

Introduction

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

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

Changes in national procedures

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

POL (HOL)	Decrease in information due to pedigree verification
JPN (HOL)	Decrease in information due to pedigree verification
FRA (HOL,SIM, FRM)	Decrease in information due to pedigree verification
CHE (BSW, HOL)	Decrease in information due to the database edits and also the change of herd-year-season assignment of certain data records
ITA (HOL, JER)	Decrease in information due to a four month cut-off of data
ITA (SIM)	Decrease in information due to pedigree verification
AUS (ALL)	Decrease in information due to pedigree verification
DEA (ALL)	Decrease in information due to pedigree verification
ISR (HOL)	Decrease in information due to pedigree verification and closing or combining of herds.
EST (ALL)	Decrease in information due to pedigree verification
ESP (HOL)	Base change. Some change in information due to changes in the database, in some cases there is even a change to non official proof.
ZAF (ALL)	Base change
USA (ALL)	Decrease in information due to pedigree verification and herd-year minimum edits.
NLD (ALL)	Some changes in Type of Proofs due to harmonisation of this record
NZL (ALL)	Base change, drops in information due to a continuos parenting testing and herds records being updated
GBR (HOL)	Drops in information due to updates by milk recording agents and data edits.
DEU (ALL)	overall base change. cowbase previous routine run 2504r: 201901 - 202112, cowbase current routine run 2508r: 201905 - 202204

INTERBULL CHANGES COMPARED TO THE PREVIOUS ROUTINE RUN

A new document called confdoc_DEFINITION{runid}.itb has been introduced reporting all the trait definitions applied by countries as reported in the PREP.

During 2023-2024, Interbull Centre and the Interbull Technical Committee (ITC) have worked on developing a new procedures for adjusting of the international correlations after a given test run in case countries would decide NOT TO implement the changes tested in the next routine run. Until now, the relative difference between the previous routineâ\200\231s and test runâ\200\231s correlations, for each pair of countries, was assessed and the average value of the two was used whenever such difference did exceed a threshold of 0.01. Otherwise, correlations from the latest test run were used. However, in some cases, the difference in correlations between routine/test runs were way above a 1% difference so that by using the average value the newly derived correlations would still be greatly affected by the changes tested but not implemented. This remark has been made in few occasions by some participating countries. A new approach proposed by Peter Sullivan, was developed and extensively tested. The new approach is based on first identifying the relative impact of the changes tested by a country during the test run (but not implemented in a routine run) and then correcting the whole correlation matrix detracting such estimated impact. This new approach would assure that the new correlations would be free from any effect from any changes tested but not implemented. The new procedure has been fully developed during 2023 and extensively tested during 2024 and introduced officially in the April 2025 routine evaluation.

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
<https://interbull.org/ib/servicecalendar>

NEXT TEST INTERNATIONAL EVALUATION

Dates for the next test run can be found on
<https://interbull.org/ib/servicecalendar>

From 2025 an extra MACE test run has been scheduled in May, data submissions' deadline and target for distribution of results are all reported in the above link.

PUBLICATION OF INTERBULL ROUTINE RUN

Results were distributed by the Interbull Centre to designated representatives in each country. The international evaluation file comprised international proofs expressed on the base and unit of each country included in the analysis. Such records readily provide more information on bull

performance in various countries, thereby minimizing the need to resort to conversions.

At the same time, all recipients of Interbull results are expected to honor the agreed code of practice, decided by the Interbull Steering Committee, and only publish international evaluations on their own country scale. Evaluations expressed on another country scale are confidential and may only be used internally for research and review purposes.

PUBLICATION OF INTERBULL TEST RUN

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

^LTable 1. Nationalevaluation data considered in the Interbull evaluation for dairy production traits (August Routine Evaluation 2025).
Number of records for milk yield by breed

Country	BSW	GUE	HOL	JER	RDC	SIM
AUS	235	154	9141	1953	888	
BEL			2457			
CAN	295	113	14456	946	908	
CHE	3324		3553	109		3805
CZE			4762			
DEA	6614					27458
DEU			25184	324	321	
DFS			14851	2429	8182	
ESP			4896			
EST			1516		509	
FRA	527		18984			516
FRM						5342
GBR	208	388	8562	1059	767	122
HUN			3306			
IRL			3471	163	62	106
ISR			1870			
ITA	2488		9279	170		2156
JPN			7261			
KOR			1955			
LTU			1005		371	
LVA			1487		677	
NLD	275		17584	364	116	590
NOR					4445	
NZL	95	64	9573	5816	1595	
POL			13296			
PRT			3187			
SVK			1232			
SVN	368		773			762
URY			1241			
USA	1264	849	43927	5709	844	122
ZAF			1317	758	144	
HRV			987			1072
CAM					51	
No.Records	15693	1568	231113	19800	19880	42051
Pub. Proofs	12320	1237	163489	15488	17387	37690

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

BSW	mil										
	CAN	FRA	USA	CHE	ITA	DEA	NLD	SVN	NZL	GBR	AUS
CAN	651.79										

AUS	0.66	0.61	13.73		
GBR	0.84	0.78	0.64	7.61	
NZL	0.62	0.59	0.79	0.63	12.64

HOL mil

	CAN	DEU	DFS	FRA	ITA	NLD	USA	CHE	GBR	NZL	AUS	BEL	IRL	ESP	CZE	SVN	EST	ISR	HUN	POL	ZAF	JPN	LVA	SVK	LTU	PRT	KOR	URY	HRV
CAN	802.25																												
DEU	0.94	647.00																											
DFS	0.92		11.23																										
FRA	0.91	0.92	0.90	619.95																									
ITA	0.88	0.87	0.87	0.88	605.73																								
NLD	0.91	0.94	0.91	0.89	0.87	666.95																							
USA	0.92	0.91	0.89	0.90	0.89	0.89	715.06																						
CHE	0.90	0.92	0.88	0.94	0.87	0.90	0.88	572.03																					
GBR	0.85	0.84	0.82	0.85	0.81	0.85	0.83	0.88	276.83																				
NZL	0.70	0.69	0.69	0.76	0.68	0.72	0.71	0.75	0.71	388.45																			
AUS	0.77	0.74	0.70	0.78	0.70	0.74	0.74	0.77	0.72	0.82	422.66																		
BEL	0.87	0.86	0.81	0.82	0.77	0.84	0.81	0.82	0.76	0.66	0.77	507.19																	
IRL	0.83	0.84	0.82	0.89	0.79	0.84	0.81	0.87	0.80	0.82	0.81	0.78	182.04																
ESP	0.93	0.92	0.89	0.92	0.90	0.90	0.91	0.89	0.82	0.67	0.75	0.86	0.82	523.14															
CZE	0.90	0.92	0.89	0.88	0.90	0.89	0.91	0.87	0.81	0.68	0.68	0.77	0.78	0.89	723.29														
SVN	0.81	0.82	0.82	0.82	0.74	0.78	0.78	0.75	0.68	0.60	0.67	0.74	0.86	0.91	0.77	0.84	11.51												
EST	0.87	0.87	0.89	0.84	0.83	0.85	0.87	0.85	0.78	0.67	0.72	0.79	0.74	0.83	0.90	0.71	583.86												
ISR	0.80	0.81	0.83	0.81	0.83	0.80	0.85	0.81	0.79	0.65	0.65	0.78	0.69	0.81	0.81	0.77	0.80	401.61											
HUN	0.86	0.87	0.84	0.87	0.87	0.83	0.90	0.82	0.78	0.65	0.68	0.76	0.74	0.86	0.91	0.77	0.84	0.82	652.54										
POL	0.90	0.90	0.87	0.90	0.86	0.87	0.88	0.86	0.80	0.66	0.77	0.83	0.80	0.89	0.88	0.79	0.85	0.79	0.88	497.97									
ZAF	0.83	0.77	0.77	0.82	0.80	0.75	0.82	0.78	0.74	0.67	0.76	0.74	0.75	0.81	0.75	0.66	0.72	0.78	0.79	0.82	539.38								
JPN	0.93	0.91	0.91	0.91	0.90	0.90	0.91	0.89	0.82	0.68	0.76	0.84	0.82	0.91	0.89	0.86	0.84	0.83	0.86	0.90	0.83	623.35							
LVA	0.75	0.75	0.72	0.76	0.69	0.70	0.75	0.74	0.68	0.64	0.65	0.68	0.72	0.73	0.68	0.66	0.75	0.78	0.76	0.74	0.71	0.73	527.83						
SVK	0.77	0.78	0.79	0.79	0.75	0.70	0.78	0.75	0.71	0.62	0.64	0.76	0.69	0.79	0.79	0.75	0.77	0.78	0.84	0.81	0.70	0.79	0.69	383.80					
LTU	0.74	0.75	0.72	0.75	0.67	0.69	0.70	0.71	0.65	0.59	0.64	0.73	0.61	0.73	0.72	0.82	0.67	0.78	0.71	0.72	0.63	0.74	0.65	0.72	412.61				
PRT	0.76	0.76	0.77	0.78	0.74	0.75	0.77	0.76	0.69	0.61	0.60	0.66	0.73	0.77	0.74	0.71	0.67	0.78	0.74	0.75	0.60	0.75	0.67	0.68	0.64	596.98			
KOR	0.85	0.80	0.79	0.79	0.78	0.77	0.85	0.78	0.70	0.70	0.74	0.81	0.72	0.84	0.76	0.77	0.75	0.79	0.79	0.77	0.77	0.86	0.74	0.76	0.70	0.67	485.82		
URY	0.71	0.69	0.67	0.75	0.68	0.68	0.70	0.71	0.63	0.76	0.73	0.70	0.71	0.70	0.65	0.64	0.67	0.77	0.69	0.73	0.74	0.67	0.71	0.62	0.64	0.60	0.69	166.51	
HRV	0.62	0.64	0.65	0.66	0.61	0.66	0.62	0.61	0.61	0.59	0.59	0.66	0.59	0.65	0.62	0.62	0.63	0.78	0.65	0.62	0.69	0.66	0.61	0.63	0.61	0.61	0.62	0.62	11.18

HOL fat

	CAN	DEU	DFS	FRA	ITA	NLD	USA	CHE	GBR	NZL	AUS	BEL	IRL	ESP	CZE	SVN	EST	ISR	HUN	POL	ZAF	JPN	LVA	SVK	LTU	PRT	KOR	URY	HRV
CAN	32.15																												
DEU	0.93	24.22																											
DFS	0.91	0.91	10.95																										
FRA	0.91	0.92	0.90	25.19																									
ITA	0.87	0.88	0.85	0.89	26.03																								
NLD	0.89	0.93	0.89	0.87	0.84	25.49																							
USA	0.92	0.92	0.87	0.91	0.89	0.87	27.61																						
CHE	0.87	0.90	0.86	0.91	0.84	0.88	0.85	22.50																					
GBR	0.85	0.87	0.83	0.87	0.83	0.85	0.85	0.87	9.54																				
NZL	0.67	0.68	0.68	0.74	0.66	0.68	0.71	0.74	0.71	15.25																			
AUS	0.73	0.72	0.67	0.74	0.71	0.69	0.74	0.70	0.79	0.79	14.90																		
BEL	0.86	0.86	0.81	0.84	0.79	0.83	0.82	0.80	0.79	0.68	0.74	20.35																	
IRL	0.81	0.80	0.82	0.84	0.72	0.81	0.78	0.83	0.77	0.79	0.78	0.80	6.79																
ESP	0.90	0.90	0.85	0.91	0.89	0.86	0.91	0.85	0.82	0.64	0.73	0.82	0.77	20.70															
CZE	0.86	0.90	0.87	0.87	0.86	0.84	0.89	0.83	0.80	0.61	0.62	0.75	0.69	0.85	22.10														
SVN	0.79	0.78	0.80	0.77	0.75	0.76	0.73	0.73	0.69	0.62	0.61	0.79	0.66	0.75	0.67	12.11													
EST	0.88	0.89	0.88	0.87	0.85	0.87	0.88	0.85	0.79	0.70	0.75	0.84	0.78	0.83	0.87	0.78	23.78												
ISR	0.77	0.79	0.71	0.76	0.79	0.74	0.83	0.74	0.70	0.63	0.59	0.62	0.59	0.75	0.77	0.62	0.77	14.94											
HUN	0.85	0.86	0.80	0.86	0.88	0.79	0.90	0.76	0.77	0.63	0.69	0.78	0.67	0.87	0.89	0.73	0.82	0.76	24.56										
POL	0.87	0.88	0.83	0.86	0.86	0.81	0.88	0.78	0.78	0.64	0.71	0.81	0.72	0.87	0.84	0.74	0.88	0.77	0.89	21.98									
ZAF	0.70	0.68	0.60	0.73	0.71	0.66	0.74	0.69	0.67	0.56	0.64	0.63	0.63	0.74	0.68	0.62	0.72	0.71	0.73	0.73	19.25								
JPN	0.92	0.91	0.91	0.90	0.87	0.89	0.89	0.87	0.83	0.68	0.68	0.83	0.80	0.87	0.84	0.84	0.85	0.72	0.81	0.84	0.66	24.06							
LVA	0.77	0.78	0.73	0.79	0.76	0.72	0.80	0.74	0.70	0.67	0.68	0.78	0.63	0.79	0.72	0.68	0.83	0.75	0.79	0.79	0.72	0.75	21.14						
SVK	0.73	0.73	0.70	0.73	0.78	0.65	0.76	0.67	0.67	0.56	0.60	0.72	0.57	0.74	0.75	0.71	0.80	0.67	0.82	0.81	0.62	0.71	0.70	15.38					
LTU	0.74	0.74	0.71	0.75	0.69	0.66	0.70	0.72	0.64	0.57	0.57	0.74	0.58	0.68	0.69	0.78	0.70	0.63	0.72	0.71	0.63	0.72	0.72	17.05					
PRT	0.74	0.76	0.71	0.77	0.75	0.72	0.77	0.73	0.72	0.61	0.59	0.64	0.64	0.76	0.71	0.65	0.69	0.60	0.74	0.74	0.59	0.74	0.69	0.60	0.62	23.71			
KOR	0.83	0.80	0.78	0.81	0.80	0.77	0.86	0.78	0.75	0.71	0.75	0.83	0.71	0.83	0.73	0.77	0.80	0.73	0.82	0.81	0.68	0.85	0.78	0.72	0.72	0.66	19.96		

URY	0.74	0.71	0.69	0.78	0.70	0.66	0.74	0.69	0.67	0.73	0.70	0.69	0.70	0.70	0.65	0.68	0.77	0.65	0.72	0.75	0.68	0.69	0.78	0.62	0.61	0.60	0.68	6.59	
HRV	0.61	0.65	0.64	0.67	0.66	0.64	0.67	0.63	0.62	0.56	0.56	0.62	0.57	0.67	0.65	0.61	0.64	0.67	0.68	0.61	0.65	0.67	0.60	0.61	0.66	0.63	0.73	0.61	11.73

HOL	pro
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	CAN	DEU	DFS	FRA	ITA	NLD	USA	CHE	GBR	NZL	AUS	BEL	IRL	ESP	CZE	SVN	EST	ISR	HUN	POL	ZAF	JPN	LVA	SVK	LTU	PRT	KOR	URY	HRV
CAN	22.58																												
DEU	0.91	17.90																											
DFS	0.90	0.92	10.62																										
FRA	0.87	0.88	0.89	16.97																									
ITA	0.85	0.85	0.85	0.84	18.78																								
NLD	0.87	0.92	0.88	0.83	0.81	19.09																							
USA	0.90	0.89	0.87	0.87	0.85	0.84	18.43																						
CHE	0.85	0.88	0.84	0.91	0.82	0.84	0.84	16.29																					
GBR	0.83	0.84	0.81	0.83	0.79	0.83	0.81	0.85	7.41																				
NZL	0.60	0.59	0.61	0.68	0.57	0.61	0.62	0.65	0.63	11.43																			
AUS	0.66	0.63	0.63	0.67	0.59	0.63	0.64	0.65	0.65	0.78	10.88																		
BEL	0.82	0.81	0.75	0.74	0.72	0.78	0.74	0.74	0.74	0.58	0.67	14.85																	
IRL	0.75	0.75	0.76	0.81	0.71	0.76	0.74	0.80	0.74	0.76	0.75	0.71	5.45																
ESP	0.90	0.89	0.87	0.88	0.86	0.85	0.88	0.84	0.81	0.57	0.66	0.79	0.76	15.15															
CZE	0.85	0.89	0.85	0.82	0.85	0.81	0.86	0.80	0.76	0.54	0.53	0.72	0.66	0.82	17.53														
SVN	0.76	0.78	0.78	0.77	0.71	0.72	0.73	0.68	0.64	0.50	0.56	0.70	0.60	0.77	0.68	10.89													
EST	0.81	0.84	0.83	0.78	0.77	0.80	0.82	0.82	0.74	0.57	0.61	0.75	0.61	0.75	0.86	0.64	17.67												
ISR	0.77	0.77	0.78	0.78	0.80	0.75	0.82	0.79	0.73	0.51	0.50	0.58	0.58	0.76	0.77	0.66	0.74	10.44											
HUN	0.82	0.84	0.81	0.84	0.83	0.78	0.87	0.77	0.74	0.56	0.54	0.70	0.63	0.82	0.87	0.69	0.78	0.78	18.82										
POL	0.85	0.85	0.84	0.84	0.80	0.80	0.83	0.80	0.75	0.55	0.62	0.76	0.72	0.84	0.83	0.74	0.81	0.72	0.84	13.48									
ZAF	0.77	0.70	0.68	0.75	0.69	0.67	0.75	0.71	0.71	0.61	0.70	0.66	0.67	0.73	0.64	0.60	0.66	0.76	0.73	0.76	14.79								
JPN	0.90	0.88	0.90	0.87	0.87	0.85	0.89	0.85	0.80	0.59	0.65	0.77	0.74	0.89	0.84	0.83	0.78	0.77	0.82	0.83	0.73	16.99							
LVA	0.73	0.73	0.69	0.73	0.67	0.67	0.74	0.70	0.67	0.60	0.56	0.69	0.61	0.71	0.65	0.60	0.73	0.68	0.73	0.73	0.68	0.70	15.16						
SVK	0.73	0.72	0.73	0.74	0.71	0.63	0.71	0.68	0.65	0.50	0.54	0.70	0.57	0.73	0.76	0.68	0.71	0.72	0.81	0.74	0.65	0.74	0.68	10.56					
LTU	0.71	0.70	0.69	0.75	0.64	0.63	0.67	0.68	0.60	0.48	0.53	0.70	0.50	0.69	0.65	0.76	0.60	0.61	0.66	0.68	0.64	0.69	0.67	0.66	12.02				
PRT	0.71	0.71	0.73	0.73	0.69	0.69	0.72	0.71	0.66	0.52	0.50	0.58	0.66	0.73	0.68	0.65	0.61	0.65	0.70	0.69	0.57	0.71	0.66	0.60	0.59	18.05			
KOR	0.81	0.75	0.76	0.74	0.76	0.72	0.82	0.73	0.67	0.59	0.62	0.79	0.63	0.81	0.70	0.72	0.70	0.73	0.75	0.74	0.68	0.81	0.68	0.70	0.68	0.62	13.48		
URY	0.63	0.63	0.62	0.72	0.59	0.58	0.63	0.63	0.58	0.71	0.66	0.59	0.63	0.63	0.59	0.61	0.59	0.61	0.61	0.63	0.67	0.58	0.71	0.59	0.59	0.57	0.60	5.16	
HRV	0.60	0.63	0.59	0.64	0.58	0.61	0.59	0.59	0.59	0.49	0.48	0.67	0.48	0.63	0.60	0.59	0.59	0.60	0.66	0.61	0.62	0.64	0.58	0.60	0.59	0.58	0.61	0.59	11.07

JER	mil
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	CAN	DFS	USA	NZL	AUS	GBR	NLD	ZAF	ITA	DEU	IRL	CHE
CAN	603.29											
DFS	0.90	9.21										
USA	0.91	0.88	625.09									
NZL	0.74	0.75	0.75	303.88								
AUS	0.80	0.72	0.74	0.81	388.05							
GBR	0.83	0.79	0.76	0.67	0.71	222.25						
NLD	0.90	0.90	0.87	0.70	0.74	0.80	603.94					
ZAF	0.87	0.83	0.84	0.76	0.80	0.74	0.76	367.33				
ITA	0.89	0.87	0.88	0.76	0.79	0.80	0.84	0.88	543.66			
DEU	0.91	0.93	0.90	0.68	0.69	0.82	0.93	0.78	0.85	596.77		
IRL	0.81	0.80	0.78	0.90	0.82	0.71	0.81	0.76	0.79	0.80	173.64	
CHE	0.87	0.88	0.83	0.73	0.75	0.84	0.89	0.78	0.83	0.91	0.82	375.82

JER	fat
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	CAN	DFS	USA	NZL	AUS	GBR	NLD	ZAF	ITA	DEU	IRL	CHE
CAN	27.61											
DFS	0.87	11.11										
USA	0.89	0.86	22.90									
NZL	0.69	0.69	0.72	14.23								
AUS	0.77	0.68	0.76	0.80	13.91							
GBR	0.80	0.77	0.78	0.67	0.71	9.14						
NLD	0.85	0.84	0.82	0.67	0.67	0.77	24.87					
ZAF	0.74	0.74	0.74	0.64	0.69	0.63	0.66	14.40				
ITA	0.87	0.83	0.86	0.69	0.73	0.75	0.79	0.75	25.34			
DEU	0.91	0.90	0.88	0.68	0.71	0.84	0.89	0.73	0.86	23.91		
IRL	0.77	0.76	0.74	0.82	0.79	0.73	0.78	0.61	0.69	0.75	6.12	

CHE	0.85	0.83	0.81	0.74	0.70	0.79	0.80	0.68	0.81	0.89	0.77	18.85
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DFS	0.87	0.88	0.84	0.64	0.61	0.75	10.61										
DEU	0.90	0.81	0.88	0.61	0.61	0.83	0.92	20.53									
ZAF	0.76	0.77	0.77	0.66	0.73	0.64	0.70	0.70	17.61								
EST	0.80	0.76	0.78	0.58	0.59	0.73	0.79	0.80	0.68	16.68							
LVA	0.72	0.67	0.73	0.57	0.54	0.68	0.64	0.72	0.69	0.70	9.54						
LTU	0.67	0.62	0.69	0.52	0.57	0.61	0.61	0.68	0.69	0.63	0.65	11.79					
IRL	0.74	0.73	0.75	0.79	0.77	0.73	0.74	0.75	0.68	0.64	0.63	0.56	5.33				
NLD	0.87	0.90	0.84	0.60	0.61	0.81	0.88	0.91	0.68	0.77	0.68	0.64	0.74	25.79			
CAM	0.79	0.78	0.90	0.69	0.69	0.77	0.78	0.78	0.78	0.77	0.76	0.76	0.73	0.77	10.02		

SIM	mil										

	CHE	DEA	FRM	ITA	SVN	FRA	NLD	IRL	GBR	HRV	USA
CHE	562.02										
DEA	0.87	506.94									
FRM	0.95	0.86	619.60								
ITA	0.77	0.68	0.67	511.33							
SVN	0.75	0.76	0.75	0.72	9.20						
FRA	0.91	0.92	0.83	0.79	0.76	711.07					
NLD	0.89	0.92	0.88	0.75	0.77	0.88	765.06				
IRL	0.84	0.75	0.84	0.67	0.71	0.87	0.79	182.98			
GBR	0.86	0.85	0.85	0.76	0.68	0.85	0.84	0.77	230.64		
HRV	0.64	0.61	0.76	0.61	0.61	0.62	0.62	0.64	0.61	10.52	
USA	0.87	0.82	0.83	0.86	0.78	0.90	0.88	0.80	0.82	0.64	640.35

SIM	fat										
	CHE	DEA	FRM	ITA	SVN	FRA	NLD	IRL	GBR	HRV	USA
CHE	22.26										
DEA	0.87	19.01									
FRM	0.94	0.89	24.13								
ITA	0.76	0.75	0.69	19.87							
SVN	0.73	0.80	0.75	0.74	9.33						
FRA	0.89	0.94	0.83	0.80	0.76	29.02					
NLD	0.86	0.91	0.89	0.72	0.77	0.88	28.94				
IRL	0.80	0.72	0.79	0.63	0.70	0.83	0.77	7.68			
GBR	0.89	0.84	0.84	0.78	0.69	0.87	0.84	0.74	7.96		
HRV	0.65	0.59	0.75	0.60	0.60	0.61	0.61	0.65	0.62	10.54	
USA	0.85	0.84	0.83	0.86	0.73	0.91	0.87	0.77	0.84	0.68	21.84

SIM	pro										

	CHE	DEA	FRM	ITA	SVN	FRA	NLD	IRL	GBR	HRV	USA
CHE	16.71										
DEA	0.86	15.49									
FRM	0.94	0.85	19.98								
ITA	0.68	0.64	0.64	16.14							
SVN	0.70	0.70	0.73	0.67	9.18						
FRA	0.88	0.91	0.78	0.75	0.67	23.22					
NLD	0.83	0.90	0.86	0.69	0.71	0.83	24.30				
IRL	0.78	0.74	0.78	0.57	0.67	0.80	0.73	6.37			
GBR	0.82	0.83	0.81	0.73	0.65	0.83	0.83	0.71	7.25		
HRV	0.62	0.57	0.76	0.58	0.59	0.59	0.59	0.57	0.60	10.69	
USA	0.83	0.76	0.76	0.82	0.73	0.87	0.84	0.73	0.80	0.62	18.16

^LAPPENDIX II. Number of common bulls

BSW mil											

common bulls below diagonal											
common three quarter sib group above diagonal											
	CAN	FRA	USA	CHE	ITA	DEA	NLD	SVN	NZL	GBR	AUS

CAN	0	100	208	161	159	175	62	38	41	89	107
FRA	91	0	141	206	247	277	112	56	38	94	81

USA	204	104	0	343	274	371	104	46	53	123	137
CHE	138	163	321	0	560	695	134	90	48	107	130
ITA	141	209	200	502	0	869	166	113	56	121	137
DEA	154	225	339	586	768	0	193	122	67	121	145
NLD	57	97	96	124	142	183	0	55	41	68	72
SVN	34	53	36	85	106	111	55	0	16	37	29
NZL	40	28	46	35	45	60	34	14	0	38	44
GBR	84	86	117	85	95	88	60	31	34	0	79
AUS	110	65	130	90	102	107	55	21	36	70	0

BSW fat

common bulls below diagonal											
common three quarter			sib group		above diagonal						
	CAN	FRA	USA	CHE	ITA	DEA	NLD	SVN	NZL	GBR	AUS
CAN	0	100	208	161	159	175	62	38	41	89	107
FRA	91	0	141	206	247	277	112	56	38	94	81
USA	204	104	0	343	274	371	104	46	53	123	137
CHE	138	163	321	0	560	696	134	90	48	107	130
ITA	141	209	200	502	0	870	166	113	56	121	137
DEA	154	225	339	586	769	0	193	122	67	121	145
NLD	57	97	96	124	142	183	0	55	41	68	72
SVN	34	53	36	85	106	111	55	0	16	37	29
NZL	40	28	46	35	45	60	34	14	0	38	44
GBR	84	86	117	85	95	88	60	31	34	0	79
AUS	110	65	130	90	102	107	55	21	36	70	0

BSW pro

common bulls below diagonal											
common three quarter			sib group		above diagonal						
	CAN	FRA	USA	CHE	ITA	DEA	NLD	SVN	NZL	GBR	AUS
CAN	0	100	208	161	159	175	62	38	41	89	107
FRA	91	0	141	206	247	277	112	56	38	94	81
USA	204	104	0	343	274	371	104	46	53	123	137
CHE	138	163	321	0	560	696	134	90	48	107	130
ITA	141	209	200	502	0	870	166	113	56	121	137
DEA	154	225	339	586	769	0	193	122	67	121	145
NLD	57	97	96	124	142	183	0	55	41	68	72
SVN	34	53	36	85	106	111	55	0	16	37	29
NZL	40	28	46	35	45	60	34	14	0	38	44
GBR	84	86	117	85	95	88	60	31	34	0	79
AUS	110	65	130	90	102	107	55	21	36	70	0

GUE mil

common bulls below diagonal					
common three quarter		sib group		above diagonal	
	CAN	USA	AUS	GBR	NZL
CAN	0	81	58	41	14
USA	73	0	76	104	32
AUS	55	73	0	49	27
GBR	35	105	42	0	16
NZL	11	29	27	14	0

GUE fat

common bulls below diagonal					
common three quarter		sib group		above diagonal	
	CAN	USA	AUS	GBR	NZL
CAN	0	81	58	41	14
USA	73	0	76	104	32
AUS	55	73	0	49	27
GBR	35	105	42	0	16
NZL	11	29	27	14	0

GUE pro

common bulls below diagonal

common three quarter sib group above diagonal

CAN

USA

AUS

GBR

NZL

CAN	0	81	58	41	14
USA	73	0	76	104	32
AUS	55	73	0	49	27
GBR	35	105	42	0	16
NZL	11	29	27	14	0

HOL mil

common bulls below diagonal

common three quarter sib group above diagonal

CAN

DEU

DFS

FRA

ITA

NLD

USA

CHE

GBR

NZL

AUS

BEL

IRL

ESP

CZE

SVN

EST

ISR

HUN

POL

ZAF

JPN

LVA

SVK

LTU

PRT

KOR

URY

HRV

CAN	0	2856	1911	1789	2057	2000	4359	1014	2085	942	1739	985	663	1558	1293	252	382	195	1233	1961	516	1547	604	487	343	1363	922	554	355
DEU	2343	0	3230	2872	2810	4000	4099	1302	2467	1177	1910	1467	974	1816	2075	416	591	213	1474	3344	561	1582	874	745	621	1558	798	529	731
DFS	1738	2564	0	2008	1776	2676	2665	853	1885	1026	1535	1084	835	1293	1417	308	454	193	1107	2182	516	1144	575	461	413	1215	655	465	495
FRA	1365	1835	1303	0	1691	2400	2819	830	1809	944	1481	1168	813	1460	1361	246	341	156	1077	2223	515	1338	509	488	311	1203	675	461	391
ITA	1852	2152	1532	1140	0	1945	2945	779	1686	693	1203	872	573	1393	1380	300	381	179	1186	2221	353	1177	585	402	381	1169	709	403	408
NLD	1978	3855	2436	1742	1749	0	3089	1052	2151	1300	1708	1531	1005	1396	1706	321	515	209	1164	2516	525	1248	614	598	419	1360	665	484	524
USA	5007	3235	2226	1709	2519	2825	0	1146	2772	1339	2305	1167	925	1840	1923	289	499	321	1588	2961	648	2201	825	613	465	1718	1118	773	454
CHE	940	1241	809	776	714	1054	1078	0	838	489	725	699	451	640	524	157	217	74	475	811	259	531	282	253	148	606	341	232	226
GBR	2353	1967	1509	1274	1407	1954	2605	801	0	1136	1681	1031	1106	1256	1170	241	373	192	1008	1822	520	1185	512	416	368	1176	645	509	390
NZL	930	927	756	630	546	1193	1294	412	994	0	1401	614	836	643	657	147	189	141	561	859	378	651	296	284	212	697	392	427	259
AUS	1779	1497	1170	1073	973	1521	2382	642	1491	1409	0	871	813	1036	905	195	287	145	831	1339	488	1020	457	341	287	997	582	496	339
BEL	989	1522	1028	1209	881	1756	1059	715	1025	506	776	0	576	800	702	192	251	103	618	1032	343	632	333	329	203	814	388	278	312
IRL	616	847	686	683	493	942	842	456	1132	728	699	559	0	557	501	125	167	125	472	718	332	480	235	225	168	558	290	304	207
ESP	1106	1240	1039	1228	1042	1274	1303	539	999	493	760	787	521	0	944	220	271	135	906	1450	455	1023	433	354	267	1050	617	397	332
CZE	983	1638	1000	901	1072	1515	1572	368	790	459	599	543	349	638	0	250	352	160	1030	1680	344	911	477	467	336	915	566	369	422
SVN	197	408	252	187	262	280	235	113	179	102	138	153	93	157	184	0	109	55	192	347	75	183	127	85	88	198	129	70	130
EST	262	452	319	189	244	384	378	132	234	99	155	164	86	136	226	66	0	70	270	490	114	251	210	145	122	267	162	131	153
ISR	140	162	142	94	123	161	316	43	144	114	94	66	98	81	126	38	39	0	139	215	68	142	93	62	70	135	86	85	78
HUN	1182	1221	935	811	1070	1005	1593	396	869	424	632	541	397	740	923	147	166	96	0	1273	379	803	427	352	287	895	559	387	303
POL	1827	3180	1892	1695	1979	2416	3062	709	1651	679	1075	971	593	1123	1450	306	370	171	1193	0	425	1204	755	516	484	1353	763	480	570
ZAF	479	439	396	410	276	447	635	221	456	312	430	294	298	409	222	54	57	43	304	324	0	432	168	184	105	456	279	281	162
JPN	856	768	663	547	644	711	1076	358	638	354	588	424	307	519	448	101	98	68	458	695	283	0	420	334	252	844	681	422	264
LVA	392	716	366	274	370	422	732	148	298	165	236	198	133	236	316	73	118	62	318	616	94	184	0	173	220	484	297	211	280
SVK	340	557	250	275	246	426	418	129	241	169	170	201	109	182	367	40	62	26	244	375	101	122	83	0	114	365	231	194	159
LTU	212	577	258	139	214	271	344	64	215	110	139	101	86	115	221	40	62	37	187	382	40	91	147	51	0	265	177	138	164
PRT	1428	1477	1132	1099	1124	1378	1849	551	1080	576	843	831	499	1027	756	157	177	88	897	1386	410	518	382	248	166	0	604	436	372
KOR	890	571	492	430	583	495	1270	243	475	286	426	290	203	454	406	80	80	45	445	643	209	421	179	138	81	515	0	333	173
URY	554	406	344	319	313	393	963	186	437	352	397	217	252	322	275	44	78	49	330	418	242	264	124	123	78	397	269	0	156
HRV	219	756	397	288	306	476	352	150	279	156	216	252	143	248	320	105	110	55	226	528	109	123	216	79	111	310	83	104	0

HOL fat

common bulls below diagonal

common three quarter sib group above diagonal

CAN

DEU

DFS

FRA

ITA

NLD

USA

CHE

GBR

NZL

AUS

BEL

IRL

ESP

CZE

SVN

EST

ISR

HUN

POL

ZAF

JPN

LVA

SVK

LTU

PRT

KOR

URY

HRV

CAN	0	2856	1910	1789	2063	2000	4357	1014	2085	942	1739	985	663	1557	1293	253	382	195	1233	1961	515	1542	604	487	343	1362	922	554	354
DEU	2343	0	3230	2872	2818	4000	4096	1302	2466	1177	1910	1467	974	1816	2075	417	591	213	1474	3344	560	1577	874	745	621	1557	798	529	730
DFS	1738	2564	0	2008	1779	2676	2662	853	1885	1026	1535	1084	834	1292	1416	309	454	193	1106	2181	515	1141	575	461	413	1215	655	465	494
FRA	1365	1835	1303	0	1693	2400	2818	830	1809	944	1481	1168	814	1460	1361	247	341	156	1077	2223	514	1335	509	488	311	1203	675	461	390
ITA	1860	2160	1538	1143	0	1951	2950	782	1690	697	1207	876	575	1397	1382	301	383	180	1188	2223	354	1176	588	404	383	1172	711	405	409
NLD	1978	3855	2436	1742	1756	0	3087	1052	2151	1300	1708	1531	1007	1396	1706	322	515	209	1164	2516	524	1243	614	598	419	1359	665	484	523
USA	5006	3231	2222	1708	2524	2824	0	1146	2771	1338	2305	1166	924	1838	1922	290	498	321	1587	2960	647	2196	824	613	465	1715	1118	773	452
CHE	940	1241	809	776	716	1054	1078	0	838	489	725	699	451	640	524	158	217	74	475	811	258	527	282	253	148	606	341	232	225
GBR	2353	1967	1509	1274	1412	1954	2603	801	0	1136	1681	1031	1107	1256	1170	242	373	192	1008	1822	519	1180	512	416	368	1175	645	509	390
NZL	930	927	756	630	550	1193	1293	412	994	0	1401	614	837	643	657	148	189	141	561	859	377	651	296	284	212	697	392	427	258
AUS	1779	1497	1170	1073	977	1521	2381	642	1491	1409	0	871	813	1036	905	196	287	145	831	1339	487	1017	457	341	287	996	582	496	339
BEL	989	1522	1028	1209	884	1756	1058	715	1025	506	776	0	576	800	702	193	251	103	618	1032	342	631	333	329	203	814	388	278	311
IRL	616	847	686	683	496	944	842	456	1133	729	699	559	0	556	501	126	167	125	472	719	332	478	235	225	168	558	290	304	206
ESP	1106	1240	1038	1228	1047	1274	1300	539	999	493	760	787	521	0	943	221	271	135	905	1449	454	1020	433	354	267	1049	617	397	332

CZE	983	1638	1000	901	1073	1515	1571	368	790	459	599	543	349	638	0	251	352	160	1030	1680	343	910	477	467	336	914	566	369	421
SVN	197	408	252	187	262	280	235	113	179	102	138	153	93	157	184	0	109	55	192	348	75	183	128	86	89	199	129	71	131
EST	262	452	319	189	245	384	377	132	234	99	155	164	86	136	226	66	0	70	270	490	114	248	210	145	122	266	162	131	153
ISR	140	162	142	94	124	161	316	43	144	114	94	66	98	81	126	38	39	0	139	215	67	141	93	62	70	134	86	85	78
HUN	1182	1221	934	811	1073	1005	1591	396	869	424	632	541	397	739	923	147	166	96	0	1273	378	801	427	352	287	895	559	387	303
POL	1827	3180	1892	1695	1981	2416	3058	709	1651	679	1075	971	593	1123	1450	306	370	171	1193	0	424	1198	755	516	484	1352	763	480	569
ZAF	478	438	395	409	277	446	634	220	455	312	429	294	298	408	221	53	57	43	303	323	0	430	167	183	104	455	278	280	161
JPN	850	763	660	543	643	706	1068	354	632	353	583	422	305	515	447	101	95	67	456	689	282	0	419	333	252	839	680	421	264
LVA	392	716	366	274	373	422	731	148	298	165	236	198	133	236	316	73	118	62	318	616	94	183	0	173	220	484	297	211	280
SVK	340	557	250	275	248	426	418	129	241	169	170	201	109	182	367	40	62	26	244	375	101	121	83	0	114	365	231	194	159
LTU	212	577	258	139	215	271	344	64	215	110	139	101	86	115	221	40	62	37	187	382	39	91	147	51	0	264	177	138	164
PRT	1427	1476	1132	1098	1128	1377	1846	551	1079	576	842	831	499	1026	755	157	176	87	897	1385	409	513	382	248	165	0	604	436	371
KOR	890	571	492	430	586	495	1268	243	475	286	426	290	203	454	406	80	80	45	445	643	209	419	179	138	81	515	0	333	173
URY	554	406	344	319	315	393	963	186	437	352	397	217	252	322	275	44	78	49	330	418	242	261	124	123	78	397	269	0	156
HRV	217	754	395	286	306	474	349	148	278	155	215	251	141	248	318	104	110	54	225	526	109	123	216	79	110	308	82	103	0

HOL pro

common bulls below diagonal																													
common three quarter sib group above diagonal																													
	CAN	DEU	DFS	FRA	ITA	NLD	USA	CHE	GBR	NZL	AUS	BEL	IRL	ESP	CZE	SVN	EST	ISR	HUN	POL	ZAF	JPN	LVA	SVK	LTU	PRT	KOR	URY	HRV
CAN	0	2856	1910	1789	2058	2000	4351	1014	2085	942	1739	985	663	1557	1293	252	382	195	1233	1961	515	1540	604	487	343	1363	922	554	355
DEU	2343	0	3230	2872	2811	4000	4094	1302	2467	1177	1910	1467	974	1816	2075	416	591	213	1474	3344	560	1576	874	745	621	1558	798	529	731
DFS	1738	2564	0	2008	1776	2676	2660	853	1886	1026	1535	1084	834	1292	1416	308	454	193	1106	2181	515	1140	575	461	413	1215	655	465	495
FRA	1365	1835	1303	0	1691	2400	2817	830	1810	944	1481	1168	814	1460	1361	246	341	156	1077	2223	514	1335	509	488	311	1203	675	461	391
ITA	1854	2153	1533	1140	0	1945	2945	779	1687	694	1203	872	573	1392	1380	300	381	179	1187	2221	352	1173	585	403	381	1170	710	403	408
NLD	1978	3855	2436	1742	1749	0	3086	1052	2152	1300	1708	1531	1007	1396	1706	321	515	209	1164	2516	524	1241	614	598	419	1360	665	484	524
USA	5003	3231	2222	1708	2518	2824	0	1146	2770	1338	2302	1165	924	1837	1922	289	498	321	1587	2960	647	2192	824	612	465	1716	1119	773	453
CHE	940	1241	809	776	714	1054	1077	0	838	489	725	699	451	640	524	157	217	74	475	811	258	526	282	253	148	606	341	232	226
GBR	2353	1969	1511	1276	1408	1956	2603	801	0	1137	1681	1032	1108	1257	1170	241	373	192	1008	1823	519	1180	512	416	368	1177	645	509	391
NZL	930	927	756	630	547	1193	1293	412	994	0	1401	614	837	643	657	147	189	141	561	859	377	651	296	284	212	697	392	427	259
AUS	1779	1497	1170	1073	973	1521	2380	642	1491	1409	0	871	813	1036	905	195	287	145	831	1339	487	1017	457	341	287	997	582	496	339
BEL	989	1522	1028	1209	881	1756	1057	715	1026	506	776	0	576	800	702	192	251	103	618	1032	342	631	333	329	203	814	388	278	312
IRL	616	847	686	683	493	944	842	456	1135	729	699	559	0	556	501	125	167	125	472	719	332	478	235	225	168	558	290	304	207
ESP	1106	1240	1038	1228	1042	1274	1300	539	1000	493	760	787	521	0	943	220	271	135	905	1449	454	1020	433	354	267	1050	617	397	332
CZE	983	1638	1000	901	1072	1515	1571	368	791	459	599	543	349	638	0	250	352	160	1030	1680	343	910	477	467	336	915	566	369	422
SVN	197	408	252	187	262	280	235	113	179	102	138	153	93	157	184	0	109	55	192	347	74	183	127	85	88	198	129	70	130
EST	262	452	319	189	244	384	377	132	234	99	155	164	86	136	226	66	0	70	270	490	114	247	210	145	122	267	162	131	153
ISR	140	162	142	94	123	161	316	43	144	114	94	66	98	81	126	38	39	0	139	215	67	141	93	62	70	135	86	85	78
HUN	1182	1221	934	811	1071	1005	1591	396	869	424	632	541	397	739	923	147	166	96	0	1273	378	801	427	352	287	895	559	387	303
POL	1827	3180	1892	1695	1979	2416	3058	709	1653	679	1075	971	593	1123	1450	306	370	171	1193	0	424	1197	755	516	484	1353	763	480	570
ZAF	478	438	395	409	275	446	634	220	455	312	429	294	298	408	221	53	57	43	303	323	0	430	167	183	104	455	278	280	161
JPN	848	762	660	543	640	704	1066	354	633	353	583	422	305	515	447	101	94	67	456	689	282	0	418	333	251	840	680	421	264
LVA	392	716	366	274	370	422	731	148	299	165	236	198	133	236	316	73	118	62	318	616	94	182	0	173	220	484	297	211	280
SVK	340	557	250	275	247	426	417	129	241	169	170	201	109	182	367	40	62	26	244	375	101	121	83	0	114	365	231	194	159
LTU	212	577	258	139	214	271	344	64	216	110	139	101	86	115	221	40	62	37	187	382	39	90	147	51	0	265	177	138	164
PRT	1428	1477	1132	1098	1125	1378	1847	551	1082	576	842	831	499	1027	756	157	177	88	897	1386	409	514	381	248	166	0	604	436	372
KOR	890	571	492	430	584	495	1270	243	475	286	426	290	203	454	406	80	80	45	445	643	209	419	179	138	81	515	0	333	173
URY	554	406	344	319	314	393	963	186	437	352	397	217	252	322	275	44	78	49	330	418	242	261	124	123	78	397	269	0	156
HRV	218	755	396	287	305	475	350	149	280	156	215	252	142	248	319	104	110	54	225	527	109	123	216	79	110	309	82	103	0

JER mil

common bulls below diagonal												
common	three quarter			sib group		above diagonal						
	CAN	DFS	USA	NZL	AUS	GBR	NLD	ZAF	ITA	DEU	IRL	CHE
CAN	0	167	554	235	309	213	65	171	70	113	9	48
DFS	164	0	264	211	191	227	250	171	109	208	37	65
USA	586	249	0	461	565	299	137	327	100	192	39	80
NZL	243	190	537	0	529	285	116	229	86	127	106	62
AUS	315	164	610	582	0	270	91	262	85	114	53	64
GBR	208	217	319	285	265	0	126	186	103	140	68	80
NLD	59	259	140	111	82	118	0	88	59	159	27	45
ZAF	167	153	340	235	245	185	84	0	90	99	34	59
ITA	67	110	107	86	79	104	60	83	0	60	19	45
DEU	109	206	191	119	105	135	155	96	61	0	21	56
IRL	6	33	40	118	50	72	25	34	18	21	0	18

CHE	42	65	81	53	54	75	38	52	44	52	13	0
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JER fat

common bulls below diagonal

common three quarter	sib	group	above diagonal									
CAN	DFS	USA	NZL	AUS	GBR	NLD	ZAF	ITA	DEU	IRL	CHE	
CAN	0	167	554	235	309	213	65	171	70	113	9	48
DFS	164	0	264	211	191	227	250	171	109	208	37	65
USA	585	249	0	461	565	298	137	326	100	192	39	80
NZL	243	190	537	0	529	285	116	229	86	127	106	63
AUS	315	164	610	582	0	270	91	262	85	114	53	64
GBR	208	217	318	285	265	0	126	186	103	140	68	80
NLD	59	259	140	111	82	118	0	88	59	159	27	45
ZAF	167	153	339	235	245	185	84	0	90	99	34	59
ITA	67	110	107	86	79	104	60	83	0	60	19	45
DEU	109	206	191	119	105	135	155	96	61	0	21	56
IRL	6	33	40	118	50	72	25	34	18	21	0	18
CHE	42	65	81	53	54	75	38	52	44	52	13	0

JER pro

common bulls below diagonal												
common three quarter sib group above diagonal												
CAN	DFS	USA	NZL	AUS	GBR	NLD	ZAF	ITA	DEU	IRL	CHE	
CAN	0	167	554	235	309	213	65	171	70	113	9	48
DFS	164	0	264	211	191	227	250	171	109	208	37	65
USA	585	249	0	461	565	300	137	326	100	192	39	80
NZL	243	190	537	0	529	286	116	229	86	127	106	62
AUS	315	164	610	582	0	271	91	262	85	114	53	64
GBR	209	218	321	287	266	0	126	186	103	140	68	80
NLD	59	259	140	111	82	118	0	88	59	159	27	45
ZAF	167	153	339	235	245	185	84	0	90	99	34	59
ITA	67	110	107	86	79	104	60	83	0	60	19	45
DEU	109	206	191	119	105	135	155	96	61	0	21	56
IRL	6	33	40	118	50	72	25	34	18	21	0	18
CHE	42	65	81	53	54	75	38	52	44	52	13	0

RDC mil

common bulls below diagonal															
common three quarter sib group above diagonal															
CAN	NOR	USA	NZL	AUS	GBR	DFS	DEU	ZAF	EST	LVA	LTU	IRL	NLD	CAM	
CAN	0	8	240	102	114	104	214	14	75	3	10	22	3	8	0
NOR	7	0	91	59	87	92	155	19	0	37	22	27	49	59	0
USA	226	92	0	146	163	146	240	32	64	32	27	43	25	56	32
NZL	103	59	146	0	182	104	220	26	39	25	21	31	11	33	13
AUS	114	76	165	182	0	112	230	50	38	53	41	49	15	52	15
GBR	102	96	138	100	110	0	142	16	43	17	17	31	19	52	0
DFS	222	130	237	216	204	136	0	74	53	157	134	113	15	68	0
DEU	13	18	30	25	49	16	65	0	1	36	37	26	5	22	0
ZAF	77	0	58	34	39	37	50	1	0	0	2	5	2	3	0
EST	2	37	31	23	47	15	144	35	0	0	55	26	0	28	0
LVA	10	20	24	18	37	16	93	31	2	47	0	47	3	20	0
LTU	21	24	38	29	46	29	100	26	5	25	42	0	6	22	0
IRL	3	48	25	11	14	18	12	5	2	0	3	6	0	10	0
NLD	8	58	55	32	50	51	65	21	3	27	19	20	10	0	0
CAM	0	0	32	13	15	0	0	0	0	0	0	0	0	0	0

RDC fat

common bulls below diagonal															
common three quarter sib group above diagonal															
CAN	NOR	USA	NZL	AUS	GBR	DFS	DEU	ZAF	EST	LVA	LTU	IRL	NLD	CAM	
CAN	0	8	240	102	114	104	214	14	75	3	10	22	3	8	0

NOR	7	0	90	59	87	92	155	19	0	37	22	27	49	59	0
USA	226	91	0	146	163	144	238	32	64	32	27	43	25	56	32
NZL	103	59	146	0	182	104	220	26	39	25	21	31	11	33	13
AUS	114	76	165	182	0	112	230	50	38	53	41	49	15	52	15
GBR	102	96	136	100	110	0	142	16	43	17	17	31	19	52	0
DFS	222	130	235	216	204	136	0	74	53	157	134	113	15	68	0
DEU	13	18	30	25	49	16	65	0	1	36	37	26	5	22	0
ZAF	77	0	58	34	39	37	50	1	0	0	2	5	2	3	0
EST	2	37	31	23	47	15	144	35	0	0	55	26	0	28	0
LVA	10	20	24	18	37	16	93	31	2	47	0	47	3	20	0
LTU	21	24	38	29	46	29	100	26	5	25	42	0	6	22	0
IRL	3	48	25	11	14	18	12	5	2	0	3	6	0	10	0
NLD	8	58	55	32	50	51	65	21	3	27	19	20	10	0	0
CAM	0	0	32	13	15	0	0	0	0	0	0	0	0	0	0

RDC pro

common bulls below diagonal															
common three quarter sib group above diagonal															
	CAN	NOR	USA	NZL	AUS	GBR	DFS	DEU	ZAF	EST	LVA	LTU	IRL	NLD	CAM
CAN	0	8	240	102	114	104	214	14	75	3	10	22	3	8	0
NOR	7	0	90	59	87	92	155	19	0	37	22	27	49	59	0
USA	226	91	0	146	163	145	238	32	64	32	27	43	25	56	32
NZL	103	59	146	0	182	104	220	26	39	25	21	31	11	33	13
AUS	114	76	165	182	0	112	230	50	38	53	41	49	15	52	15
GBR	102	96	137	100	110	0	142	16	43	17	17	31	19	52	0
DFS	222	130	235	216	204	136	0	74	53	157	134	113	15	68	0
DEU	13	18	30	25	49	16	65	0	1	36	37	26	5	22	0
ZAF	77	0	58	34	39	37	50	1	0	0	2	5	2	3	0
EST	2	37	31	23	47	15	144	35	0	0	55	26	0	28	0
LVA	10	20	24	18	37	16	93	31	2	47	0	47	3	20	0
LTU	21	24	38	29	46	29	100	26	5	25	42	0	6	22	0
IRL	3	48	25	11	14	18	12	5	2	0	3	6	0	10	0
NLD	8	58	55	32	50	51	65	21	3	27	19	20	10	0	0
CAM	0	0	32	13	15	0	0	0	0	0	0	0	0	0	0

SIM mil

common bulls below diagonal											
common three quarter sib group above diagonal											
	CHE	DEA	FRM	ITA	SVN	FRA	NLD	IRL	GBR	HRV	USA
CHE	0	409	261	109	2	15	95	57	56	3	33
DEA	376	0	294	1190	316	275	458	68	55	741	42
FRM	313	335	0	200	11	2	143	72	73	2	99
ITA	111	1099	226	0	183	160	302	66	48	352	39
SVN	2	299	10	169	0	61	103	6	0	138	2
FRA	12	233	1	145	57	0	90	6	0	111	3
NLD	99	478	167	294	95	85	0	59	53	182	33
IRL	54	61	77	62	6	6	54	0	40	10	18
GBR	64	58	94	52	0	0	54	34	0	0	20
HRV	3	775	1	335	128	99	176	9	0	0	6
USA	32	43	113	46	2	3	34	17	28	6	0

SIM fat

common bulls below diagonal											
common three quarter sib group above diagonal											
	CHE	DEA	FRM	ITA	SVN	FRA	NLD	IRL	GBR	HRV	USA
CHE	0	408	261	109	2	15	95	57	56	3	33
DEA	376	0	294	1191	316	275	457	68	55	739	42
FRM	313	335	0	200	11	2	143	72	73	2	98
ITA	111	1100	226	0	183	160	301	66	48	351	39
SVN	2	299	10	169	0	61	102	6	0	139	2
FRA	12	233	1	145	57	0	90	6	0	111	3
NLD	99	477	167	293	94	85	0	59	53	181	33
IRL	54	61	77	62	6	6	54	0	40	10	18

GBR	64	58	94	52	0	0	54	34	0	0	20
HRV	3	773	1	334	129	99	175	9	0	0	6
USA	32	43	112	46	2	3	34	17	28	6	0

SIM pro

common bulls below diagonal

common three quarter sib group above diagonal

	CHE	DEA	FRM	ITA	SVN	FRA	NLD	IRL	GBR	HRV	USA
CHE	0	408	261	109	2	15	95	57	56	3	33
DEA	376	0	294	1190	316	275	457	68	55	740	42
FRM	313	335	0	200	11	2	143	72	73	2	98
ITA	111	1099	226	0	183	160	301	66	48	351	39
SVN	2	299	10	169	0	61	102	6	0	139	2
FRA	12	233	1	145	57	0	90	6	0	111	3
NLD	99	477	167	293	94	85	0	59	53	181	33
IRL	54	61	77	62	6	6	54	0	40	10	18
GBR	64	58	94	52	0	0	54	34	0	0	20
HRV	3	774	1	334	129	99	175	9	0	0	6
USA	32	43	112	46	2	3	34	17	28	6	0