Preliminary study of VCE for Limousine breed through MiX99 software

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Tallin – Saturday 26th August 2017

INTRODUCTION

8 populations:

CHE CZE DEU DFS FRA GBR IRL ESP

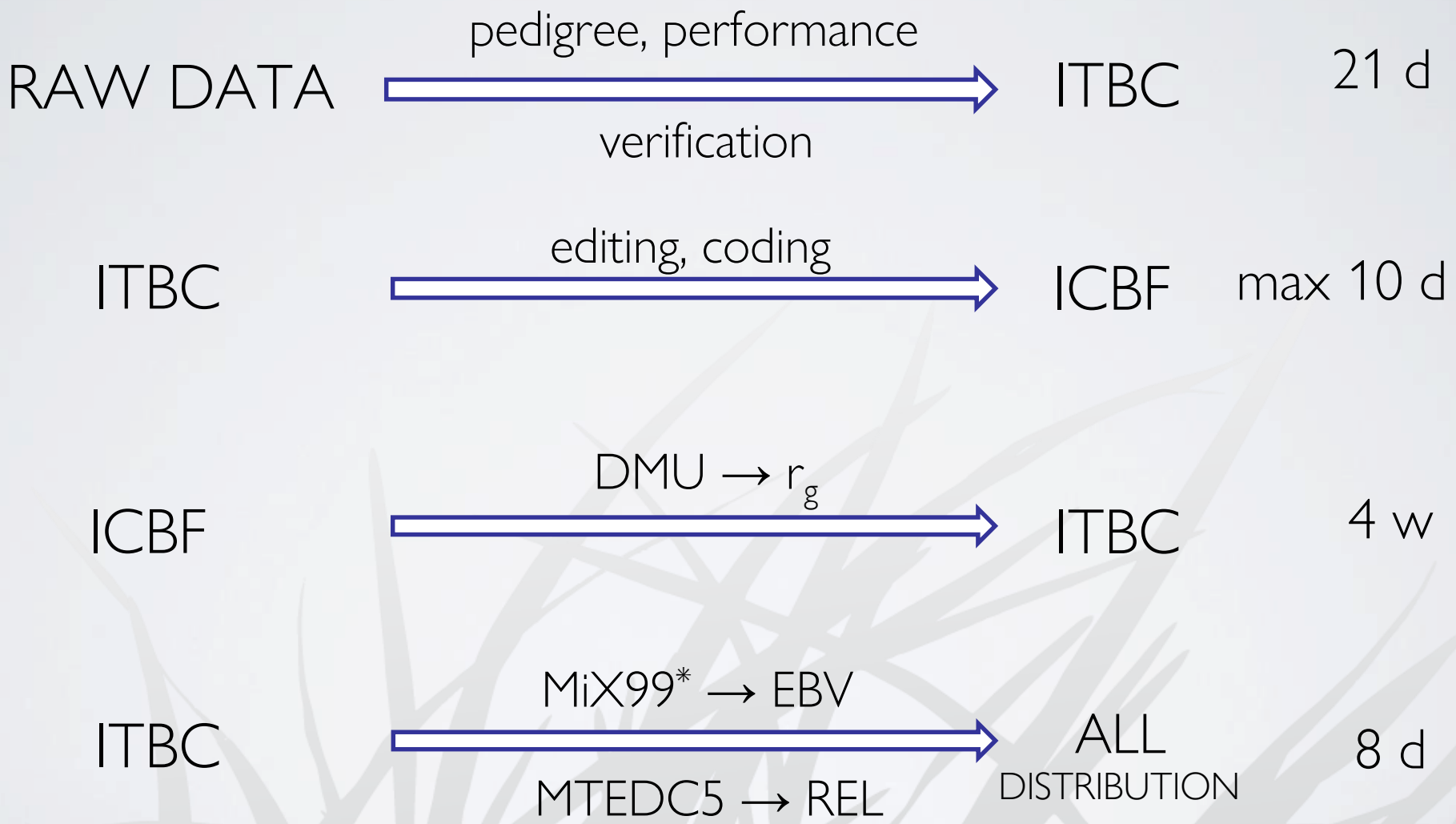
3 breeds – LIM CHA BSM

Runs: 2 routine + 2 test

Adjusted weaning weight: aww

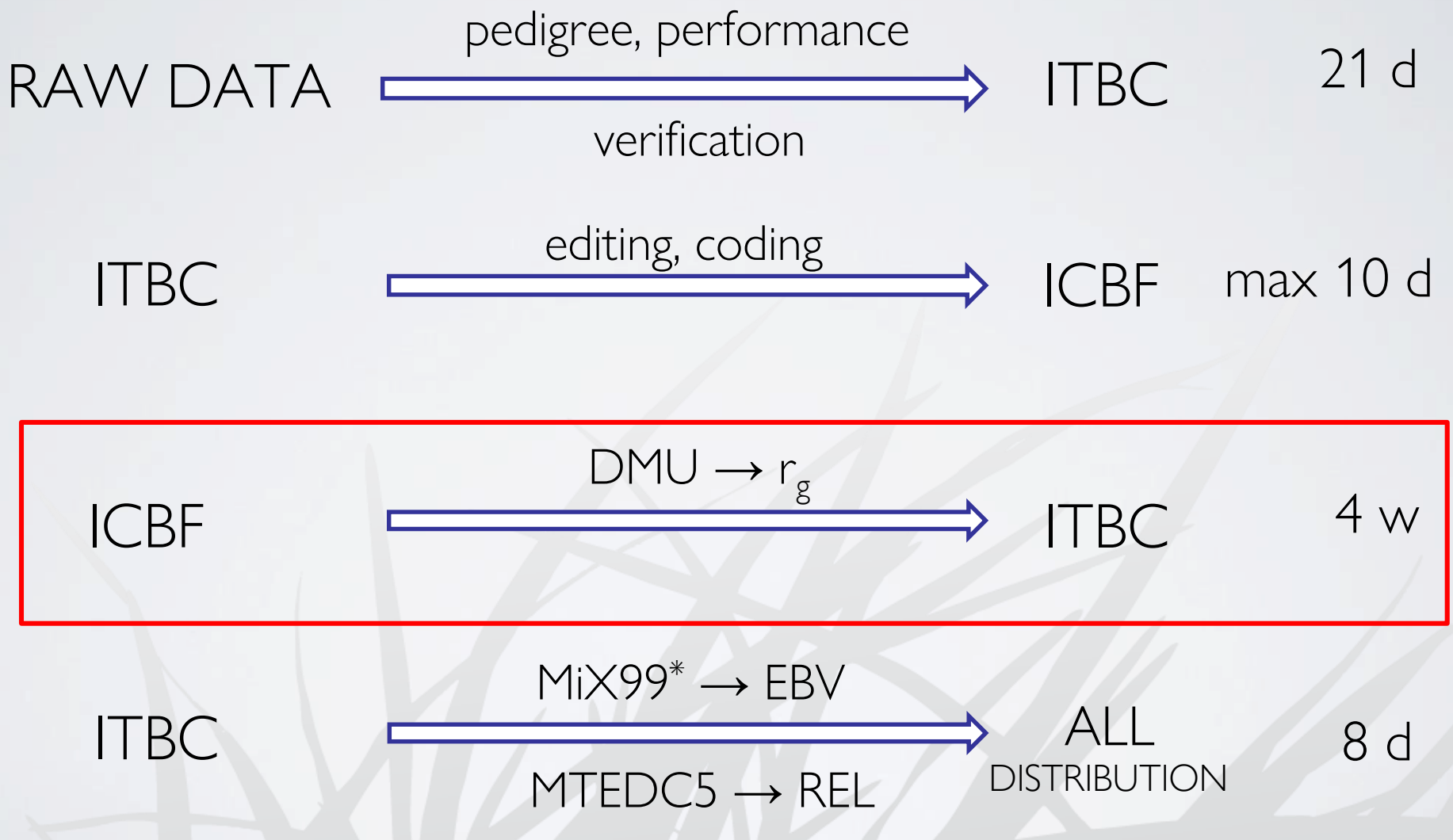
September 2017 → test run for calving traits

CURRENT USAGE OF DATA AT TEST RUNS



*MiX99 Release VIII/2015

CURRENT USAGE OF DATA AT TEST RUNS



*MiX99 Release VIII/2015

CURRENT USAGE OF DATA AT TEST RUNS

Bivariate estimation

ICBF → DMU → r_g → ITBC

		direct								maternal							
		CZE	DFS	ESP	GBR	IRL	FRA	DEU	CHE	CZE	DFS	ESP	GBR	IRL	FRA	DEU	CHE
direct	CZE	1															
	DFS	0.90	1														
	ESP	0.79	0.79	1													
	GBR	0.71	0.85	0.96	1												
	IRL	0.90	0.79	0.90	0.93	1											
	FRA	0.79	0.92	0.79	0.84	0.79	1										
	DEU	0.79	0.95	0.79	0.80	0.64	0.83	1									
	CHE	0.89	0.83	0.80	0.75	0.72	0.72	0.71	1								
maternal	CZE	-0.18	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1							
	DFS	0.00	-0.16	0.00	0.00	0.00	0.00	0.00	0.00	0.70	1						
	ESP	0.00	0.00	-0.24	0.00	0.00	0.00	0.00	0.00	0.70	0.70	1					
	GBR	0.00	0.00	0.00	-0.15	0.00	0.00	0.00	0.00	0.80	0.70	0.70	1				
	IRL	0.00	0.00	0.00	0.00	-0.21	0.00	0.00	0.00	0.70	0.70	0.83	0.71	1			
	FRA	0.00	0.00	0.00	0.00	0.00	-0.39	0.00	0.00	0.85	0.70	0.70	0.87	0.82	1		
	DEU	0.00	0.00	0.00	0.00	0.00	0.00	-0.30	0.00	0.70	0.70	0.70	0.70	0.70	0.70	1	
	CHE	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.34	0.74	0.70	0.70	0.66	0.66	0.76	0.67	1

PRE-BENDING

Weighted bending

(Jorjani *et al.*, 2003)

CURRENT USAGE OF DATA AT TEST RUNS

Bivariate estimation

ICBF $\xrightarrow{\text{DMU} \rightarrow r_g}$ ITBC

		direct								maternal							
		CZE	DFS	ESP	GBR	IRL	FRA	DEU	CHE	CZE	DFS	ESP	GBR	IRL	FRA	DEU	CHE
direct	CZE	1															
	DFS	0.88	1														
	ESP	0.77	0.79	1													
	GBR	0.74	0.84	0.95	1												
	IRL	0.85	0.78	0.89	0.92	1											
	FRA	0.79	0.91	0.79	0.84	0.79	1										
	DEU	0.77	0.94	0.77	0.79	0.65	0.83	1									
	CHE	0.86	0.82	0.77	0.73	0.72	0.72	0.71	1								
maternal	CZE	-0.18	-0.05	0.02	0.06	-0.04	-0.15	-0.02	-0.06	1							
	DFS	-0.06	-0.16	0.01	-0.02	-0.02	-0.10	0.11	-0.02	0.68	1						
	ESP	-0.01	0.03	-0.24	-0.11	-0.10	-0.07	-0.02	-0.02	0.65	0.69	1					
	GBR	0.07	-0.03	-0.08	-0.15	-0.07	-0.19	-0.03	0.02	0.77	0.69	0.69	1				
	IRL	-0.08	-0.01	-0.10	-0.10	-0.21	-0.15	0.03	0.05	0.68	0.69	0.81	0.71	1			
	FRA	-0.11	-0.16	-0.11	-0.13	-0.14	-0.39	-0.13	-0.01	0.84	0.69	0.70	0.86	0.81	1		
	DEU	-0.05	-0.14	-0.05	-0.04	0.05	-0.12	-0.30	0.05	0.69	0.69	0.68	0.69	0.69	0.70	1	
	CHE	0.05	0.02	0.02	0.03	0.00	-0.09	-0.03	0.34	0.72	0.68	0.66	0.64	0.64	0.76	0.66	1

POST-BENDING

Currently in use in Interbeef:

September 2015

(DNK, FIN, SWE → DFS)

AIM OF THE STUDY

MiX99
Solving Large Mixed Model Equations

Luke
LUONNONVARAKESKUS

Test MiX99 for VCE using Interbeef data and compare results in term of genetic correlations with those currently in use

Current required time: 4 weeks

Desired computational time: 5 days (or less)

MATERIALS AND METHODS

Interbull FTP server → January 2017 routine run

Limousine - aww

STARTING CO-VARIANCE MATRIX (ICBF)

8 POPULATIONS

NO DATA REDUCTION

POP	N. of OBS
CZE	10,379
IRL	19,413
CHE	27,215
ESP	33,191
DEU	83,648
DFS	87,780
GBR	124,890
FRA	2,625,016
TOT	*3,011,532*

MATERIALS AND METHODS

Interbull FTP server ⇨ January 2017 routine run

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MATERIALS AND METHODS

Interbull FTP server → January 2017 routine run

Limousine - aww

STARTING CO-VARIANCE MATRIX (ICBF)

3 SMALLEST POPULATIONS

NO DATA REDUCTION

POP	N. of OBS
CZE	10,379
IRL	19,413
CHE	27,215
TOT	*57,007*

MATERIALS AND METHODS

MiX99 settings	3 SMALLEST POPULATIONS	8 POPULATIONS
Model	Animal model	Animal model
EBV Convergence criteria §	1.0 e^{-4}	1.0 e^{-4}
VCE Convergence criteria §§	1.0 e^{-9}	1.0 e^{-9}
n. Samples	3	3
Convergence time	*50.5 hours*	*≈ 12 weeks*
REML rounds	*3'381*	*≈ 1'000*

§ = PCG iterations §§ = MC EM REML

RESULTS – Genetic correlations - 3 POP

MiX99

		direct			maternal		
		CZE	IRL	CHE	CZE	IRL	CHE
direct	CZE	1					
	IRL	0.76	1				
	CHE	0.82	0.64	1			
maternal	CZE	-0.27	-0.06	-0.08	1		
	IRL	-0.12	-0.29	0.04	0.50	1	
	CHE	0.18	0.11	0.54	0.58	0.46	1

DMU PRE-BENDING

		direct			maternal		
		CZE	IRL	CHE	CZE	IRL	CHE
direct	CZE	1					
	IRL	0.90	1				
	CHE	0.89	0.72	1			
maternal	CZE	-0.18	0.00	0.00	1		
	IRL	0.00	-0.21	0.00	0.70	1	
	CHE	0.00	0.00	0.34	0.74	0.66	1

MiX99 vs DMU PRE-BENDING

		direct			maternal		
		CZE	IRL	CHE	CZE	IRL	CHE
direct	CZE						
	IRL	-0.14					
	CHE	-0.07	-0.08				
maternal	CZE	-0.09	-0.06	-0.08			
	IRL	-0.12	-0.08	0.04	-0.20		
	CHE	0.18	0.11	0.20	-0.16	-0.20	

RESULTS – Genetic correlations - 3 POP

MiX99

		direct			maternal		
		CZE	IRL	CHE	CZE	IRL	CHE
direct	CZE	1					
	IRL	0.76	1				
	CHE	0.82	0.64	1			
maternal	CZE	-0.27	-0.06	-0.08	1		
	IRL	-0.12	-0.29	0.04	0.50	1	
	CHE	0.18	0.11	0.54	0.58	0.46	1

DMU PRE-BENDING

		direct			maternal		
		CZE	IRL	CHE	CZE	IRL	CHE
direct	CZE	1					
	IRL	0.90	1				
	CHE	0.89	0.72	1			
maternal	CZE	-0.18	0.00	0.00	1		
	IRL	0.00	-0.21	0.00	0.70	1	
	CHE	0.00	0.00	0.34	0.74	0.66	1

MiX99 vs DMU PRE-BENDING

		direct			maternal		
		CZE	IRL	CHE	CZE	IRL	CHE
direct	CZE						
	IRL	-0.14					
	CHE	-0.07	-0.08				
maternal	CZE	-0.09	-0.06	-0.08			
	IRL	-0.12	-0.08	0.04	-0.20		
	CHE	0.18	0.11	0.20	-0.16	-0.20	

RESULTS – Genetic correlations - 3 POP

MiX99

		direct			maternal		
		CZE	IRL	CHE	CZE	IRL	CHE
direct	CZE	1					
	IRL	0.76	1				
	CHE	0.82	0.64	1			
maternal	CZE	-0.27	-0.06	-0.08	1		
	IRL	-0.12	-0.29	0.04	0.50	1	
	CHE	0.18	0.11	0.54	0.58	0.46	1

DMU POST-BENDING

		direct			maternal		
		CZE	IRL	CHE	CZE	IRL	CHE
direct	CZE	1					
	IRL	0.85	1				
	CHE	0.86	0.72	1			
maternal	CZE	-0.18	-0.04	-0.06	1		
	IRL	-0.08	-0.21	0.05	0.68	1	
	CHE	0.05	0.00	0.34	0.72	0.64	1

MiX99 vs DMU POST-BENDING

		direct			maternal		
		CZE	IRL	CHE	CZE	IRL	CHE
direct	CZE						
	IRL	-0.09					
	CHE	-0.04	-0.08				
maternal	CZE	-0.09	-0.02	-0.02			
	IRL	-0.04	-0.08	-0.01	-0.18		
	CHE	0.13	0.11	0.20	-0.14	-0.18	

RESULTS – Genetic correlations - 8 POP

MiX99

		direct								maternal							
		CZE	DFS	ESP	GBR	IRL	FRA	DEU	CHE	CZE	DFS	ESP	GBR	IRL	FRA	DEU	CHE
direct	CZE	1															
	DFS	0.88	1														
	ESP	0.75	0.78	1													
	GBR	0.72	0.83	0.95	1												
	IRL	0.84	0.77	0.88	0.91	1											
	FRA	0.77	0.89	0.77	0.82	0.77	1										
	DEU	0.76	0.94	0.76	0.78	0.63	0.81	1									
	CHE	0.86	0.81	0.76	0.72	0.71	0.70	0.70	1								
maternal	CZE	-0.11	0.04	0.08	0.12	0.00	-0.10	0.06	0.01	1							
	DFS	-0.03	-0.12	0.04	0.01	0.00	-0.08	-0.06	0.01	0.69	1						
	ESP	0.04	0.09	-0.20	-0.07	-0.07	-0.04	0.05	0.03	0.67	0.69	1					
	GBR	0.14	0.06	-0.02	-0.09	-0.02	-0.14	0.06	0.09	0.79	0.70	0.70	1				
	IRL	-0.03	0.06	-0.05	-0.05	-0.17	-0.11	0.11	0.11	0.70	0.69	0.82	0.72	1			
	FRA	-0.02	-0.06	-0.03	-0.06	-0.08	-0.33	-0.02	0.08	0.85	0.70	0.72	0.88	0.82	1		
	DEU	-0.01	-0.08	-0.01	0.00	0.08	-0.09	-0.24	0.10	0.69	0.69	0.68	0.70	0.69	0.71	1	
	CHE	0.12	0.10	0.07	0.09	0.04	-0.05	0.05	0.40	0.73	0.69	0.67	0.66	0.66	0.77	0.67	1

RESULTS – Genetic correlations - 8 POP

MiX99 vs DMU post-bending

		direct								maternal							
		CZE	DFS	ESP	GBR	IRL	FRA	DEU	CHE	CZE	DFS	ESP	GBR	IRL	FRA	DEU	CHE
direct	CZE																
	DFS	0.00															
	ESP	-0.02	-0.01														
	GBR	-0.02	-0.01	0.00													
	IRL	-0.01	-0.01	-0.01	-0.01												
	FRA	-0.02	-0.02	-0.02	-0.02	-0.02											
	DEU	-0.01	0.00	-0.01	-0.01	-0.02	-0.02										
	CHE	0.00	-0.01	-0.01	-0.01	-0.01	-0.02	-0.01									
maternal	CZE	0.07	0.09	0.06	0.06	0.04	0.05	0.08	0.07								
	DFS	0.03	0.04	0.03	0.03	0.02	0.02	-0.17	0.03	0.01							
	ESP	0.05	0.06	0.04	0.04	0.03	0.03	0.07	0.05	0.02	0.00						
	GBR	0.07	0.09	0.06	0.06	0.05	0.05	0.09	0.07	0.02	0.01	0.01					
	IRL	0.05	0.07	0.05	0.05	0.04	0.04	0.08	0.06	0.02	0.00	0.01	0.01				
	FRA	0.09	0.10	0.08	0.07	0.06	0.06	0.11	0.09	0.01	0.01	0.02	0.02	0.01			
	DEU	0.04	0.06	0.04	0.04	0.03	0.03	0.06	0.05	0.00	0.00	0.00	0.01	0.00	0.01		
	CHE	0.07	0.08	0.05	0.06	0.04	0.04	0.08	0.06	0.01	0.01	0.01	0.02	0.02	0.01	0.01	

RESULTS – Genetic correlations - 8 POP

MiX99 vs DMU post-bending

		direct								maternal							
		CZE	DFS	ESP	GBR	IRL	FRA	DEU	CHE	CZE	DFS	ESP	GBR	IRL	FRA	DEU	CHE
direct	CZE																
	DFS	0.00															
	ESP	-0.02	-0.01														
	GBR	-0.02	-0.01	0.00													
	IRL	-0.01	-0.01	-0.01	-0.01												
	FRA	-0.02	-0.02	-0.02	-0.02	-0.02											
	DEU	-0.01	0.00	-0.01	-0.01	-0.02	-0.02										
	CHE	0.00	-0.01	-0.01	-0.01	-0.01	-0.02	-0.01									
maternal	CZE	0.07	0.09	0.06	0.06	0.04	0.05	0.08	0.07								
	DFS	0.03	0.04	0.03	0.03	0.02	0.02	-0.17	0.03	0.01							
	ESP	0.05	0.06	0.04	0.04	0.03	0.03	0.07	0.05	0.02	0.00						
	GBR	0.07	0.09	0.06	0.06	0.05	0.05	0.09	0.07	0.02	0.01	0.01					
	IRL	0.05	0.07	0.05	0.05	0.04	0.04	0.08	0.06	0.02	0.00	0.01	0.01				
	FRA	0.09	0.10	0.08	0.07	0.06	0.06	0.11	0.09	0.01	0.01	0.02	0.02	0.01			
	DEU	0.04	0.06	0.04	0.04	0.03	0.03	0.06	0.05	0.00	0.00	0.00	0.01	0.00	0.01		
	CHE	0.07	0.08	0.05	0.06	0.04	0.04	0.08	0.06	0.01	0.01	0.01	0.02	0.02	0.01	0.01	

CONCLUSIONS

MiX99 can estimate all genetic correlations between populations:

both for direct and maternal effect

MiX99 can handle data from all 8 POP without animal sub-settings

Time required is a critical point

Many possibilities to achieve desired computational time 5 days (or less)

FUTURE DEVELOPEMENTS

Apply settings tested on the 3 smallest POP on all 8 POP

Reducing input data (FRA):

- apply ICBF animal sub-setting criteria
- apply new methods of animal sub-setting

Simultaneous estimations → bivariate estimation

Parallel processing

Charolais

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