

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.

Changes in national procedures

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

BEL (HOL)	Few bulls (7) are missing in current evaluation as their herds number dropped below 10
NOR (RDC)	The rolling definition of hys is causing the daughters to distribute somewhat differently over hys-classes at each evaluation. Therefore some bulls occasionally may loose EDC although the number of daughters stay the same. Reliability changes is a function of the EDC changes
AUS (ALL)	A small cohort of animals changed proof type from 12 previous (second crop daughters) back to 11 (only first crop daughters). The determination of a first and second crop proof type is based on the proportion of daughters born within 5 years of the bulls birth date (first crop) and those born after 5 years (second crop). The pedigree has been recently updated and completed so that a number of older daughters have been entering proofs and this has tripped the threshold from proof type causing the reversion from second to first crop daughter proof.
JPN (HOL)	Some changes in proofs caused by additional records and in EDCs caused by modification of pedigree.
DFS (ALL)	When new information are registered in the system they are checked against previous information and if data is not consistent with earlier information it is deleted. This cause reduction in number of herds, daughters.
CHE (ALL)	Base change. decrease in information due to the continuous work on the raw data by herd-book organizations and in the fact that data have been merged from two data bases (for HOL-CHE and SIM-CHE).
ESP (HOL)	Base change
NLD (ALL)	No longer have the data from one of the Dutch management systems.
ITA (SIM)	Some decrease in information due to pedigree checks by the herd book

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 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 (August 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			1950			
CAN	216	97	11919	706	790	
CHE	2878		3271	84		3152
CZE			3821			
DEA	5487					21882
DEU			27248		425	
DFS			13025	2096	7763	
ESP			3710			
EST			1098		416	
FRA	377		16824			448
FRM						4211
GBR	109	270	6506	677	493	82
HUN			2715			165
IRL			2365			
ISR			1379			
ITA	1873		9400			1450
JPN			5925			
KOR			1220			
LTU			779		435	
LVA			528		564	
NLD	189		15310	150	77	383
NOR					4084	
NZL	49	57	7347	4354	1268	
POL			10125			
PRT			2329			
SVK			1091			557
SVN	356		506			585
URY			1658			
USA	1045	691	37424	4365	664	45
ZAF			1163	558	122	
HRV			722			799
MEX						
CAM					37	
=====						
No. Records	12579	1240	198934	14502	17821	33759
Pub. Proofs	10257	968	151762	11957	17055	30331

^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	0.25									
FRA	0.93	1.03								
NLD	0.90	0.92	3.70							
USA	0.92	0.91	0.88	0.21						
CHE	0.92	0.94	0.93	0.88	10.57					
DEA	0.93	0.96	0.92	0.88	0.97	11.90				
NZL	0.87	0.87	0.87	0.86	0.87	0.87	0.38			

ITA	0.90	0.90	0.88	0.88	0.95	0.91	0.87	17.03		
GBR	0.92	0.96	0.96	0.90	0.94	0.95	0.89	0.89	12.71	
SVN	0.89	0.89	0.89	0.89	0.89	0.89	0.88	0.89	0.89	10.51

BSW mas

	CAN	FRA	NLD	USA	CHE	DEA	NZL	ITA	GBR	SVN
CAN	0.25									
FRA	0.89	1.06								
NLD	0.87	0.87	3.75							
USA	0.88	0.88	0.88	0.21						
CHE	0.92	0.88	0.89	0.88	10.57					
DEA	0.91	0.86	0.89	0.87	0.97	11.90				
NZL	0.89	0.89	0.89	0.86	0.87	0.87	0.38			
ITA	0.90	0.88	0.89	0.88	0.95	0.91	0.87	17.03		
GBR	0.88	0.88	0.88	0.89	0.89	0.90	0.89	0.89	2.78	
SVN	0.90	0.89	0.89	0.89	0.89	0.89	0.88	0.89	0.89	10.51

GUE scs

	CAN	GBR	USA	AUS	NZL
CAN	0.24				
GBR	0.93	13.38			
USA	0.93	0.90	0.25		
AUS	0.87	0.93	0.86	28.45	
NZL	0.87	0.89	0.86	0.95	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	0.27																													
CHE	0.88	11.04																												
DEU	0.93	0.94	12.67																											
DFS	0.92	0.93	0.96	11.97																										
EST	0.88	0.89	0.94	0.92	13.49																									
FRA	0.94	0.93	0.95	0.97	0.91	1.19																								
GBR	0.93	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	4.20																						
USA	0.94	0.88	0.89	0.88	0.90	0.90	0.90	0.88	0.21																					
ISR	0.85	0.84	0.85	0.84	0.87	0.85	0.83	0.83	0.88	0.24																				
ITA	0.89	0.89	0.94	0.92	0.93	0.92	0.90	0.88	0.89	0.85	5.81																			
AUS	0.86	0.91	0.88	0.89	0.85	0.90	0.93	0.92	0.86	0.82	0.85	30.25																		
HUN	0.88	0.90	0.92	0.91	0.91	0.91	0.89	0.88	0.92	0.88	0.93	0.85	1.43																	
BEL	0.91	0.93	0.97	0.96	0.95	0.95	0.94	0.94	0.89	0.84	0.94	0.88	0.93	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	0.86	0.93	0.96	0.88	11.54														
ZAF	0.90	0.90	0.91	0.90	0.89	0.93	0.92	0.89	0.89	0.87	0.92	0.88	0.91	0.91	0.88	0.95	26.54													
NZL	0.86	0.86	0.86	0.86	0.85	0.86	0.89	0.87	0.85	0.82	0.84	0.96	0.85	0.86	0.85	0.85	0.86	0.40												
IRL	0.88	0.93	0.93	0.94	0.90	0.93	0.96	0.94	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	0.89	0.89	0.89	0.88	0.88	0.88	0.85	0.90	0.86	0.89	0.89	0.88	0.91	0.88	0.86	0.86	14.25										
SVK	0.88	0.89	0.90	0.89	0.88	0.90	0.87	0.87	0.88	0.84	0.90	0.85	0.95	0.90	0.88	0.91	0.88	0.85	0.86	0.88	0.42									
POL	0.90	0.92	0.96	0.95	0.94	0.93	0.91	0.91	0.88	0.86	0.94	0.86	0.94	0.96	0.88	0.95	0.91	0.86	0.89	0.90	0.90	9.96								
LTU	0.88	0.89	0.90	0.88	0.93	0.88	0.88	0.88	0.88	0.86	0.88	0.86	0.88	0.92	0.88	0.89	0.89	0.87	0.86	0.88	0.89	0.90	0.35							
LVA	0.88	0.89	0.94	0.92	0.94	0.89	0.89	0.89	0.88	0.82	0.91	0.86	0.88	0.94	0.88	0.89	0.87	0.85	0.89	0.88	0.87	0.93	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	0.47					
KOR	0.88	0.87	0.88	0.89	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	0.85	0.88	0.87	0.92	0.89	0.90	0.88	0.34				
SVN	0.88	0.87	0.88	0.87	0.87	0.87	0.87	0.87	0.88	0.84	0.88	0.85	0.88	0.88	0.88	0.88	0.87	0.85	0.86	0.88	0.87	0.88	0.89	0.88	0.88	0.87	10.85			
HRV	0.88	0.88	0.88	0.88	0.88	0.87	0.87	0.88	0.88	0.84	0.88	0.85	0.88	0.88	0.88	0.88	0.88	0.85	0.85	0.88	0.87	0.88	0.88	0.88	0.88	0.87	0.88	11.77		
URY	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.88	0.85	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	0.89	0.88	0.20	

HOL mas

NOR	0.92	0.93	0.89	13.70										
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	0.92	0.92	0.91	0.86	0.90	31.25							
EST	0.89	0.94	0.91	0.90	0.91	0.95	0.91	12.18						
ZAF	0.89	0.90	0.90	0.93	0.89	0.92	0.88	0.90	25.01					
NZL	0.88	0.88	0.88	0.89	0.85	0.87	0.96	0.88	0.86	0.41				
LTU	0.90	0.89	0.89	0.90	0.89	0.89	0.87	0.91	0.91	0.87	0.34			
LVA	0.90	0.89	0.90	0.90	0.89	0.94	0.90	0.96	0.89	0.88	0.90	0.44		
NLD	0.91	0.95	0.96	0.90	0.88	0.95	0.92	0.92	0.90	0.87	0.89	0.90	3.83	
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	0.18

RDC mas

	CAN	DFS	GBR	NOR	USA	DEU	AUS	EST	ZAF	NZL	LTU	LVA	NLD	CAM
CAN	7.79													
DFS	0.91	13.04												
GBR	0.88	0.88	1.98											
NOR	0.92	0.88	0.89	13.70										
USA	0.88	0.88	0.88	0.89	0.24									
DEU	0.87	0.86	0.89	0.90	0.89	13.62								
AUS	0.86	0.84	0.90	0.90	0.86	0.89	31.30							
EST	0.86	0.85	0.89	0.90	0.89	0.93	0.87	12.18						
ZAF	0.88	0.88	0.89	0.93	0.89	0.92	0.88	0.90	25.11					
NZL	0.87	0.87	0.89	0.90	0.86	0.87	0.96	0.87	0.87	0.41				
LTU	0.87	0.86	0.89	0.90	0.88	0.89	0.87	0.92	0.90	0.87	0.34			
LVA	0.86	0.84	0.89	0.90	0.88	0.93	0.89	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	4.01	
CAM	0.93	0.93	0.93	0.93	0.90	0.94	0.92	0.94	0.93	0.91	0.93	0.94	0.94	0.18

SIM scs

	FRM	FRA	ITA	NLD	CHE	DEA	HUN	SVK	SVN	GBR	HRV	USA
FRM	1.09											
FRA	0.93	1.02										
ITA	0.95	0.90	13.70									
NLD	0.91	0.93	0.88	3.82								
CHE	0.93	0.93	0.90	0.93	10.51							
DEA	0.92	0.93	0.88	0.90	0.89	12.15						
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	0.38				
SVN	0.90	0.89	0.89	0.89	0.89	0.88	0.90	0.89	9.10			
GBR	0.92	0.96	0.89	0.95	0.91	0.93	0.89	0.88	0.88	11.74		
HRV	0.92	0.88	0.88	0.88	0.88	0.88	0.89	0.88	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	13.71									
NLD	0.88	0.88	0.89	3.80								
CHE	0.92	0.87	0.90	0.88	10.51							
DEA	0.91	0.92	0.88	0.88	0.89	12.15						
HUN	0.92	0.88	0.92	0.91	0.90	0.93	15.91					
SVK	0.88	0.88	0.89	0.89	0.89	0.88	0.94	0.38				
SVN	0.90	0.88	0.89	0.88	0.89	0.88	0.89	0.89	9.10			
GBR	0.90	0.88	0.89	0.89	0.89	0.90	0.88	0.89	0.89	2.67		
HRV	0.92	0.88	0.88	0.87	0.88	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	0.92	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	76	49	157	119	124	22	111	57	29
FRA	65	0	80	117	153	201	21	175	50	51
NLD	46	66	0	75	90	141	23	118	37	40
USA	143	79	65	0	308	300	27	214	76	39
CHE	94	114	84	289	0	548	24	414	63	71
DEA	101	150	135	263	447	0	32	589	65	95
NZL	20	17	16	24	19	27	0	26	17	8
ITA	92	140	98	148	360	493	19	0	65	90
GBR	53	41	30	72	49	45	15	47	0	20
SVN	25	50	41	32	68	88	7	89	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	70	46	157	119	124	22	111	28	29
FRA	61	0	65	103	151	184	18	161	26	50
NLD	41	55	0	69	82	126	23	107	18	36
USA	143	71	59	0	308	300	27	214	34	39
CHE	94	113	77	289	0	548	24	414	31	71
DEA	101	138	118	263	447	0	32	589	30	95
NZL	20	15	16	24	19	27	0	26	10	8
ITA	92	131	87	148	360	493	19	0	32	90
GBR	25	21	15	33	26	23	8	25	0	12
SVN	25	49	37	32	68	88	7	89	10	0

GUE

common bulls below diagonal
common three quarter sib group above diagonal

	CAN	GBR	USA	AUS	NZL
CAN	0	28	67	44	13
GBR	23	0	83	33	13
USA	58	85	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	774	2230	1251	216	1319	1383	1291	2951	102	1510	1220	880	712	1231	1171	455	646	413	922	397	1160	214	191	921	573	175	246	656
CHE	614	0	1088	658	148	612	621	820	916	57	664	547	412	563	439	516	255	368	316	471	219	607	112	139	480	225	127	182	286
DEU	1435	928	0	2669	377	2447	1947	3308	3478	150	2446	1575	1179	1199	1430	1468	562	923	710	1680	707	2196	470	307	1193	553	274	564	727
DFS	968	579	1669	0	262	1549	1414	1939	1913	132	1520	1181	841	796	919	951	481	778	598	1115	399	1444	292	209	886	428	221	355	593
EST	113	82	262	154	0	234	222	325	310	47	246	194	182	175	191	183	101	121	107	231	107	280	73	90	177	94	84	111	127
FRA	806	532	1191	760	105	0	1425	1856	2358	121	1632	1178	873	870	1153	1067	455	755	587	1102	406	1496	223	187	885	450	180	259	556
GBR	1516	565	1370	1002	123	832	0	1587	1929	120	1428	1232	789	799	962	984	486	830	732	909	354	1169	240	179	890	429	188	294	610
NLD	1155	791	2950	1614	233	1080	1328	0	2292	142	1614	1344	896	1203	1002	1032	493	956	703	1312	516	1611	281	228	999	416	225	393	613
USA	3003	805	2238	1348	199	1186	1619	1937	0	156	2437	1707	1194	907	1842	1441	607	991	616	1455	515	1824	311	260	1227	748	211	333	1004
ISR	64	37	123	102	28	63	80	114	141	0	127	98	101	76	96	103	57	101	78	109	47	126	43	28	97	50	42	59	82

ITA	1066	590	1532	1075	137	811	1031	1278	1537	91	0	1108	959	773	1131	1201	466	708	518	1161	380	1454	267	224	961	528	215	349	639
AUS	1168	482	1097	807	92	752	1013	1146	1626	64	772	0	666	689	833	811	448	1087	568	746	292	917	197	163	728	374	160	253	587
HUN	766	330	912	646	110	566	684	732	1133	74	797	484	0	506	676	718	374	469	356	816	300	869	188	139	675	401	146	230	467
BEL	682	571	1226	728	109	839	774	1380	785	50	732	593	439	0	512	623	319	479	411	568	281	738	149	144	632	257	162	241	329
JPN	574	285	564	476	67	396	485	507	807	45	503	451	387	323	0	851	407	526	357	749	302	916	179	149	674	482	151	194	531
ESP	667	422	917	685	87	755	774	910	891	62	863	566	562	608	396	0	428	499	404	759	304	959	197	167	792	409	171	256	484
ZAF	384	205	430	361	50	313	417	413	578	38	361	382	298	268	284	374	0	352	276	345	174	393	98	99	411	243	93	138	313
NZL	632	308	701	531	63	429	700	868	926	82	510	1078	364	391	279	379	279	0	584	531	242	605	152	113	535	276	119	192	466
IRL	336	291	554	448	54	413	681	603	494	55	399	451	285	382	211	367	223	461	0	383	174	469	121	94	388	168	94	143	294
CZE	599	313	1199	677	145	622	562	1109	1044	80	755	448	708	422	319	487	218	353	240	0	422	1175	227	182	708	415	189	310	482
SVK	266	112	529	205	49	213	199	352	333	19	227	148	213	171	113	153	91	144	85	326	0	419	90	96	307	186	76	121	222
POL	861	487	1845	1102	198	890	916	1416	1648	98	1058	649	745	668	469	656	287	450	348	912	285	0	318	251	947	496	222	408	578
LTU	97	43	441	154	34	57	110	154	198	19	134	77	111	64	53	84	36	66	51	138	41	238	0	75	191	124	52	130	134
LVA	109	79	207	129	63	87	102	150	208	20	152	78	99	92	66	95	58	55	52	118	47	186	52	0	190	99	44	115	120
PRT	916	423	1086	774	123	742	819	1001	1271	72	890	566	664	637	414	749	365	431	326	568	209	954	115	143	0	422	152	290	509
KOR	521	157	362	294	47	253	313	286	844	31	422	274	330	188	290	286	183	195	108	285	112	414	55	59	355	0	89	119	353
SVN	124	96	260	185	51	126	137	194	161	31	179	115	111	134	87	132	65	83	69	139	44	200	26	27	122	52	0	93	92
HRV	123	121	578	272	80	154	208	355	247	43	265	158	176	199	91	200	92	111	96	223	61	358	88	90	234	53	75	0	160
URY	609	221	523	420	78	330	510	494	1266	47	462	461	395	268	316	394	273	380	225	321	140	475	72	81	455	283	54	94	0

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	496	1214	612	125	681	710	691	1495	65	932	642	552	444	700	731	228	336	232	592	224	820	153	112	573	396	130	181	392
CHE	406	0	1085	577	145	523	576	805	913	57	610	547	411	560	438	516	254	368	316	470	217	607	112	138	479	225	127	182	283
DEU	878	927	0	2419	375	1829	1718	3224	3467	150	2101	1569	1179	1187	1428	1464	559	916	710	1679	695	2193	468	305	1180	549	274	564	718
DFS	563	501	1402	0	241	1150	1178	1685	1752	127	1203	1088	790	719	872	903	470	729	579	1024	353	1330	281	193	835	398	210	333	556
EST	73	82	262	137	0	195	203	320	307	47	227	192	181	173	188	181	98	118	105	230	105	279	73	89	174	93	84	110	125
FRA	480	443	832	577	95	0	1045	1389	1649	102	1224	916	752	718	880	900	368	585	483	955	321	1301	195	156	758	381	163	226	450
GBR	676	544	1276	847	117	652	0	1439	1724	120	1212	1116	759	746	869	923	452	749	683	868	326	1117	227	160	836	408	182	279	572
NLD	664	777	2829	1286	230	834	1207	0	2232	140	1374	1331	887	1180	994	1021	490	952	700	1297	502	1586	280	224	983	412	220	390	606
USA	1526	805	2236	1137	199	759	1471	1849	0	156	2099	1704	1193	896	1840	1439	603	983	616	1454	508	1821	309	259	1211	743	211	333	997
ISR	44	37	123	92	28	56	80	112	141	0	115	98	101	76	96	103	57	101	78	109	46	126	42	28	97	50	42	59	82
ITA	682	535	1278	851	129	620	899	1070	1390	75	0	959	890	684	1016	1095	412	589	447	1074	350	1343	244	203	878	507	204	309	586
AUS	666	482	1097	698	92	611	922	1130	1626	64	696	0	665	680	833	811	447	1083	568	745	284	917	195	162	721	371	160	253	583
HUN	515	330	912	597	110	489	665	715	1133	74	750	484	0	502	676	718	373	468	356	815	298	869	188	138	669	401	146	230	466
BEL	450	570	1224	643	109	684	735	1351	783	50	662	592	439	0	508	618	319	472	410	565	275	736	148	142	626	255	162	241	326
JPN	445	285	564	431	67	348	472	502	807	45	477	451	387	323	0	851	406	523	357	748	296	916	178	147	667	480	151	194	526
ESP	444	422	917	637	87	664	751	891	891	62	752	566	562	608	396	0	428	498	404	758	300	958	195	166	789	409	171	256	479
ZAF	210	205	430	346	50	268	401	408	578	38	322	382	298	268	284	374	0	351	276	345	172	391	97	98	410	241	93	137	313
NZL	300	308	700	484	62	351	605	861	926	82	448	1078	364	391	279	379	279	0	583	530	238	604	152	111	531	274	119	192	462
IRL	225	291	554	417	54	369	653	600	494	55	359	451	285	382	211	367	223	461	0	383	172	468	121	93	386	168	94	143	293
CZE	413	313	1199	598	145	502	552	1092	1044	80	705	448	708	422	319	487	218	353	240	0	420	1174	226	182	703	413	189	310	479
SVK	150	112	528	173	49	162	191	345	333	19	211	147	213	171	113	153	91	144	85	325	0	416	90	95	304	186	76	121	220
POL	681	487	1845	976	198	780	895	1385	1648	98	983	649	745	668	469	656	287	450	348	912	285	0	317	251	943	496	222	408	576
LTU	81	43	441	140	34	51	108	151	198	19	113	77	111	64	53	84	36	66	51	138	41	238	0	74	189	122	52	129	132
LVA	72	79	207	115	63	77	95	147	208	20	128	78	99	92	66	95	58	54	52	118	47	186	52	0	188	99	44	115	119
PRT	572	422	1086	713	123	648	783	991	1269	72	826	566	664	637	414	749	365	431	326	568	209	954	115	143	0	419	152	288	503
KOR	376	157	362	266	47	222	302	279	844	31	403	274	330	188	290	286	183	195	108	285	112	414	55	59	355	0	89	119	352
SVN	97	96	260	168	51	115	137	189	161	31	169	115	111	134	87	132	65	83	69	139	44	200	26	27	122	52	0	93	92
HRV	108	121	578	245	80	139	205	348	247	43	214	158	176	199	91	200	92	111	96	223	61	358	88	90	234	53	75	0	159
URY	368	221	523	374	78	267	484	480	1266	47	435	461	395	268	316	394	273	380	225	321	140	475	72	81	454	283	54	94	0

JER

common bulls below diagonal

common three quarter sib group above diagonal

	CAN	DFS	GBR	NLD	USA	AUS	ZAF	NZL	CHE
CAN	0	73	140	33	378	228	131	157	35
DFS	57	0	134	90	148	119	119	112	52
GBR	141	122	0	74	209	185	149	190</	

USA	389	118	228	81	0	442	257	328	61
AUS	232	83	193	54	474	0	202	388	48
ZAF	127	96	150	60	269	197	0	178	51
NZL	167	84	195	56	398	433	187	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	62	14	136	92	56	63	22
DFS	25	0	85	74	137	107	109	104	51
GBR	57	77	0	52	155	131	109	129	60
NLD	8	67	47	0	70	63	64	60	35
USA	127	97	164	75	0	442	257	328	61
AUS	82	69	133	54	474	0	202	387	48
ZAF	51	84	110	59	269	197	0	178	51
NZL	62	73	131	52	398	432	187	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	143	74	5	184	15	92	2	69	78	17	7	6	0
DFS	144	0	94	114	173	67	165	89	50	152	115	91	47	0
GBR	74	87	0	42	98	18	73	6	36	69	26	11	29	0
NOR	5	87	44	0	66	19	56	14	0	39	27	16	37	0
USA	171	168	93	67	0	29	110	16	58	105	37	15	35	20
DEU	14	57	17	19	28	0	43	25	2	22	39	29	16	0
AUS	93	138	69	47	111	42	0	24	32	124	44	27	25	9
EST	2	79	5	14	15	24	22	0	0	6	25	36	13	0
ZAF	71	47	32	0	52	2	32	0	0	32	5	1	3	0
NZL	76	149	65	38	105	21	126	5	28	0	27	13	17	9
LTU	16	98	24	22	30	35	40	24	5	23	0	38	17	0
LVA	7	59	11	14	11	23	25	28	1	10	32	0	9	0
NLD	6	46	28	37	34	16	23	12	3	16	14	8	0	0
CAM	0	0	0	0	20	0	9	0	0	9	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	23	3	67	8	30	0	35	29	13	4	3	0
DFS	67	0	63	115	164	67	183	89	45	149	114	92	43	0
GBR	23	59	0	38	64	16	47	4	22	48	20	9	20	0
NOR	3	86	40	0	66	19	56	14	0	39	27	16	32	0
USA	66	160	63	68	0	29	108	16	53	102	37	15	33	20
DEU	8	57	16	19	29	0	43	25	2	22	39	29	15	0
AUS	30	158	45	47	110	42	0	24	30	123	44	27	22	9
EST	0	79	4	14	15	24	22	0	0	6	25	36	11	0
ZAF	36	45	21	0	51	2	32	0	0	30	5	1	2	0
NZL	29	144	47	38	105	21	125	5	28	0	27	13	15	9
LTU	12	97	18	22	30	35	40	24	5	23	0	38	16	0
LVA	4	59	9	14	11	23	25	28	1	10	32	0	8	0
NLD	3	41	20	32	33	15	20	10	2	14	13	7	0	0
CAM	0	0	0	0	20	0	9	0	0	9	0	0	0	0

SIM

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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  156  114  184  225    2   58   17   65    2   30
FRA    1    0  136   59   12  251    5   53   53    0   84    0
ITA   190  121    0  174   84  768   14  135  101   44  209   20
NLD   138   57  171    0   84  274    7   64   46   48   89   15
CHE   235    9   86   87    0  294    2   32    5   51    1   18
DEA   264  211  670  287  257    0   30  362  173   46  503   17
HUN    0    4   11    7    1   19    0    9    8    0   15    0
SVK   57   45  114   54   26  369    8    0   44   11   87    4
SVN   17   50   95   44    5  159    7   43    0    0   69    0
GBR   82    0   48   48   58   49    0    6    0    0    0   18
HRV    1   78  198   86    1  526   13   69   59    0    0    0
USA   45    0   27   18   19   24    0    4    0   25    0    0
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SIM

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common bulls below diagonal
common three quarter sib group above diagonal
  FRM  FRA  ITA  NLD  CHE  DEA  HUN  SVK  SVN  GBR  HRV  USA
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FRM    0    2  151  104  174  209    2   58   17   24    2   30
FRA    1    0   86   31    8  159    3   39   34    0   58    0
ITA   186   75    0  165   84  766   14  135  101   18  209   20
NLD   125   30  161    0   80  249    7   62   44   17   85   15
CHE   225    5   86   80    0  294    2   32    5   20    1   18
DEA   251  122  670  263  257    0   30  362  173   17  503   17
HUN    0    2   11    7    1   19    0    9    8    0   15    0
SVK   57   31  114   52   26  369    8    0   44    5   87    4
SVN   17   29   95   42    5  159    7   43    0    0   69    0
GBR   30    0   21   19   23   21    0    5    0    0    0   16
HRV    1   51  198   83    1  526   13   69   59    0    0    0
USA   45    0   27   18   19   24    0    4    0   21    0    0
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