

Introduction

The latest routine international evaluation for udder traits took place as scheduled at the Interbull Centre. Data from thirty-three (33) countries were included in this evaluation.

International genetic evaluations for udder health traits of bulls from Australia, Austria-Germany, Belgium, Canada, Croatia, Czech Republic, Denmark-Finland-Sweden, Estonia, France, Hungary, Ireland, Israel, Italy, Japan, Netherlands, New Zealand, Norway, South Africa, Slovak Republic, Spain, Switzerland, the United Kingdom, the United States of America, Poland, Lithuania, Latvia, Croatia, Slovenia, Portugal and Uruguay were computed. Brown Swiss, Holstein, Red Dairy Cattle, Guernsey, Jersey and Simmental breed data were included in this evaluation.

Countries sending real MAS data (other countries participate to the MAS evaluation using SCS data as predictor):

HOL : DFS, NLD, FRA, CAN, ITA
RDC : DFS, NLD, CAN
BSW : NLD, FRA
JER : DFS, NLD, CAN
SIM : NLD
GUE : No evaluation for MAS yet

Changes in national procedures

Changes in the national genetic evaluation of udder health traits are as follows:

CZE (HOL)	Base change from 2005 to 2010
ITA (HOL)	Change of genetic groups
ITA (SIM)	Pedigree edits
NOR (RDC)	Evaluation and EDC estimation performed by using Mix99. Inbreeding considered in setting up A-matrix. Base change
DFS (ALL)	Change in lactation weights for all traits and breeds
FRA (ALL)	Evaluation now performed by a new genetic centre, GENEVAL
CHE (HOL)	Correction in the software used for preparing the data, milking speed observations have been assigned to cows that actually didn't have it. This error has now been corrected. As a consequence many bulls loose data. Only observations made from 2005 or earlier were affected by this
CAN (ALL)	Change the proof expression for SCS to a mean of 100 and a Std. Dev of 5. Moved to an RBV scale This also affects mas for 'RDC CAM' and 'BSW' for which SCS proofs are submitted.
PRT (HOL)	Pedigree corrections
NZL (ALL)	Continues DNA parentage testing resulting in pedigree editing
EST (RDC)	Pedigree updates
SVN (ALL)	Pedigree updates and phenotypic data improvement

INTERBULL CHANGES COMPARED TO THE DECEMBER ROUTINE RUN

----- Subsetting: -----

As decided by the ITC in Orlando, new subsetting was introduced in the september test run. Sub-setting is necessary for operational purposes and restrictions of time scales. To minimize the effect of subsetting, larger subsets with 10-12 countries and with 4 link providing countries have been applied.

Window: -----

According to the decision taken by ITC in Orlando, the following changes have been introduced in regards to the windows used for post processing:

The upper bounds have been set to 0.99 as these were judged to have

very little effect on evaluations. The lower values have been set to about the 25% percentile value. The largest changes are for the lower values for conformation traits, with the lowest window being 40% for OFL otherwise it is about 50% for all other confirmation traits. It is anticipated that these low values may not have large impact on evaluations since there were very few countries combinations whose estimated correlations fell between the old limit of 0.30 and these new limits.

DATA AND METHOD OF ANALYSIS

Data were national genetic evaluations of AI sampled bulls with at least 10 daughters or 10 EDC (for clinical mastitis and maternal calving traits at least 50 daughters or 50 EDC, and for direct calving traits at least 50 calvings or 50 EDC) in at least 10 herds. Table 1 presents the amount of data included in this Interbull evaluation for all breeds.

National proofs were first de-regressed within country and then analysed jointly with a linear model including the effects of evaluation country, genetic group of bull and bull merit. Heritability estimates used in both the de-regression and international evaluation were as in each country's national evaluation.

Table 2 presents the date of evaluation as supplied by each country

Estimated genetic parameters and sire standard deviations are shown in APPENDIX I and the corresponding number of common bulls are listed in APPENDIX II.

SCIENTIFIC LITERATURE

The international genetic evaluation procedure is based on international work described in the following scientific publications:

International genetic evaluation computation:

Schaeffer. 1994. J. Dairy Sci. 77:2671-2678
Klei, 1998. Interbull Bulletin 17:3-7

Verification and Genetic trend validation:

Klei et al., 2002. Interbull Bulletin 29:178-182.
Boichard et al., 1995. J. Dairy Sci. 78:431-437

Weighting factors:

Fikse and Banos, 2001. J. Dairy Sci. 84:1759-1767

De-regression:

Sigurdsson and G. Banos. 1995. Acta Agric. Scand. 45:207-219
Jairath et al. 1998. J. Dairy Sci. Vol. 81:550-562

Genetic parameter estimation:

Klei and Weigel, 1998, Interbull Bulletin 17:8-14
Sullivan, 1999. Interbull Bulletin 22:146-148

Post-processing of estimated genetic correlations:

Mark et al., 2003, Interbull Bulletin 30:126-135
Jorjani et al., 2003. J. Dairy Sci. 86:677-679
<https://wiki.interbull.org/public/rG%20procedure?action=print>

Time edits

Weigel and Banos. 1997. J. Dairy Sci. 80:3425-3430

International reliability estimation

Harris and Johnson. 1998. Interbull Bulletin 17:31-36

NEXT ROUTINE INTERNATIONAL EVALUATION

Dates for the next routine evaluation can be found on
<http://www.interbull.org/ib/servicecalendar>.

NEXT TEST INTERNATIONAL EVALUATION

Dates for the next test run can be found on
<http://www.interbull.org/ib/servicecalendar>.
 PUBLICATION OF INTERBULL TEST RUN

Test evaluation results are meant for review purposes only and should not be published.

^LTable 1. National evaluation data considered in the Interbull evaluation for udder health (December Routine Evaluation 2018).
 Number of records for milk somatic cells by breed

Country	BSW	GUE	HOL	JER	RDC	SIM
AUS		125	7576	1512	683	
BEL			1972			
CAN	222	97	12045	713	798	
CHE	2892		3315	84		3176
CZE			3870			
DEA	5524					22091
DEU			27429		428	
DFS			13060	2120	7786	
ESP			3791			
EST			1112		422	
FRA	379		16942			452
FRM						4244
GBR	112	272	6577	681	499	83
HUN			2757			165
IRL			2452			
ISR			1406			
ITA	1885		9535			1477
JPN			5967			
KOR			1245			
LTU			786		435	
LVA			527		564	
NLD	190		15461	156	83	389
NOR					4128	
NZL	50	57	7661	4509	1305	
POL			10256			
PRT			2399			
SVK			1093			562
SVN	359		528			600
URY			1687			
USA	1061	693	37800	4451	670	49
ZAF			1183	575	122	
HRV			721			799
MEX						
CAM					37	
=====						
No. Records	12674	1244	201153	14801	17960	34087
Pub. Proofs	10324	970	153035	12217	17198	30602
=====						

^LAPPENDIX I. Sire standard deviations in diagonal and genetic correlations below diagonal

BSW	scs									
	CAN	FRA	NLD	USA	CHE	DEA	NZL	ITA	GBR	SVN

CAN	5.71									
FRA	0.90	1.03								
NLD	0.88	0.92	3.72							
USA	0.88	0.91	0.88	0.21						
CHE	0.92	0.94	0.94	0.88	10.59					
DEA	0.92	0.96	0.92	0.88	0.97	11.94				
NZL	0.87	0.87	0.87	0.86	0.87	0.87	0.37			
ITA	0.89	0.90	0.88	0.89	0.95	0.91	0.87	16.91		
GBR	0.89	0.96	0.95	0.91	0.94	0.95	0.89	0.89	12.78	
SVN	0.89	0.89	0.89	0.89	0.89	0.89	0.88	0.89	0.89	10.49

BSW mas

	CAN	FRA	NLD	USA	CHE	DEA	NZL	ITA	GBR	SVN
CAN	5.71									
FRA	0.92	1.06								
NLD	0.89	0.88	3.74							
USA	0.88	0.88	0.88	0.21						
CHE	0.91	0.89	0.90	0.89	10.59					
DEA	0.93	0.87	0.89	0.88	0.93	11.94				
NZL	0.90	0.89	0.89	0.87	0.87	0.87	0.37			
ITA	0.89	0.88	0.89	0.88	0.92	0.91	0.87	16.91		
GBR	0.89	0.88	0.88	0.89	0.90	0.90	0.89	0.89	2.82	
SVN	0.89	0.89	0.89	0.89	0.89	0.89	0.88	0.89	0.89	10.49

GUE scs

	CAN	GBR	USA	AUS	NZL
CAN	5.91				
GBR	0.88	13.47			
USA	0.88	0.90	0.25		
AUS	0.89	0.91	0.87	28.45	
NZL	0.87	0.89	0.86	0.92	0.63

HOL scs

	CAN	CHE	DEU	DFS	EST	FRA	GBR	NLD	USA	ISR	ITA	AUS	HUN	BEL	JPN	ESP	ZAF	NZL	IRL	CZE	SVK	POL	LTU	LVA	PRT	KOR	SVN	HRV	URY	
CAN	5.76																													
CHE	0.89	11.15																												
DEU	0.93	0.94	12.70																											
DFS	0.92	0.93	0.96	11.86																										
EST	0.88	0.89	0.93	0.92	13.55																									
FRA	0.94	0.93	0.95	0.97	0.91	1.19																								
GBR	0.94	0.94	0.95	0.94	0.90	0.96	12.75																							
NLD	0.91	0.94	0.95	0.94	0.91	0.94	0.96	4.21																						
USA	0.94	0.88	0.89	0.88	0.90	0.90	0.90	0.88	0.21																					
ISR	0.84	0.84	0.85	0.84	0.86	0.85	0.83	0.83	0.88	0.24																				
ITA	0.90	0.89	0.94	0.92	0.93	0.92	0.90	0.88	0.89	0.85	5.82																			
AUS	0.87	0.92	0.90	0.90	0.86	0.91	0.94	0.93	0.86	0.82	0.86	30.25																		
HUN	0.88	0.90	0.92	0.91	0.90	0.91	0.89	0.88	0.92	0.88	0.93	0.86	1.43																	
BEL	0.91	0.93	0.96	0.96	0.95	0.95	0.94	0.94	0.89	0.84	0.94	0.89	0.92	0.52																
JPN	0.88	0.88	0.88	0.89	0.87	0.90	0.88	0.88	0.88	0.83	0.88	0.86	0.88	0.88	0.42															
ESP	0.92	0.92	0.95	0.94	0.94	0.96	0.93	0.91	0.91	0.88	0.95	0.88	0.93	0.96	0.88	11.54														
ZAF	0.90	0.90	0.92	0.90	0.88	0.93	0.92	0.89	0.89	0.86	0.92	0.90	0.91	0.91	0.88	0.95	26.47													
NZL	0.86	0.86	0.86	0.86	0.85	0.86	0.89	0.87	0.85	0.82	0.85	0.96	0.85	0.86	0.85	0.85	0.86	0.40												
IRL	0.88	0.93	0.93	0.93	0.90	0.93	0.95	0.93	0.86	0.82	0.88	0.95	0.86	0.93	0.86	0.92	0.91	0.92	0.11											
CZE	0.88	0.88	0.90	0.88	0.88	0.89	0.88	0.88	0.88	0.84	0.90	0.86	0.89	0.89	0.88	0.91	0.88	0.86	0.86	17.16										
SVK	0.88	0.89	0.91	0.89	0.88	0.90	0.87	0.87	0.88	0.83	0.89	0.85	0.95	0.90	0.88	0.91	0.88	0.85	0.86	0.88	0.42									
POL	0.89	0.92	0.96	0.95	0.94	0.93	0.91	0.91	0.88	0.85	0.94	0.87	0.94	0.96	0.88	0.95	0.90	0.86	0.89	0.90	0.90	9.93								
LTU	0.88	0.88	0.90	0.88	0.92	0.88	0.88	0.88	0.88	0.85	0.88	0.86	0.88	0.92	0.88	0.89	0.88	0.86	0.86	0.88	0.88	0.89	0.35							
LVA	0.88	0.89	0.94	0.92	0.93	0.89	0.89	0.89	0.88	0.81	0.91	0.87	0.88	0.94	0.87	0.89	0.87	0.85	0.90	0.88	0.87	0.93	0.92	0.48						
PRT	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.84	0.88	0.86	0.88	0.88	0.88	0.88	0.88	0.86	0.86	0.88	0.88	0.88	0.88	0.88	0.46					
KOR	0.88	0.87	0.88	0.90	0.88	0.88	0.88	0.87	0.88	0.83	0.89	0.85	0.88	0.89	0.88	0.90	0.88	0.85	0.86	0.88	0.87	0.92	0.88	0.89	0.88	0.34				

SVN	0.88	0.87	0.88	0.88	0.87	0.87	0.87	0.87	0.88	0.83	0.88	0.85	0.87	0.88	0.88	0.88	0.87	0.85	0.87	0.88	0.87	0.88	0.88	0.88	0.87	10.74			
HRV	0.88	0.87	0.88	0.88	0.87	0.87	0.88	0.88	0.88	0.83	0.88	0.86	0.88	0.88	0.88	0.88	0.87	0.85	0.85	0.88	0.87	0.88	0.88	0.88	0.88	0.87	0.87	11.78	
URY	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.84	0.88	0.86	0.88	0.88	0.88	0.88	0.88	0.86	0.86	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.20

HOL mas

	CAN	CHE	DEU	DFS	EST	FRA	GBR	NLD	USA	ISR	ITA	AUS	HUN	BEL	JPN	ESP	ZAF	NZL	IRL	CZE	SVK	POL	LTU	LVA	PRT	KOR	SVN	HRV	URY
CAN	7.58																												
CHE	0.88	11.14																											
DEU	0.87	0.93	12.71																										
DFS	0.94	0.88	0.87	12.44																									
EST	0.85	0.87	0.92	0.86	13.57																								
FRA	0.96	0.88	0.87	0.94	0.85	1.21																							
GBR	0.88	0.89	0.89	0.88	0.88	0.88	2.50																						
NLD	0.87	0.91	0.93	0.88	0.90	0.88	0.88	4.82																					
USA	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.21																				
ISR	0.81	0.80	0.83	0.81	0.84	0.81	0.83	0.83	0.84	0.24																			
ITA	0.87	0.89	0.90	0.87	0.88	0.88	0.88	0.89	0.88	0.83	6.02																		
AUS	0.87	0.91	0.90	0.87	0.85	0.86	0.89	0.89	0.86	0.81	0.86	30.26																	
HUN	0.87	0.89	0.92	0.87	0.90	0.87	0.88	0.90	0.90	0.86	0.91	0.86	1.43																
BEL	0.87	0.93	0.97	0.87	0.94	0.87	0.89	0.94	0.88	0.82	0.90	0.90	0.93	0.52															
JPN	0.86	0.87	0.88	0.86	0.86	0.86	0.88	0.87	0.88	0.81	0.88	0.86	0.87	0.87	0.42														
ESP	0.87	0.92	0.96	0.87	0.92	0.88	0.89	0.92	0.89	0.86	0.90	0.88	0.93	0.96	0.88	11.54													
ZAF	0.87	0.88	0.92	0.87	0.87	0.87	0.88	0.89	0.88	0.85	0.89	0.90	0.91	0.92	0.87	0.95	26.37												
NZL	0.86	0.86	0.86	0.87	0.83	0.86	0.89	0.87	0.85	0.81	0.85	0.96	0.85	0.86	0.85	0.85	0.86	0.40											
IRL	0.88	0.93	0.92	0.88	0.88	0.88	0.89	0.89	0.86	0.82	0.86	0.94	0.86	0.93	0.86	0.92	0.90	0.92	0.11										
CZE	0.87	0.88	0.90	0.87	0.88	0.87	0.88	0.88	0.88	0.82	0.88	0.85	0.90	0.89	0.88	0.91	0.88	0.85	0.86	17.16									
SVK	0.85	0.87	0.90	0.86	0.88	0.86	0.88	0.88	0.87	0.81	0.88	0.85	0.95	0.90	0.87	0.90	0.87	0.84	0.85	0.86	0.42								
POL	0.88	0.93	0.96	0.88	0.92	0.88	0.88	0.92	0.88	0.83	0.90	0.88	0.94	0.96	0.88	0.95	0.90	0.86	0.89	0.90	0.90	9.93							
LTU	0.88	0.87	0.90	0.88	0.91	0.88	0.88	0.88	0.88	0.84	0.88	0.87	0.88	0.90	0.88	0.89	0.87	0.86	0.86	0.88	0.88	0.90	0.35						
LVA	0.86	0.86	0.93	0.86	0.92	0.86	0.87	0.88	0.87	0.80	0.88	0.86	0.87	0.93	0.87	0.88	0.86	0.83	0.88	0.87	0.86	0.92	0.91	0.48					
PRT	0.88	0.88	0.88	0.88	0.87	0.88	0.88	0.88	0.88	0.83	0.88	0.86	0.88	0.88	0.88	0.88	0.88	0.86	0.86	0.88	0.88	0.88	0.88	0.87	0.46				
KOR	0.86	0.88	0.87	0.86	0.85	0.87	0.88	0.87	0.88	0.80	0.88	0.85	0.87	0.89	0.87	0.90	0.87	0.85	0.85	0.87	0.86	0.91	0.88	0.88	0.88	0.34			
SVN	0.86	0.85	0.87	0.86	0.86	0.86	0.87	0.87	0.87	0.81	0.87	0.85	0.87	0.88	0.87	0.87	0.86	0.84	0.87	0.87	0.85	0.87	0.87	0.87	0.87	0.85	10.74		
HRV	0.85	0.84	0.87	0.86	0.86	0.85	0.88	0.87	0.87	0.82	0.87	0.85	0.87	0.87	0.87	0.87	0.86	0.84	0.85	0.87	0.86	0.88	0.88	0.88	0.88	0.85	0.87	11.78	
URY	0.88	0.87	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.84	0.88	0.87	0.88	0.88	0.88	0.88	0.88	0.86	0.86	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.20

JER scs

	CAN	DFS	GBR	NLD	USA	AUS	ZAF	NZL	CHE
CAN	6.29								
DFS	0.89	12.36							
GBR	0.90	0.91	11.16						
NLD	0.89	0.95	0.95	3.66					
USA	0.88	0.88	0.89	0.88	0.19				
AUS	0.88	0.89	0.90	0.90	0.86	29.11			
ZAF	0.88	0.88	0.89	0.90	0.88	0.91	21.41		
NZL	0.88	0.88	0.89	0.88	0.86	0.96	0.86	0.38	
CHE	0.89	0.91	0.91	0.93	0.88	0.88	0.89	0.87	11.80

JER mas

	CAN	DFS	GBR	NLD	USA	AUS	ZAF	NZL	CHE
CAN	7.45								
DFS	0.94	12.33							
GBR	0.88	0.89	1.83						
NLD	0.88	0.88	0.89	4.01					
USA	0.88	0.88	0.88	0.89	0.19				
AUS	0.88	0.88	0.89	0.89	0.86	29.13			
ZAF	0.88	0.87	0.88	0.89	0.88	0.92	21.41		
NZL	0.89	0.88	0.89	0.89	0.86	0.96	0.86	0.38	
CHE	0.89	0.89	0.89	0.89	0.89	0.88	0.89	0.87	11.80

RDC scs														
	CAN	DFS	GBR	NOR	USA	DEU	AUS	EST	ZAF	NZL	LTU	LVA	NLD	CAM
CAN	5.48													
DFS	0.94	12.83												
GBR	0.93	0.92	11.43											
NOR	0.92	0.92	0.89	13.67										
USA	0.92	0.88	0.89	0.89	0.24									
DEU	0.93	0.95	0.94	0.90	0.89	13.62								
AUS	0.89	0.93	0.93	0.91	0.86	0.91	31.24							
EST	0.89	0.94	0.91	0.90	0.90	0.95	0.91	12.00						
ZAF	0.89	0.90	0.91	0.93	0.89	0.92	0.88	0.90	25.06					
NZL	0.88	0.88	0.89	0.90	0.86	0.87	0.96	0.88	0.86	0.41				
LTU	0.90	0.90	0.89	0.90	0.89	0.89	0.88	0.91	0.91	0.87	0.34			
LVA	0.90	0.89	0.90	0.90	0.89	0.94	0.91	0.96	0.89	0.88	0.90	0.44		
NLD	0.91	0.95	0.96	0.90	0.88	0.95	0.93	0.92	0.90	0.87	0.89	0.90	3.90	
CAM	0.94	0.94	0.94	0.93	0.90	0.94	0.93	0.94	0.93	0.90	0.93	0.93	0.94	5.75

RDC mas														
	CAN	DFS	GBR	NOR	USA	DEU	AUS	EST	ZAF	NZL	LTU	LVA	NLD	CAM
CAN	7.84													
DFS	0.91	13.42												
GBR	0.88	0.88	1.97											
NOR	0.92	0.88	0.89	13.67										
USA	0.88	0.88	0.88	0.89	0.24									
DEU	0.87	0.87	0.89	0.90	0.88	13.62								
AUS	0.88	0.87	0.89	0.90	0.86	0.91	31.29							
EST	0.87	0.86	0.89	0.90	0.89	0.93	0.88	12.00						
ZAF	0.89	0.88	0.89	0.93	0.89	0.92	0.89	0.90	25.17					
NZL	0.88	0.87	0.89	0.90	0.86	0.87	0.96	0.87	0.87	0.41				
LTU	0.88	0.86	0.89	0.90	0.89	0.89	0.88	0.92	0.90	0.87	0.34			
LVA	0.87	0.85	0.89	0.90	0.88	0.94	0.91	0.95	0.88	0.88	0.91	0.44		
NLD	0.88	0.88	0.88	0.90	0.89	0.93	0.89	0.91	0.89	0.88	0.89	0.90	4.16	
CAM	0.93	0.93	0.93	0.93	0.90	0.94	0.92	0.94	0.93	0.92	0.93	0.94	0.94	5.75

SIM scs												
	FRM	FRA	ITA	NLD	CHE	DEA	HUN	SVK	SVN	GBR	HRV	USA
FRM	1.09											
FRA	0.93	1.03										
ITA	0.94	0.90	13.73									
NLD	0.91	0.93	0.88	3.87								
CHE	0.93	0.93	0.90	0.93	10.60							
DEA	0.92	0.93	0.88	0.90	0.89	12.18						
HUN	0.93	0.91	0.93	0.88	0.90	0.94	15.91					
SVK	0.89	0.89	0.89	0.91	0.90	0.88	0.94	0.39				
SVN	0.90	0.89	0.89	0.89	0.90	0.88	0.90	0.89	8.94			
GBR	0.92	0.96	0.89	0.95	0.91	0.93	0.89	0.89	0.88	11.67		
HRV	0.93	0.88	0.88	0.88	0.89	0.88	0.89	0.89	0.89	0.88	10.07	
USA	0.89	0.90	0.89	0.88	0.89	0.90	0.92	0.89	0.89	0.90	0.88	0.22

SIM mas												
	FRM	FRA	ITA	NLD	CHE	DEA	HUN	SVK	SVN	GBR	HRV	USA
FRM	1.08											
FRA	0.92	1.00										
ITA	0.95	0.88	13.73									
NLD	0.88	0.88	0.88	3.82								
CHE	0.93	0.90	0.91	0.91	10.60							
DEA	0.91	0.92	0.88	0.88	0.89	12.18						
HUN	0.93	0.88	0.91	0.91	0.91	0.93	15.91					

SVK	0.89	0.88	0.89	0.89	0.91	0.88	0.94	0.39				
SVN	0.90	0.89	0.89	0.88	0.89	0.88	0.89	0.89	8.94			
GBR	0.90	0.88	0.88	0.89	0.90	0.90	0.88	0.89	0.88	2.62		
HRV	0.92	0.88	0.88	0.88	0.89	0.88	0.89	0.88	0.89	0.88	10.07	
USA	0.89	0.88	0.89	0.89	0.89	0.90	0.91	0.89	0.89	0.89	0.88	0.22

^LAPPENDIX II. Number of common bulls

BSW

common bulls below diagonal
common three quarter sib group above diagonal

	CAN	FRA	NLD	USA	CHE	DEA	NZL	ITA	GBR	SVN
CAN	0	77	50	159	122	127	22	114	57	30
FRA	68	0	80	117	153	201	21	175	50	51
NLD	47	66	0	76	90	142	23	119	38	41
USA	147	79	66	0	310	306	28	215	77	39
CHE	97	114	84	290	0	558	24	416	63	73
DEA	106	150	136	270	459	0	32	595	65	96
NZL	20	17	16	25	19	27	0	26	17	8
ITA	96	140	100	149	362	498	19	0	65	91
GBR	54	41	30	72	49	45	15	47	0	20
SVN	26	50	42	32	70	89	7	90	16	0

BSW

common bulls below diagonal
common three quarter sib group above diagonal

	CAN	FRA	NLD	USA	CHE	DEA	NZL	ITA	GBR	SVN
CAN	0	71	48	159	122	127	22	114	28	30
FRA	63	0	66	103	151	187	18	163	26	50
NLD	43	56	0	70	82	129	23	109	19	37
USA	147	71	60	0	310	306	28	215	35	39
CHE	97	113	77	290	0	558	24	416	32	73
DEA	106	140	121	270	459	0	32	595	31	96
NZL	20	15	16	25	19	27	0	26	10	8
ITA	96	133	90	149	362	498	19	0	32	91
GBR	26	21	15	33	26	23	8	25	0	12
SVN	26	49	38	32	70	89	7	90	10	0

GUE

common bulls below diagonal
common three quarter sib group above diagonal

	CAN	GBR	USA	AUS	NZL
CAN	0	29	67	44	13
GBR	24	0	85	33	13
USA	58	87	0	57	29
AUS	42	28	54	0	26
NZL	11	11	29	26	0

GUE

HOL

common bulls below diagonal
common three quarter sib group above diagonal

	CAN	CHE	DEU	DFS	EST	FRA	GBR	NLD	USA	ISR	ITA	AUS	HUN	BEL	JPN	ESP	ZAF	NZL	IRL	CZE	SVK	POL	LTU	LVA	PRT	KOR	SVN	HRV	URY
CAN	0	795	2261	1269	216	1339	1407	1334	3016	106	1544	1222	895	719	1243	1195	465	666	429	936	399	1195	224	191	951	585	179	246	667
CHE	632	0	1104	670	150	627	633	835	934	57	678	553	417	567	447	534	259	376	328	478	223	620	116	138	487	233	129	181	291
DEU	1473	950	0	2676	379	2470	1972	3370	3514	153	2472	1578	1195	1206	1443	1498	570	945	731	1696	707	2241	476	306	1222	563	285	563	731


```

common three quarter sib group above diagonal
      CAN  DFS  GBR  NLD  USA  AUS  ZAF  NZL  CHE
-----
CAN   0   73  140   33  386  228  139  159   35
DFS   57   0  134   93  148  119  121  114   52
GBR  141  122   0   74  210  186  151  193   64
NLD   27   90   68   0   79   64   66   68   37
USA  398  118  229   84   0  442  268  332   61
AUS  232   83  194   55  475   0  207  391   48
ZAF  134   97  152   61  281  200   0  182   51
NZL  168   86  198   60  402  435  191   0   48
CHE   28   47   62   32   61   40   46   40   0
-----

```

JER

```

common bulls below diagonal
common three quarter sib group above diagonal
      CAN  DFS  GBR  NLD  USA  AUS  ZAF  NZL  CHE
-----
CAN   0   31   63   14  139   95   61   65   22
DFS  25   0   87   77  137  107  111  106   51
GBR  59   79   0   53  156  132  112  131   60
NLD   8   70   48   0   71   63   65   63   35
USA  131  97  165   76   0  442  268  332   61
AUS  85   69  134   54  475   0  207  390   48
ZAF  54   85  113   60  281  200   0  182   51
NZL  63   75  133   55  402  434  191   0   48
CHE  18   46   55   30   61   40   46   40   0
-----

```

RDC

```

common bulls below diagonal
common three quarter sib group above diagonal
      CAN  DFS  GBR  NOR  USA  DEU  AUS  EST  ZAF  NZL  LTU  LVA  NLD  CAM
-----
CAN   0  145   75   5  188   15   92   2   69   80   17   7   6   0
DFS  146   0   95  118  173   68  165   91   50  155  115   91  51   0
GBR   75   88   0   44  100   19   73   6   36   71   26  11  30   0
NOR   5   91   46   0   68   19   57  16   0   39   27  17  39   0
USA  175  168   95   69   0   29  110  17   58  109  37  15  37  20
DEU  14   58  18  19  28   0  43  26   2  22  39  29  16   0
AUS  93  138   69  48  111  42   0  24  32  125  44  27  25   9
EST   2   80   5  16  16  25  22   0   0   7  25  36  13   0
ZAF  71  47  32   0  52   2  32   0   0  32   5   1   3   0
NZL  77  150  66  38  109  21  127  6  28  0  28  13  19  10
LTU  16   98  24  22  30  35  40  24  5  24  0  38  17   0
LVA   7   59  11  15  11  23  25  28  1  10  32  0   9   0
NLD   6   50  29  39  35  16  23  12  3  18  14  8   0   0
CAM   0   0   0   0  20   0   9   0   0  10  0  0  0  0
-----

```

RDC

```

common bulls below diagonal
common three quarter sib group above diagonal
      CAN  DFS  GBR  NOR  USA  DEU  AUS  EST  ZAF  NZL  LTU  LVA  NLD  CAM
-----
CAN   0   67  24   3  68   8  30   0  35  30  13  4  3  0
DFS  67   0  66  120  166  68  183  91  45  153  114  92  45  0
GBR  24   61   0  41  67  16  47  4  22  49  20  9  21  0
NOR   3   92  43   0  68  19  57  16  0  39  27  17  33  0
USA  67  161  66  69   0  29  108  17  53  106  37  15  33  20
DEU   8   58  16  19  28   0  43  26  2  22  39  29  16  0
AUS  30  158  45  48  110  42   0  24  30  124  44  27  23  9
EST   0   80  4  16  16  25  22  0  0  7  25  36  13  0
ZAF  36  45  21  0  51  2  32  0  0  30  5  1  2  0
NZL  30  146  47  38  109  21  126  6  28  0  28  13  16  10
-----

```

LTU	12	97	18	22	30	35	40	24	5	24	0	38	16	0
LVA	4	59	9	15	11	23	25	28	1	10	32	0	8	0
NLD	3	43	21	33	32	16	21	12	2	15	13	7	0	0
CAM	0	0	0	0	20	0	9	0	0	10	0	0	0	0

SIM

common bulls below diagonal
common three quarter sib group above diagonal

	FRM	FRA	ITA	NLD	CHE	DEA	HUN	SVK	SVN	GBR	HRV	USA
FRM	0	3	158	112	183	227	2	57	17	65	2	33
FRA	1	0	138	60	12	252	5	54	53	0	84	1
ITA	192	123	0	185	86	788	14	136	102	44	211	21
NLD	139	58	182	0	82	279	7	63	48	48	89	16
CHE	234	9	88	87	0	298	2	31	5	51	1	19
DEA	267	212	691	293	262	0	30	366	178	47	503	19
HUN	0	4	11	7	1	19	0	9	8	0	15	0
SVK	57	45	114	54	26	373	8	0	44	11	87	4
SVN	17	50	96	46	5	164	7	43	0	0	69	0
GBR	83	0	48	48	58	50	0	6	0	0	0	19
HRV	1	78	200	86	1	526	13	69	59	0	0	1
USA	48	1	28	19	20	25	0	4	0	27	1	0

SIM

common bulls below diagonal
common three quarter sib group above diagonal

	FRM	FRA	ITA	NLD	CHE	DEA	HUN	SVK	SVN	GBR	HRV	USA
FRM	0	2	153	103	175	210	2	57	17	24	2	31
FRA	1	0	86	31	8	159	3	39	34	0	58	1
ITA	188	75	0	174	86	786	14	136	102	18	211	21
NLD	126	30	170	0	80	257	7	62	45	17	85	16
CHE	226	5	88	81	0	298	2	31	5	20	1	19
DEA	254	122	691	270	262	0	30	366	178	18	503	19
HUN	0	2	11	7	1	19	0	9	8	0	15	0
SVK	57	31	114	53	26	373	8	0	44	5	87	4
SVN	17	29	96	43	5	164	7	43	0	0	69	0
GBR	31	0	22	19	24	23	0	5	0	0	0	16
HRV	1	51	200	83	1	526	13	69	59	0	0	1
USA	46	1	28	19	20	25	0	4	0	21	1	0