

## 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 Uruguay 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:

ITA (SIM)	Base change
JPN (HOL)	Some changes in proofs caused by additional records and in EDCs caused by modification of pedigree.
FRA (ALL)	Base change
AUS (ALL)	Drops in information due to data clean-up such as pedigree changes, status change of a bull which leads to a good number of bulls no longer being qualifying
CAN (ALL)	Base change
CHE (ALL)	Base change. BSW: Manual edits in the database due cause some drops in information. Made some modifications in the pedigree-based (PBLUP) evaluation to make it in line to the Single step evaluation: Applied the software package MiX99 for the ebv/rel estimation and the mtedc software for the edc calculation. Further, the pedigrees used for these evaluations were expanded to include all the genotyped animals. The evaluation for production (mil, falt, pro) BSW runs no longer together with scs (multitrait with three traits instead of four). The heritabilities and genetic variances for these three traits remain unchanged.
DEA (ALL)	Some drops in information due to ongoing pedigree corrections based on results from ongoing genotyping of females in the populations. SIM: Some HUN animals missing in this evaluation (18) due to a correction in their ids
DEU (ALL)	Base change
SVN (HOL, BSW)	Base change
ITA (HOL, JER)	Base change, HOL: drim of one year of phenotypic data
ITA (BSW)	Base change
POL (HOL)	New organisation, CGen, replacing NIAP. New model and estimated new genetic parameters as part of a single step evaluation. Only bulls with a minimum number of 10 herds were submitted. A new data editing pipeline has been implemented including stricter filters on herd size, contemporary group size, outliers identification, and the cows' breed causing a reduction in the number of daughters and herds for almost all the bulls in the evaluation. Applied the mtedc software for EDC calculation. Changed Type Of Proof from 12 to 11 due to a new procedure for setting type of proof: The previous procedure counted daughters based on milk yield and used this information to set the bulls' type of proof for all traits. Currently, the Type Of Proof is based on each trait-specific daughter count. Pedigree clean-up and verification. Some animals appear to be missing in this evaluation because they were either identified as duplicate of another animal during predigree clean-up or dropped in the numbers of daughters or herds below publication criteria or there were breed inconsistency of bulls which actually were not HOL
EST (HOL, RDC)	Base change
NLD (ALL)	Base change
ISR (HOL)	Changes to edits and correction factors, which resulted in slight reductions in the number of herds and daughters for some bulls. Base change, few drops in information due to data edits
USA (ALL)	Base change, drops in information due to pedigree accuracy and herd-year minimum edits.
CZE (HOL)	Changed the in-house solver to Misztal's BLUPF90. Reliability is now computed using ACCF90 while before it was calculated via a simple method based on EDCs. Base change. Trimmed old bulls, born before 1992 which used to have "N" status for publication.
URY (HOL)	Base change
GBR (ALL)	Few drops in information due to data updates from milk recording companies
NZL (ALL)	Some drops in information, especially EDC, added a filter for which if a daughters breed didn't match a bulls breed the daughter got dropped from a bulls proof, this has affected the national herd because of the number of cross bred animals present.
LVA (HOL, RDC)	New legal organisation called Rural Support Service - LAD. Changes in data selection have been made using our new recording system, CILDA, removing daughters with unfinished lactations. Causing drops in information and some bulls not been submitted anymore
LTU (HOL, RDC)	New database with merging of registered and breeding animals
PRT (HOL)	Base change, new variance components and new heritabilities, drops in EDC due to changes in pedigree
HUN (HOL)	Changes in the type of proof for some bulls makes them no longer meeting the minimum requirements for inclusion.

## 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 procedure 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 routine's and test run's 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

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

NEXT TEST INTERNATIONAL EVALUATION

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

From this year 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

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 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

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 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 dairy production traits (April Routine Evaluation 2025).  
 Number of records for milk yield by breed

Country	BSW	GUE	HOL	JER	RDC	SIM
AUS	235	154	9109	1938	880	
BEL			2431			
CAN	292	113	14365	942	903	
CHE	3317		3526	109		3782
CZE			4703			
DEA	6580					27297
DEU			25008	309	318	
DFS			14705	2411	8150	
ESP			4789			
EST			1498		506	
FRA	523		18919			513
FRM						5306
GBR	211	385	8496	1054	763	122
HUN			3276			
IRL			3470	163	62	106
ISR			1835			
ITA	2457		9285	170		2132
JPN			7147			
KOR			1955			
LTU			982		365	
LVA			1453		674	
NLD	263		17471	292	109	556
NOR					4429	
NZL	95	64	9554	5809	1590	
POL			13132			
PRT			3187			









DFS	0.89	0.89	0.86	0.70	0.68	0.79	10.69								
DEU	0.92	0.83	0.91	0.68	0.69	0.87	0.91	26.98							
ZAF	0.75	0.78	0.80	0.62	0.64	0.64	0.70	0.69	20.61						
EST	0.87	0.68	0.86	0.64	0.71	0.78	0.82	0.85	0.73	20.93					
LVA	0.75	0.66	0.77	0.65	0.63	0.70	0.69	0.78	0.73	0.82	14.63				
LTU	0.69	0.66	0.75	0.60	0.63	0.64	0.69	0.73	0.69	0.73	0.72	18.68			
IRL	0.80	0.71	0.78	0.81	0.79	0.76	0.80	0.79	0.64	0.77	0.66	0.63	7.32		
NLD	0.89	0.85	0.86	0.67	0.69	0.84	0.90	0.93	0.67	0.81	0.73	0.68	0.80	29.33	
CAM	0.80	0.79	0.93	0.66	0.68	0.78	0.79	0.79	0.80	0.79	0.78	0.78	0.76	0.79	21.81

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RDC pro  
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	CAN	NOR	USA	NZL	AUS	GBR	DFS	DEU	ZAF	EST	LVA	LTU	IRL	NLD	CAM
CAN	18.60														
NOR	0.83	12.11													
USA	0.89	0.86	21.07												
NZL	0.58	0.66	0.63	11.48											
AUS	0.62	0.65	0.65	0.77	12.10										
GBR	0.80	0.76	0.79	0.59	0.66	7.03									
DFS	0.87	0.88	0.84	0.64	0.61	0.75	10.60								
DEU	0.90	0.81	0.88	0.61	0.61	0.83	0.92	20.40							
ZAF	0.76	0.77	0.77	0.66	0.72	0.65	0.70	0.70	17.61						
EST	0.80	0.73	0.79	0.58	0.58	0.73	0.79	0.81	0.68	16.62					
LVA	0.71	0.67	0.73	0.57	0.54	0.68	0.64	0.72	0.70	0.69	9.59				
LTU	0.67	0.62	0.69	0.52	0.57	0.61	0.61	0.68	0.69	0.63	0.65	11.82			
IRL	0.74	0.73	0.75	0.79	0.77	0.73	0.74	0.74	0.68	0.63	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	0.76	0.68	0.64	0.75	25.58	
CAM	0.79	0.78	0.90	0.68	0.69	0.77	0.78	0.78	0.79	0.77	0.76	0.76	0.73	0.77	10.01

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SIM mil  
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	CHE	DEA	FRM	ITA	SVN	FRA	NLD	IRL	GBR	HRV	USA
CHE	564.86										
DEA	0.87	505.76									
FRM	0.95	0.86	619.39								
ITA	0.77	0.68	0.66	510.30							
SVN	0.75	0.76	0.75	0.72	9.11						
FRA	0.91	0.92	0.83	0.80	0.77	736.33					
NLD	0.88	0.92	0.89	0.75	0.77	0.88	762.88				
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	0.69	0.85	0.84	0.77	230.08		
HRV	0.64	0.62	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	640.85

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SIM fat  
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	CHE	DEA	FRM	ITA	SVN	FRA	NLD	IRL	GBR	HRV	USA
CHE	22.51										
DEA	0.87	19.01									
FRM	0.94	0.89	24.13								
ITA	0.77	0.75	0.68	19.83							
SVN	0.73	0.81	0.76	0.74	9.30						
FRA	0.89	0.94	0.84	0.80	0.77	29.98					
NLD	0.86	0.91	0.89	0.72	0.78	0.88	28.79				
IRL	0.80	0.72	0.79	0.63	0.71	0.83	0.77	7.68			
GBR	0.89	0.84	0.85	0.78	0.69	0.87	0.84	0.74	7.95		
HRV	0.64	0.59	0.75	0.60	0.60	0.61	0.61	0.65	0.62	10.54	
USA	0.84	0.84	0.83	0.86	0.74	0.91	0.87	0.77	0.84	0.68	21.89

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SIM pro  
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	CHE	DEA	FRM	ITA	SVN	FRA	NLD	IRL	GBR	HRV	USA
CHE	16.87										
DEA	0.86	15.46									
FRM	0.94	0.85	19.96								



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

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

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

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	2819	1865	1771	2032	1972	4311	1005	2059	930	1723	975	663	1535	1273	247	375	186	1227	1921	516	1525	592	483	338	1363	922	547	355
DEU	2303	0	3161	2845	2792	3941	4049	1283	2429	1161	1896	1446	969	1781	2046	409	580	207	1456	3258	561	1559	854	741	608	1555	797	523	731
DFS	1688	2487	0	1985	1747	2619	2604	838	1859	1008	1521	1060	831	1267	1390	301	446	187	1092	2114	516	1121	559	453	408	1213	654	461	493
FRA	1340	1808	1283	0	1701	2375	2803	820	1793	941	1471	1151	811	1440	1349	243	338	154	1072	2180	515	1330	497	484	304	1198	672	458	391
ITA	1822	2110	1496	1130	0	1930	2922	773	1672	689	1206	869	577	1377	1365	294	378	174	1183	2175	360	1166	580	401	382	1179	715	406	417
NLD	1948	3790	2377	1718	1723	0	3054	1041	2121	1292	1694	1514	1004	1369	1679	314	504	203	1152	2460	525	1224	596	592	413	1357	663	478	524
USA	4949	3178	2165	1687	2476	2789	0	1136	2729	1323	2291	1151	924	1816	1888	285	490	299	1575	2900	648	2174	807	607	455	1717	1118	760	454
CHE	931	1219	793	766	708	1042	1067	0	827	479	718	692	449	634	521	153	216	73	473	799	259	517	278	252	147	605	340	229	225
GBR	2331	1932	1485	1258	1389	1924	2563	793	0	1123	1670	1022	1105	1239	1154	238	366	187	1000	1784	520	1171	504	413	363	1175	645	502	390
NZL	919	913	745	626	542	1185	1281	405	983	0	1389	611	833	635	649	146	189	138	554	846	378	642	291	282	208	694	389	423	259
AUS	1765	1482	1157	1064	972	1508	2367	636	1478	1396	0	868	811	1029	899	195	286	144	830	1318	488	1010	449	340	283	995	582	489	339
BEL	978	1500	1006	1192	875	1738	1044	710	1016	502	773	0	577	792	699	191	248	103	613	1014	343	623	323	328	202	813	388	275	312
IRL	616	843	683	681	496	941	841	455	1130	725	698	560	0	556	500	124	165	125	470	715	332	476	230	225	166	558	290	302	207
ESP	1079	1201	1007	1209	1014	1240	1273	530	981	487	752	776	519	0	926	219	266	131	896	1394	455	1008	427	352	262	1042	610	391	332
CZE	967	1612	976	892	1049	1493	1536	367	775	451	594	540	349	621	0	247	348	151	1014	1635	344	894	467	464	329	912	563	366	422
SVN	193	401	245	185	256	276	233	110	177	102	138	151	93	155	182	0	109	54	189	339	75	180	126	84	88	198	129	69	130
EST	255	440	309	186	233	373	368	131	227	99	154	161	84	129	221	66	0	68	268	484	114	248	207	144	122	267	162	130	153
ISR	132	157	139	94	118	157	293	43	140	112	93	66	98	78	120	38	38	0	135	206	68	138	92	59	67	134	86	83	78
HUN	1178	1204	922	804	1066	994	1583	394	863	418	629	535	396	726	907	145	164	94	0	1249	379	793	418	348	283	894	559	385	303
POL	1787	3104	1838	1662	1930	2373	2997	701	1616	663	1053	953	590	1075	1417	302	363	162	1172	0	422	1173	727	508	472	1349	759	475	566
ZAF	479	438	396	410	280	447	635	221	456	312	430	294	298	408	221	54	57	43	303	324	0	432	167	184	105	456	279	281	162
JPN	834	744	643	540	624	689	1044	349	623	347	575	417	304	503	434	99	95	64	448	670	283	0	414	331	248	842	677	420	264
LVA	383	700	353	265	366	408	713	145	294	163	232	192	131	232	312	73	115	60	313	596	94	183	0	171	214	478	293	210	278
SVK	337	555	245	271	243	423	413	129	239	168	169	200	109	180	365	40	60	25	241	369	101	121	81	0	114	364	231	194	159
LTU	208	564	253	134	211	263	335	64	210	106	136	102	83	111	215	40	62	34	183	368	40	86	143	51	0	265	177	136	163
PRT	1428	1473	1131	1095	1131	1374	1848	551	1079	572	841	830	499	1016	754	157	177	87	895	1378	410	515	378	247	166	0	604	434	372
KOR	890	568	491	428	585	494	1270	243	475	285	426	287	203	446	404	80	80	45	445	638	209	418	179	138	81	515	0	331	173
URY	545	398	340	317	314	386	947	182	430	348	389	214	250	318	272	42	77	46	328	413	242	263	123	123	75	394	267	0	155
HRV	219	756	396	288	310	476	352	150	279	156	216	251	143	247	320	105	110	55	226	526	109	123	215	79	110	310	83	102	0

HOL

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	2819	1864	1771	2036	1972	4309	1005	2059	930	1723	975	663	1534	1273	248	375	186	1227	1921	515	1521	592	483	338	1362	922	547	354
DEU	2303	0	3161	2845	2798	3941	4046	1283	2428	1161	1896	1446	969	1781	2046	410	580	207	1456	3258	560	1555	854	741	608	1554	797	523	730
DFS	1688	2487	0	1985	1749	2619	2601	838	1859	1008	1521	1060	830	1266	1389	302	446	187	1091	2113	515	1119	559	453	408	1213	654	461	492
FRA	1340	1808	1283	0	1704	2375	2802	820	1793	941	1471	1151	812	1440	1349	244	338	154	1072	2180	514	1327	497	484	304	1198	672	458	390
ITA	1829	2118	1501	1135	0	1935	2926	778	1676	691	1209	873	579	1379	1369	297	379	175	1183	2179	361	1166	583	403	383	1183	715	406	418
NLD	1948	3790	2377	1718	1729	0	3052	1041	2121	1292	1694	1514	1006	1369	1679	315	504	203	1152	2460	524	1220	596	592	413	1356	663	478	523
USA	4948	3175	2160	1686	2482	2788	0	1136	2728	1322	2291	1150	923	1814	1887	286	489	299	1574	2899	647	2170	806	607	455	1714	1118	760	452
CHE	931	1219	793	766	712	1042	1067	0	827	479	718	692	449	634	521	154	216	73	473	799	258	514	278	252	147	605	340	229	224
GBR	2331	1932	1485	1258	1395	1924	2562	793	0	1123	1670	1022	1106	1239	1154	239	366	187	1000	1784	519	1167	504	413	363	1174	645	502	390
NZL	919	913	745	626	545	1185	1280	405	983	0	1389	611	834	635	649	147	189	138	554	846	377	642	291	282	208	694	389	423	258
AUS	1765	1482	1157	1064	975	1508	2367	636	1478	1396	0	868	811	1029	899	196	286	144	830	1318	487	1007	449	340	283	994	582	489	339
BEL	978	1500	1006	1192	878	1738	1043	710	1016	502	773	0	577	792	699	192	248	103	613	1014	342	622	323	328	202	813	388	275	311
IRL	616	843	683	681	499	943	841	455	1131	726	698	560	0	555	500	125	165	125	470	716	332	474	230	225	166	558	290	302	206
ESP	1079	1201	1006	1209	1017	1240	1270	530	981	487	752	776	519	0	925	220	266	131	895	1393	454	1006	427	352	262	1041	610	391	332
CZE	967	1612	976	892	1053	1493	1535	367	775	451	594	540	349	621	0	248	348	151	1014	1635	343	893	467	464	329	911	563	366	421
SVN	193	401	245	185	259	276	233	110	177	102	138	151	93	155	182	0	109	54	189	340	75	180	127	85	89	199	129	70	131
EST	255	440	309	186	235	373	367	131	227	99	154	161	84	129	221	66	0	68	268	484	114	245	207	144	122	266	162	130	153
ISR	132	157	139	94	119	157	293	43	140	112	93	66	98	78	120	38	38	0	135	206	67	137	92	59	67	133	86	83	78
HUN	1178	1204	921	804	1068	994	1581	394	863	418	629	535	396	725	907	145	164	94	0	1249	378	791	418	348	283	894	559	385	303
POL	1787	3104	1838	1662	1936	2373	2994	701	1616	663	1053	953	590	1075	1417	302	363	162	1172	0	421	1168	727	508	472	1348	759	475	565
ZAF	478	437	395	409	282	446	634	220	455	312	429	294	298	407	220	53	57	43	302	323	0	430	166	183	104	455	278	280	161
JPN	829	740	641	536	624	685	1037	346	618	346	570	415	302	500	433	99	92	63	446	665	282	0	413	330	248	837	676	419	264
LVA	383	700	353	265	369	408	712	145	294	163	232	192	131	232	312	73	115	60	313	596	94	182	0	171	214	478	293	210	278
SVK	337	555	245	271	244	423	413	129	239	168	169	200	109	180	365	40	60	25	241	369	101	120	81	0	114	364	231	194	159
LTU	208	564	253	134	212	263	335	64	210	106	136	102	83	111	215	40	62	34	183	368	39	86	143	51	0	264	177	136	163
PRT	1427	1472	1131	1094	1137	1373	1845	551	1078	572	840	830	499	1015	753	157	176	86	895	1377	409	510	378	247	165	0	604	434	371
KOR	890	568	491	428	585	494	1268	243	475	285	426	287	203	446	404	80	80	45	445	638	209	416	179	138	81	515	0	331	173
URY	545	398	340	317	314	386	947	182	430	348	389	214	250	318	272	42	77	46	328	413	242	260	123	123	75	394	267	0	155
HRV	217	754	394	286	312	474	349	148	278	155	215	250	141	247	318	104	110	54	225	524	109	123	215	79	109	308	82	102	0

HOL

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	2819	1864	1771	2033	1972	4303	1005	2059	930	1723	975	663	1534	1273	247	375	186	1227	1921	515	1518	592	483	338	1363	922	547	355
DEU	2303	0	3161	2845	2793	3941	4044	1283	2429	1161	1896	1446	969	1781	2046	409	580	207	1456	3258	560	1553	854	741	608	1555	797	523	731
DFS	1688	2487	0	1985	1746	2619	2599	838	1860	1008	1521	1060	830	1266	1389	301	446	187	1091	2113	515	1117	559	453	408	1213	654	461	493
FRA	1340	1808	1283	0	1701	2375	2801	820	1794	941	1471	1151	812	1440	1349	243	338	154	1072	2180	514	1327	497	484	304	1198	672	458	391
ITA	1824	2110	1496	1130	0	1931	2922	774	1674	690	1207	870	577	1377	1366	294	378	174	1183	2175	359	1163	580	401	382	1180	715	406	417
NLD	1948	3789	2377	1718	1722	0	3051	1041	2122	1292	1694	1514	1006	1369	1679	314	504	203	1152	2460	524	1218	596	592	413	1357	663	478	524
USA	4945	3175	2160	1686	2476	2788	0	1136	2727	1322	2288	1149	923	1813	1887	285	489	299	1574	2899	647	2165	806	606	455	1715	1119	760	453
CHE	931	1219	793	766	708	1042	1066	0	827	479	718	692	449	634	521	153	216	73	473	799	258	512	278	252	147	605	340	229	225
GBR	2331	1934	1487	1260	1391	1925	2562	793	0	1124	1670	1023	1107	1240	1154	238	366	187	1000	1785	519	1166	504	413	363	1176	645	502	391
NZL	919	913	745	626	543	1185	1280	405	983	0	1389	611	834	635	649	146	189	138	554	846	377	641	291	282	208	694	389	423	259
AUS	1765	1482	1157	1064	972	1507	2366	636	1478	1396	0	868	811	1029	899	195	286	144	830	1318	487	1006	449	340	283	995	582	489	339
BEL	978	1500	1006	1192	875	1738	1042	710	1017	502	773	0	577	792	699	191	248	103	613	1014	342	622	323	328	202	813	388	275	312
IRL	616	843	683	681	496	943	841	455	1133	726	698	560	0	555	500	124	165	125	470	716	332	474	230	225	166	558	290	302	207
ESP	1079	1201	1006	1209	1014	1240	1270	530	982	487	752	776	519	0	925	219	266	131	895	1393	454	1005	427	352	262	1042	610	391	332
CZE	967	1612	976	892	1049	1493	1535	367	776	451	594	540	349	621	0	247	348	151	1014	1635	343	893	467	464	329	912	563	366	422
SVN	193	401	245	185	256	276	233	110	177	102	138	151	93	155	182	0	109	54	189	339	74	180	126	84	88	198	129	69	130
EST	255	440	309	186	233	373	367	131	227	99	154	161	84	129	221	66	0	68	268	484	114	244	207	144	122	267	162	130	153
ISR	132	157	139	94	118	157	293	43	140	112	93	66	98	78	120	38	38	0	135	206	67	137	92	59	67	134	86	83	78
HUN	1178	1204	921	804	1066	994																							

URY	545	398	340	317	314	386	947	182	430	348	389	214	250	318	272	42	77	46	328	413	242	260	123	123	75	394	267	0	155
HRV	218	755	395	287	309	475	350	149	280	156	215	251	142	247	319	104	110	54	225	525	109	123	215	79	109	309	82	102	0

JER

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	162	548	235	308	211	61	171	70	111	9	48					
DFS	158	0	256	207	189	224	190	171	109	196	37	65					
USA	581	241	0	457	559	295	127	326	100	187	39	80					
NZL	243	185	534	0	526	281	113	228	86	123	106	62					
AUS	314	162	605	581	0	267	90	261	84	114	53	64					
GBR	208	215	317	281	265	0	121	186	104	140	68	79					
NLD	55	194	131	108	80	113	0	87	56	136	27	45					
ZAF	167	153	340	235	245	187	83	0	90	99	34	59					
ITA	67	110	107	85	79	106	56	83	0	60	19	44					
DEU	107	195	186	115	105	136	132	96	61	0	21	56					
IRL	6	33	40	118	50	71	25	34	18	21	0	18					
CHE	42	65	81	53	54	76	38	52	43	52	13	0					

JER

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	162	548	235	308	211	61	171	70	111	9	48					
DFS	158	0	256	207	189	224	190	171	109	196	37	65					
USA	580	241	0	457	559	294	127	325	100	187	39	80					
NZL	243	185	534	0	526	281	113	228	86	123	106	63					
AUS	314	162	605	581	0	267	90	261	84	114	53	64					
GBR	208	215	316	281	265	0	121	186	104	140	68	79					
NLD	55	194	131	108	80	113	0	87	56	136	27	45					
ZAF	167	153	339	235	245	187	83	0	90	99	34	59					
ITA	67	110	107	85	79	106	56	83	0	60	19	44					
DEU	107	195	186	115	105	136	132	96	61	0	21	56					
IRL	6	33	40	118	50	71	25	34	18	21	0	18					
CHE	42	65	81	53	54	76	38	52	43	52	13	0					

JER

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	162	548	235	308	211	61	171	70	111	9	48					
DFS	158	0	256	207	189	224	190	171	109	196	37	65					
USA	580	241	0	457	559	296	127	325	100	187	39	80					
NZL	243	185	534	0	526	282	113	228	86	123	106	62					
AUS	314	162	605	581	0	268	90	261	84	114	53	64					
GBR	209	216	319	283	266	0	121	186	104	140	68	79					
NLD	55	194	131	108	80	113	0	87	56	136	27	45					
ZAF	167	153	339	235	245	187	83	0	90	99	34	59					
ITA	67	110	107	85	79	106	56	83	0	60	19	44					
DEU	107	195	186	115	105	136	132	96	61	0	21	56					
IRL	6	33	40	118	50	71	25	34	18	21	0	18					
CHE	42	65	81	53	54	76	38	52	43	52	13	0					

RDC

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	236	100	111	103	209	14	75	3	10	22	3	7	0
NOR	7	0	89	57	83	90	151	18	0	35	22	27	49	56	0
USA	222	90	0	144	160	143	237	31	64	30	27	43	25	52	32

NZL	101	57	144	0	180	102	218	25	39	25	20	30	11	30	13
AUS	112	72	162	180	0	108	227	49	38	52	41	48	15	49	15
GBR	101	94	135	98	106	0	140	16	43	17	17	30	19	50	0
DFS	216	126	234	213	201	134	0	74	53	154	134	112	15	64	0
DEU	13	17	29	24	48	16	65	0	1	36	37	26	5	21	0
ZAF	77	0	58	34	39	37	50	1	0	0	2	5	2	2	0
EST	2	35	29	23	46	15	141	35	0	0	55	25	0	28	0
LVA	10	20	24	17	37	16	93	31	2	47	0	46	3	18	0
LTU	21	24	38	28	45	28	99	26	5	24	41	0	6	19	0
IRL	3	48	25	11	14	18	12	5	2	0	3	6	0	10	0
NLD	7	55	51	29	47	49	61	20	2	27	17	18	10	0	0
CAM	0	0	32	13	15	0	0	0	0	0	0	0	0	0	0

RDC

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	236	100	111	103	209	14	75	3	10	22	3	7	0
NOR	7	0	88	57	83	90	151	18	0	35	22	27	49	56	0
USA	222	89	0	144	160	142	235	31	64	30	27	43	25	52	32
NZL	101	57	144	0	180	102	218	25	39	25	20	30	11	30	13
AUS	112	72	162	180	0	108	227	49	38	52	41	48	15	49	15
GBR	101	94	134	98	106	0	140	16	43	17	17	30	19	50	0
DFS	216	126	232	213	201	134	0	74	53	154	134	112	15	64	0
DEU	13	17	29	24	48	16	65	0	1	36	37	26	5	21	0
ZAF	77	0	58	34	39	37	50	1	0	0	2	5	2	2	0
EST	2	35	29	23	46	15	141	35	0	0	55	25	0	28	0
LVA	10	20	24	17	37	16	93	31	2	47	0	46	3	18	0
LTU	21	24	38	28	45	28	99	26	5	24	41	0	6	19	0
IRL	3	48	25	11	14	18	12	5	2	0	3	6	0	10	0
NLD	7	55	51	29	47	49	61	20	2	27	17	18	10	0	0
CAM	0	0	32	13	15	0	0	0	0	0	0	0	0	0	0

RDC

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	236	100	111	103	209	14	75	3	10	22	3	7	0
NOR	7	0	88	57	83	90	151	18	0	35	22	27	49	56	0
USA	222	89	0	144	160	143	235	31	64	30	27	43	25	52	32
NZL	101	57	144	0	180	102	218	25	39	25	20	30	11	30	13
AUS	112	72	162	180	0	108	227	49	38	52	41	48	15	49	15
GBR	101	94	135	98	106	0	140	16	43	17	17	30	19	50	0
DFS	216	126	232	213	201	134	0	74	53	154	134	112	15	64	0
DEU	13	17	29	24	48	16	65	0	1	36	37	26	5	21	0
ZAF	77	0	58	34	39	37	50	1	0	0	2	5	2	2	0
EST	2	35	29	23	46	15	141	35	0	0	55	25	0	28	0
LVA	10	20	24	17	37	16	93	31	2	47	0	46	3	18	0
LTU	21	24	38	28	45	28	99	26	5	24	41	0	6	19	0
IRL	3	48	25	11	14	18	12	5	2	0	3	6	0	10	0
NLD	7	55	51	29	47	49	61	20	2	27	17	18	10	0	0
CAM	0	0	32	13	15	0	0	0	0	0	0	0	0	0	0

SIM

common bulls below diagonal											
common three quarter sib group above diagonal											
	CHE	DEA	FRM	ITA	SVN	FRA	NLD	IRL	GBR	HRV	USA
CHE	0	401	258	107	2	15	95	57	56	3	33
DEA	369	0	292	1171	308	273	435	68	55	741	41
FRM	310	335	0	197	11	2	139	72	73	2	95
ITA	109	1080	223	0	179	160	285	66	48	351	39
SVN	2	291	10	165	0	61	97	6	0	137	2
FRA	12	231	1	145	57	0	89	6	0	111	3

