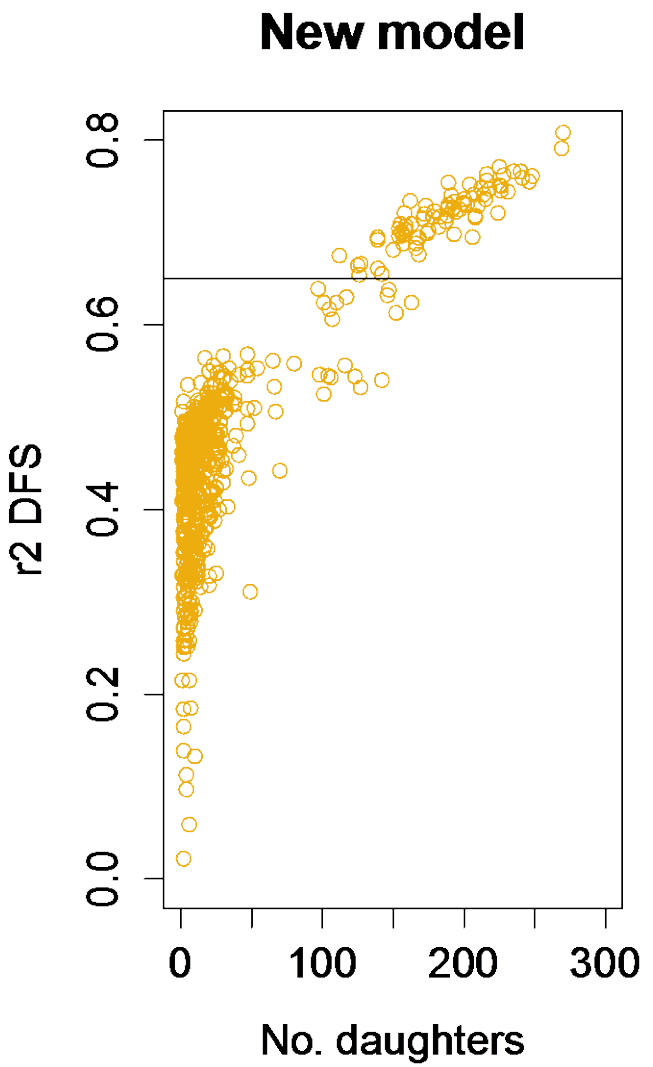


1.6 % of all bulls pass publication criteria



10.5 % of all bulls pass publication criteria

Conclusions and next steps

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- The additional traits offer valuable information for fertility
- Increase in reliability of EBVs
- Increase in no. bulls passing publication criteria

- Next steps:
  - fine tuning of data editing and effect definitions
  - Publication as single traits or as fertility index?
  - Include new traits in the genomic evaluation
  - Interbull test run January 2014

Thank you!

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