

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 conformation traits are as follows:

NOR (RDC)	The rolling definition of effects redistribute the daughters and some bulls loose EDC.
ISR (HOL)	Drops in information due to pedigree corrections and edits.
AUS (HOL, JER, RDC)	Decreasing in information due to pedigree changes, changes in status of bull which leads to a good number of bulls no longer being qualified
JPN (HOL)	Some changes in proofs caused by additional records and in EDCs caused by modification of pedigree.
IRL (HOL, JER, RDC, SIM)	Fixed a bug on identifying publishable bulls. Decrease in information due to pedigree verification.
DEA (BSW, SIM)	Pedigree corrections leads decreasing reliabilities in few bulls. Some bulls lost daughters from the second crop period and changed ToP. Few bulls decrease in number of herds/EDC with same number of daughters, due to herd changes regarding to the movement of cows from alpine pasturing back to herds in the valleys.
USA (ALL)	Drops in information for most traits are due to pedigree corrections and herd-year minimum edits.
NZL (BSW, GUE, HOL, JER, RDC)	Continuous DNA parentage testing affected daughter counts, herd count, EDCs, and reliabilities.
SVN (BSW, HOL, SIM)	Some bulls losing information (herds/daughters/EDC), due to changes in data base, related to the pedigree completeness as well as phenotypic data improvement.
HRV (SIM)	Decrease in information due to changes related to the pedigree completeness and additional pedigree changes.
ESP (HOL)	Change in base definition. Some Bulls lost some EDC, due to some daughters that were assigned as culled but did contribute more information now.
ITA (BSW)	For some traits, new information cause low correlation with previous evaluation for some years.
FRA (HOL, SIM, MON)	The reliability from the singlestep is now used as a factor for the publication rule. As the single step reliability showed differences between traits, even belonging to the same trait group, there are a different amount of bulls no more qualifying for publication across all traits due to the fact that such bulls do not meet anymore the new threshold set by the organisation.

INTERBULL CHANGES COMPARED TO THE PREVIOUS ROUTINE RUN

Post-processing Windows:

According to the decision taken by ITC in Orlando (2015) to review the post-processing windows every 5 years, during the 2020 the relative working group has been re-activated and new windows have been identified.

As before, the upper bounds have been set to 0.99 as these were judged to have very little effect on evaluations while the lower values have been reduced to the 10th percentile. This reduction would provide post-processed correlations to be closer to the real estimated ones. Over the past five years, in fact, the previous adopted lower value (25th percentile) had been found too high causing estimated and post-processed correlations to differ significantly from each other. The new lower values have been applied to all breeds and traits.

The weight assigned to the magnitude of the changes tested by each country has also been revised. The new weight will allow post-processed correlations to take more in consideration the value of the new estimated ones even when no changes are applied by the countries.

The new weights are as follows:

No changes :: 2
Small changes:: 1
Big changes :: 0

More information can be read on https://interbull.org/ib/rg_procedure

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>.

 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. National evaluation data considered in the Interbull evaluation for dairy production traits (August Routine Evaluation 2022).
 Number of records for milk yield by breed

Country	BSW	GUE	HOL	JER	RDC	SIM
AUS	224	146	8747	1863	822	
BEL			2248			
CAN	274	106	13593	854	866	
CHE	3145		3297	98		3524
CZE			5045			
DEA	6324					25760
DEU			23756	220	293	
DFS			14022	2309	7985	
ESP			4397			
EST			1330		477	
FRA	437		18336			477
FRM						5013
GBR	185	372	7949	975	691	95
HUN			3615			237
IRL			3118	163	62	101
ISR			1646			
ITA	2318		9089	171		1938
JPN			6666			
KOR			1688			
LTU			1353		438	
LVA			1451		709	
NLD	219		16635	235	94	482
NOR					4292	
NZL	82	62	8714	5349	1501	
POL			12099			
PRT			2472			
SVK			1178			
SVN	416		699			753
URY			1149			
USA	1193	817	41599	5249	796	92
ZAF			1316	742	144	
HRV			932			1039
CAM					46	
=====						
No. Records	14817	1503	218139	18228	19216	39511
Pub. Proofs	11841	1191	157860	14521	17018	35534

^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	655.77										
FRA	0.88	632.85									
USA	0.92	0.88	630.92								
CHE	0.90	0.88	0.87	492.95							
ITA	0.87	0.80	0.88	0.87	611.24						
DEA	0.85	0.81	0.86	0.94	0.89	464.94					
NLD	0.88	0.85	0.87	0.85	0.86	0.86	649.16				
SVN	0.72	0.71	0.71	0.70	0.67	0.68	0.71	9.11			
NZL	0.66	0.74	0.69	0.69	0.64	0.67	0.70	0.64	456.90		
GBR	0.85	0.87	0.84	0.86	0.79	0.78	0.84	0.69	0.70	295.42	
AUS	0.73	0.75	0.69	0.68	0.66	0.63	0.71	0.67	0.82	0.71	389.80

BSW fat											
	CAN	FRA	USA	CHE	ITA	DEA	NLD	SVN	NZL	GBR	AUS
CAN	28.15										
FRA	0.88	26.61									
USA	0.90	0.89	23.68								
CHE	0.86	0.87	0.84	19.34							
ITA	0.88	0.82	0.86	0.86	23.27						
DEA	0.83	0.83	0.84	0.94	0.87	17.33					
NLD	0.86	0.84	0.85	0.83	0.85	0.86	25.43				
SVN	0.72	0.72	0.72	0.70	0.66	0.70	0.70	9.44			
NZL	0.69	0.74	0.71	0.76	0.64	0.77	0.68	0.65	21.29		
GBR	0.84	0.87	0.85	0.85	0.79	0.78	0.85	0.68	0.71	10.80	
AUS	0.73	0.71	0.72	0.64	0.66	0.66	0.68	0.64	0.79	0.69	15.62

BSW pro											
	CAN	FRA	USA	CHE	ITA	DEA	NLD	SVN	NZL	GBR	AUS
CAN	23.67										
FRA	0.83	20.13									
USA	0.89	0.86	18.79								
CHE	0.84	0.83	0.83	15.67							
ITA	0.84	0.78	0.83	0.84	21.32						
DEA	0.80	0.76	0.82	0.93	0.87	14.49					
NLD	0.85	0.81	0.83	0.81	0.82	0.84	21.14				
SVN	0.70	0.67	0.69	0.66	0.66	0.65	0.68	8.89			
NZL	0.59	0.66	0.63	0.67	0.60	0.70	0.63	0.59	15.40		
GBR	0.84	0.84	0.82	0.82	0.76	0.73	0.83	0.66	0.64	8.80	
AUS	0.69	0.65	0.66	0.61	0.59	0.60	0.65	0.59	0.77	0.65	12.21

GUE mil					
	CAN	USA	AUS	GBR	NZL
CAN	759.69				
USA	0.93	778.50			
AUS	0.79	0.74	473.51		
GBR	0.86	0.82	0.72	250.39	
NZL	0.70	0.68	0.82	0.69	373.94

GUE fat					
	CAN	USA	AUS	GBR	NZL
CAN	30.25				
USA	0.92	27.29			
AUS	0.77	0.74	17.53		
GBR	0.86	0.83	0.72	10.20	
NZL	0.70	0.72	0.81	0.70	18.16

BSW

```

common bulls below diagonal
common three quarter sib group above diagonal
  CAN  FRA  USA  CHE  ITA  DEA  NLD  SVN  NZL  GBR  AUS
-----
CAN   0   89  189  146  143  159   57   39   36   76  101
FRA   78   0  120  166  199  222   86   63   32   65   70
USA  184   82   0  328  254  347   89   49   45  108  131
CHE  125  125  305   0  499  626  107   93   42   86  124
ITA  127  159  180  441   0  783  139  115   46   96  130
DEA  141  167  310  519  683   0  160  122   58   94  137
NLD   53   70   81   99  116  153   0   54   34   45   64
SVN   36   61   39   89  112  113   55   0   16   29   35
NZL   35   24   38   31   38   52   27   14   0   29   40
GBR   75   54  102   66   71   65   39   24   25   0   68
AUS  104   53  123   84   96  100   48   28   32   62   0
-----

```

BSW

```

common bulls below diagonal
common three quarter sib group above diagonal
  CAN  FRA  USA  CHE  ITA  DEA  NLD  SVN  NZL  GBR  AUS
-----
CAN   0   89  189  146  143  159   57   39   36   76  101
FRA   78   0  120  166  199  222   86   63   32   65   70
USA  184   82   0  328  254  347   89   49   45  108  131
CHE  125  125  305   0  499  627  107   93   42   86  124
ITA  127  159  180  441   0  784  139  115   46   96  130
DEA  141  167  310  519  684   0  160  122   58   94  137
NLD   53   70   81   99  116  153   0   54   34   45   64
SVN   36   61   39   89  112  113   55   0   16   29   35
NZL   35   24   38   31   38   52   27   14   0   29   40
GBR   75   54  102   66   71   65   39   24   25   0   68
AUS  104   53  123   84   96  100   48   28   32   62   0
-----

```

BSW

```

common bulls below diagonal
common three quarter sib group above diagonal
  CAN  FRA  USA  CHE  ITA  DEA  NLD  SVN  NZL  GBR  AUS
-----
CAN   0   89  189  146  143  159   57   39   36   76  101
FRA   78   0  120  166  199  222   86   63   32   65   70
USA  184   82   0  328  254  347   89   49   45  108  131
CHE  125  125  305   0  499  626  107   93   42   86  124
ITA  127  159  180  441   0  783  139  115   46   96  130
DEA  141  167  310  519  683   0  160  122   58   94  137
NLD   53   70   81   99  116  153   0   54   34   45   64
SVN   36   61   39   89  112  113   55   0   16   29   35
NZL   35   24   38   31   38   52   27   14   0   29   40
GBR   75   54  102   66   71   65   39   24   25   0   68
AUS  104   53  123   84   96  100   48   28   32   62   0
-----

```

GUE

```

common bulls below diagonal
common three quarter sib group above diagonal
  CAN  USA  AUS  GBR  NZL
-----
CAN   0   74   52   36   14
USA   66   0   69   99   32
AUS   49   66   0   43   27
GBR   30  101   37   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	74	52	36	14
USA	66	0	69	99	32
AUS	49	66	0	43	27
GBR	30	101	37	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	74	52	36	14
USA	66	0	69	99	32
AUS	49	66	0	43	27
GBR	30	101	37	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	2562	1646	1671	1796	1724	3874	916	1858	832	1575	891	609	1410	1296	249	304	150	1109	1675	515	1414	564	460	351	1065	788	525	337
DEU 1997	0	2830	2668	2528	3536	3718	1170	2218	1049	1756	1309	903	1630	2057	381	480	176	1305	2871	560	1458	885	708	689	1229	696	499	694	
DFS 1446	2132	0	1852	1559	2344	2324	754	1690	915	1402	947	768	1129	1435	297	357	166	988	1857	515	1033	548	431	413	948	553	441	462	
FRA 1230	1633	1151	0	1683	2236	2711	764	1698	887	1410	1076	783	1337	1466	258	310	143	1036	1992	513	1285	510	470	349	1006	608	449	370	
ITA 1472	1663	1209	992	0	1729	2613	731	1565	692	1183	806	594	1273	1295	263	301	141	1018	1775	418	1136	552	389	369	945	636	415	398	
NLD 1677	3325	2094	1570	1395	0	2743	954	1929	1152	1575	1381	921	1235	1735	311	420	175	1051	2160	523	1128	613	569	460	1069	560	452	493	
USA 4388	2766	1845	1591	1893	2447	0	1045	2454	1182	2103	1049	845	1677	1902	284	401	220	1430	2463	647	2031	755	573	470	1330	957	713	427	
CHE 840	1105	707	708	660	952	983	0	752	439	667	643	419	597	568	162	184	69	449	744	260	481	314	247	196	499	297	222	214	
GBR 2109	1710	1312	1159	1186	1707	2247	717	0	1011	1530	932	1009	1164	1212	245	296	160	937	1556	519	1096	487	398	364	967	559	474	366	
NZL 834	808	655	579	499	1050	1129	371	878	0	1286	563	756	583	719	151	159	122	541	744	376	604	282	275	210	596	353	388	243	
AUS 1604	1340	1033	1005	872	1394	2154	590	1342	1296	0	805	759	964	968	203	244	127	788	1182	487	951	436	328	297	807	510	464	319	
BEL 890	1350	892	1109	784	1592	940	656	924	457	714	0	536	733	764	198	222	88	587	914	342	579	339	315	233	680	339	266	296	
IRL 567	780	629	657	485	859	758	426	1029	650	651	523	0	526	582	131	150	109	464	652	330	450	236	218	173	498	257	283	197	
ESP 959	1069	867	1107	896	1113	1132	496	919	445	695	721	499	0	981	221	238	119	836	1209	455	952	414	337	265	851	540	379	309	
CZE 1002	1656	995	1016	935	1596	1556	441	883	542	663	630	456	729	0	259	310	142	1037	1568	439	929	504	539	373	857	548	426	409	
SVN 183	368	239	188	218	270	219	118	176	106	141	157	99	160	193	0	108	54	185	309	103	192	145	96	91	176	122	82	132	
EST 190	347	232	169	169	306	281	104	173	80	125	141	79	115	195	63	0	55	226	390	113	225	219	129	137	204	138	119	143	
ISR 110	136	122	90	90	135	208	40	111	99	81	56	82	70	110	38	33	0	123	162	67	116	82	55	61	110	71	74	72	
HUN 1044	1045	799	767	868	891	1409	376	811	422	599	511	403	676	968	137	137	84	0	1069	404	765	386	335	258	734	512	392	286	
POL 1505	2656	1567	1459	1426	2062	2451	637	1356	572	925	851	537	889	1344	276	283	129	970	0	427	1075	729	479	513	1041	645	447	531	
ZAF 479	438	396	409	319	444	635	221	456	312	429	293	297	408	313	73	57	43	336	323	0	431	176	184	123	439	279	280	160	
JPN 736	659	571	500	558	606	917	324	566	319	532	374	284	460	428	105	84	47	421	590	283	0	387	319	248	712	612	410	248	
LVA 346	730	346	278	345	418	636	173	283	161	221	207	134	220	342	84	132	53	276	592	101	166	0	202	261	425	265	201	285	
SVK 322	524	230	267	222	400	384	127	228	164	163	192	106	171	462	52	54	22	234	336	101	114	102	0	143	324	221	190	152	
LTU 197	639	246	157	192	297	327	90	197	100	135	125	82	113	257	46	70	29	156	404	49	85	180	73	0	249	165	135	186	
PRT 1106	1118	839	902	864	1064	1398	449	882	484	645	679	446	804	718	138	137	76	727	1042	395	423	321	223	158	0	497	407	333	
KOR 771	484	408	384	515	410	1108	213	411	259	377	251	180	389	399	73	66	39	413	545	208	370	158	133	70	412	0	319	161	
URY 523	377	323	309	313	365	894	178	403	313	364	208	231	312	332	49	70	41	336	386	240	254	119	123	78	369	260	0	150	
HRV 204	722	369	271	290	452	328	142	265	145	204	243	137	232	314	106	103	51	213	483	108	114	221	76	134	269	75	97	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	2562	1646	1671	1804	1724	3872	916	1858	832	1575	891	609	1410	1296	249	304	150	1109	1675	513	1409	564	460	351	1064	788	525	336
DEU 1997	0	2830	2668	2536	3536	3716	1170	2218	1049	1756	1309	903	1630	2057	381	480	176	1305	2871	558	1453	885	708	689	1228	696	499	693	
DFS 1446	2131	0	1852	1568	2344	2323	754	1690	915	1402	947	768	1129	1435	297	357	166	988	1857	513	1029	548	431	413	948	553	441	461	
FRA 1230	1633	1151	0	1690	2236	2710	764	1698	887	1410	1076	784	1337	1466	258	310	143	1036	1992	512	1281	510	470	349	1005	608	449	369	
ITA 1482	1673	1218	1000	0	1736	2623	733	1574	699	1190	811	598	1279	1302	263	302	141	1025	1779	422	1139	552	391	371	950	638	419	397	
NLD 1677	3325	2094	1570	1406	0	2741	954	1929	1152	1575	1381	923	1235	1735	311	420	175	1051	2160	522	1122	613	569	460	1068	560	452	492	

USA	4383	2762	1843	1590	1905	2446	0	1045	2453	1181	2103	1048	844	1676	1901	284	400	220	1429	2462	645	2026	754	573	470	1328	957	713	425
CHE	840	1105	707	708	664	952	983	0	752	439	667	643	419	597	568	162	184	69	449	744	259	477	314	247	196	499	297	222	213
GBR	2109	1710	1312	1159	1195	1707	2245	717	0	1011	1530	932	1010	1164	1212	245	296	160	937	1556	517	1091	487	398	364	967	559	474	366
NZL	834	808	655	579	506	1050	1128	371	878	0	1286	563	756	583	719	151	159	122	541	744	374	604	282	275	210	596	353	388	242
AUS	1604	1340	1033	1005	880	1394	2153	590	1342	1296	0	805	759	964	968	203	244	127	788	1182	485	947	436	328	297	807	510	464	319
BEL	890	1350	892	1109	789	1592	939	656	924	457	714	0	536	733	764	198	222	88	587	914	341	576	339	315	233	680	339	266	295
IRL	567	780	629	657	490	861	758	426	1030	650	651	523	0	526	582	131	150	109	464	652	330	448	236	218	173	498	257	283	196
ESP	959	1069	867	1107	905	1113	1131	496	919	445	695	721	499	0	981	221	238	119	836	1209	454	950	414	337	265	850	540	379	309
CZE	1002	1656	995	1016	943	1596	1555	441	883	542	663	630	456	729	0	259	310	142	1037	1568	437	927	504	539	373	857	548	426	408
SVN	183	368	239	188	219	270	219	118	176	106	141	157	99	160	193	0	108	54	185	309	102	191	145	96	91	175	122	82	132
EST	190	347	232	169	170	306	280	104	173	80	125	141	79	115	195	63	0	55	226	390	113	222	219	129	137	203	138	119	143
ISR	110	136	122	90	90	135	208	40	111	99	81	56	82	70	110	38	33	0	123	162	66	115	82	55	61	110	71	74	72
HUN	1044	1045	799	767	876	891	1408	376	811	422	599	511	403	676	968	137	137	84	0	1069	403	763	386	335	258	733	512	392	286
POL	1505	2655	1566	1459	1430	2062	2448	637	1356	572	925	851	537	889	1344	276	283	129	970	0	425	1069	729	479	513	1040	645	447	530
ZAF	477	436	394	408	322	443	633	220	454	311	427	293	297	407	311	72	57	43	335	321	0	428	175	183	122	438	278	278	159
JPN	730	654	567	495	558	600	908	320	560	318	526	370	282	457	426	104	81	46	419	583	281	0	386	318	248	709	611	409	248
LVA	346	730	346	278	346	418	635	173	283	161	221	207	134	220	342	84	132	53	276	592	101	165	0	202	261	424	265	201	285
SVK	322	524	230	267	224	400	383	127	228	164	163	192	106	171	462	52	54	22	234	336	101	113	102	0	143	324	221	190	152
LTU	197	639	246	157	194	297	327	90	197	100	135	125	82	113	257	46	70	29	156	404	48	85	180	73	0	249	165	135	186
PRT	1106	1118	839	900	869	1064	1396	449	882	484	645	679	446	803	718	138	137	76	727	1041	394	420	321	223	158	0	497	407	331
KOR	771	484	408	384	517	410	1107	213	411	259	377	251	180	389	399	73	66	39	413	545	208	368	158	133	70	412	0	319	161
URY	523	377	323	309	317	365	894	178	403	313	364	208	231	312	332	49	70	41	336	386	239	251	119	123	78	369	260	0	150
HRV	202	720	367	269	288	450	325	140	264	144	203	242	135	232	312	105	103	50	212	481	108	114	221	76	133	267	74	97	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	2562	1646	1671	1796	1724	3866	916	1858	832	1575	891	609	1410	1296	249	304	150	1109	1675	513	1408	564	460	351	1065	788	525	337						
DEU	1997	0	2830	2668	2528	3536	3714	1170	2218	1049	1756	1309	903	1630	2057	381	480	176	1305	2871	558	1453	885	708	689	1229	696	499	694						
DFS	1446	2131	0	1852	1559	2344	2321	754	1690	915	1402	947	768	1129	1435	297	357	166	988	1857	513	1029	548	431	413	948	553	441	462						
FRA	1230	1633	1151	0	1683	2236	2709	764	1698	887	1410	1076	784	1337	1466	258	310	143	1036	1992	512	1281	510	470	349	1006	608	449	370						
ITA	1473	1664	1210	993	0	1729	2612	731	1565	692	1183	806	594	1273	1295	263	301	141	1018	1775	416	1133	552	389	369	945	636	415	398						
NLD	1677	3325	2094	1570	1396	0	2740	954	1929	1152	1575	1381	923	1235	1735	311	420	175	1051	2160	522	1121	613	569	460	1069	560	452	493						
USA	4380	2762	1843	1590	1894	2446	0	1045	2452	1181	2100	1047	844	1675	1901	284	400	220	1429	2462	645	2023	754	572	470	1329	958	713	426						
CHE	840	1105	707	708	661	952	982	0	752	439	667	643	419	597	568	162	184	69	449	744	259	476	314	247	196	499	297	222	214						
GBR	2109	1710	1312	1159	1187	1707	2245	717	0	1011	1530	932	1010	1164	1212	245	296	160	937	1556	517	1091	487	398	364	967	559	474	366						
NZL	834	808	655	579	499	1050	1128	371	878	0	1286	563	756	583	719	151	159	122	541	744	374	604	282	275	210	596	353	388	243						
AUS	1604	1340	1033	1005	872	1394	2152	590	1342	1296	0	805	759	964	968	203	244	127	788	1182	485	947	436	328	297	807	510	464	319						
BEL	890	1350	892	1109	784	1592	938	656	924	457	714	0	536	733	764	198	222	88	587	914	341	576	339	315	233	680	339	266	296						
IRL	567	780	629	657	485	861	758	426	1030	650	651	523	0	526	582	131	150	109	464	652	330	448	236	218	173	498	257	283	197						
ESP	959	1069	867	1107	897	1113	1131	496	919	445	695	721	499	0	981	221	238	119	836	1209	454	950	414	337	265	851	540	379	309						
CZE	1002	1656	995	1016	936	1596	1555	441	883	542	663	630	456	729	0	259	310	142	1037	1568	437	927	504	539	373	857	548	426	409						
SVN	183	368	239	188	218	270	219	118	176	106	141	157	99	160	193	0	108	54	185	309	102	191	145	96	91	176	122	82	132						
EST	190	347	232	169	169	306	280	104	173	80	125	141	79	115	195	63	0	55	226	390	113	221	219	129	137	204	138	119	143						
ISR	110	136	122	90	90	135	208	40	111	99	81	56	82	70	110	38	33	0	123	162	66	115	82	55	61	110	71	74	72						
HUN	1044	1045	799	767	869	891	1408	376	811	422	599	511	403	676	968	137	137	84	0	1069	403	763	386	335	258	734	512	392	286						
POL	1505	2655	1566	1459	1426	2062	2448	637	1356	572	925	851	537	889	1344	276	283	129	970	0	425	1069	729	479	513	1041	645	447	531						
ZAF	477	436	394	408	318	443	633	220	454	311	427	293	297	407	311	72	57	43	335	321	0	428	175	183	122	438	278	278	159						
JPN	729	654	567	495	555	599	907	320	560	318	526	370	282	457	426	104	80	46	419	583	281	0	386	318	248	709	611	409	248						
LVA	346	730	346	278	345	418	635	173	283	161	221	207	134	220	342	84	132	53	276	592	101	165	0	202	261	425	265	201	285						
SVK	322	524	230	267	222	400	382	127	228	164	163	192	106	171	462	52	54	22	234	336	101	113	102	0	143	324	221	190	152						
LTU	197	639	246	157	192	297	327	90	197	100	135	125	82	113	257	46	70	29	156	404	48	85	180	73	0	249	165	135	186						
PRT	1106	1118	839	901	865	1064	1395	449	882	484	644	679	446	804	718	138	137																		

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   7  227  94 105  90 186  14  75   3  10  17   2   6   0
NOR   6   0   83  47  74  65 137  15   0  28  19  25  48  48   0
USA  210  84   0 134 146 124 216  24  64  24  25  34  24  47  25
NZL   94  47 135   0 159  92 189  19  39  15  17  29  10  22  12
AUS  106  63 147 159   0  92 203  43  38  41  39  45  14  38  12
GBR   88  68 116  88  91   0 117  15  41  13  17  27  18  41   0
DFS  191 111 212 187 178 112   0  62  53 127 128 111  14  54   0
DEU   13  14  22  19  42  15  53   0   1  25  36  29   4  15   0
ZAF   77   0  58  34  39  36  50   1   0   0   2   5   2   2   0
EST   2  28  23  14  37  11 115  25  0   0  53  26   0  20   0
LVA  10  17  22  14  35  16  87  30  2  46   0  55   2  14   0
LTU  16  22  29  26  42  25  99  28  5  25  49   0   4  14   0
IRL   2  47  24  10  13  17  11   4   2   0   2   4   0   9   0
NLD   6  47  46  22  36  40  51  14  2  19  13  13   9   0   0
CAM   0   0  25  12  12   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   7  227  94 105  90 186  14  75   3  10  17   2   6   0
NOR   6   0   83  47  74  65 137  15   0  28  19  25  48  48   0
USA  210  84   0 134 146 124 216  24  64  24  25  34  24  47  25
NZL   94  47 135   0 159  92 189  19  39  15  17  29  10  22  12
AUS  106  63 147 159   0  92 203  43  38  41  39  45  14  38  12
GBR   88  68 116  88  91   0 117  15  41  13  17  27  18  41   0
DFS  191 111 212 187 178 112   0  62  53 127 128 110  14  54   0
DEU   13  14  22  19  42  15  53   0   1  25  36  29   4  15   0
ZAF   77   0  58  34  39  36  50   1   0   0   2   5   2   2   0
EST   2  28  23  14  37  11 115  25  0   0  53  26   0  20   0
LVA  10  17  22  14  35  16  87  30  2  46   0  55   2  14   0
LTU  16  22  29  26  42  25  98  28  5  25  49   0   4  14   0
IRL   2  47  24  10  13  17  11   4   2   0   2   4   0   9   0
NLD   6  47  46  22  36  40  51  14  2  19  13  13   9   0   0
CAM   0   0  25  12  12   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  HUN  NLD  IRL  GBR  HRV  USA
-----
CHE   0  375  232  97   6  10   2  91  57  56   2  32
DEA  342   0  284 1046 267 254  52 373  65  55  707  36
FRM  284 335   0 179  17   2   3 128  72  73   2  72
ITA  100 960 205   0 158 145  24 241  64  48  328  33
SVN   6 245  17 148   0  59  15  70   4   0 129   1
FRA   8 212   1 130  55   0  11  77   4   0 100   3
HUN   1  36   1  20  13   8   0   8   2   0  23   0
NLD  93 393 151 238  67  74   8   0  56  53 158  28
IRL  54  58  77  61   4   4   2  50   0  40   7  17
GBR  64  58  94  52   0   0   0  54  34   0   0  19
HRV   2 741   1 315 117  90  21 155   6   0   0   4
USA  31  42  87  40   1   3   0  30  16  27   4   0
-----

```

SIM

```

-----
common bulls below diagonal
common three quarter sib group above diagonal
  CHE  DEA  FRM  ITA  SVN  FRA  HUN  NLD  IRL  GBR  HRV  USA
-----

```

CHE	0	374	232	97	6	10	2	91	57	56	2	32
DEA	342	0	284	1047	267	254	52	373	65	55	705	36
FRM	284	335	0	179	17	2	3	128	72	73	2	72
ITA	100	961	205	0	158	145	24	241	64	48	327	33
SVN	6	245	17	148	0	59	15	70	4	0	129	1
FRA	8	212	1	130	55	0	11	77	4	0	100	3
HUN	1	36	1	20	13	8	0	8	2	0	23	0
NLD	93	393	151	238	67	74	8	0	56	53	158	28
IRL	54	58	77	61	4	4	2	50	0	40	7	17
GBR	64	58	94	52	0	0	0	54	34	0	0	19
HRV	2	739	1	314	117	90	21	155	6	0	0	4
USA	31	42	87	40	1	3	0	30	16	27	4	0

SIM

common bulls below diagonal
common three quarter sib group above diagonal

	CHE	DEA	FRM	ITA	SVN	FRA	HUN	NLD	IRL	GBR	HRV	USA
CHE	0	374	232	97	6	10	2	91	57	56	2	32
DEA	342	0	284	1046	267	254	52	373	65	55	706	36
FRM	284	335	0	179	17	2	3	128	72	73	2	72
ITA	100	960	205	0	158	145	24	241	64	48	327	33
SVN	6	245	17	148	0	59	15	70	4	0	129	1
FRA	8	212	1	130	55	0	11	77	4	0	100	3
HUN	1	36	1	20	13	8	0	8	2	0	23	0
NLD	93	393	151	238	67	74	8	0	56	53	158	28
IRL	54	58	77	61	4	4	2	50	0	40	7	17
GBR	64	58	94	52	0	0	0	54	34	0	0	19
HRV	2	740	1	314	117	90	21	155	6	0	0	4
USA	31	42	87	40	1	3	0	30	16	27	4	0
