

## Introduction

---

The latest routine international evaluation for udder traits took place as scheduled at the Interbull Centre. Data from twenty seven (27) countries were included in this evaluation.

International genetic evaluations for udder health traits of bulls from Australia, Austria-Germany, Belgium, Canada, 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 and Portugal 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:

DEA (BSW, SIM)	Base change
CHE (HOL, SIM)	Changes in pedigree
HRV (HOL, SIM)	Some changes in pedigree and phenotypic data.
NZL (ALL)	Continuous DNA parentage testing causing decrease in number of daughters, herds and EDC.

## INTERBULL CHANGES COMPARED TO THE DECEMBER ROUTINE RUN

---

### Subsetting:

---

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

### Window:

---

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

The upper bounds have been set to 0.99 as these were judged to have very little effect on evaluations. The lower values have been set to about the 25% percentile value. The largest changes are for the lower values for conformation traits, with the lowest window being 40% for OFL otherwise it is about 50% for all other confirmation traits. It is anticipated that these low values may not have large impact on evaluations since there were very few countries combinations whose estimated correlations fell between the old limit of 0.30 and these new limits.

## DATA AND METHOD OF ANALYSIS

---

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

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

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

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

SCIENTIFIC LITERATURE

---

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

International genetic evaluation computation:

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

Verification and Genetic trend validation:

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

Weighting factors:

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

De-regression:

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

Genetic parameter estimation:

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

Post-processing of estimated genetic correlations:

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

Time edits

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

International reliability estimation

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

NEXT ROUTINE INTERNATIONAL EVALUATION

---

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

NEXT TEST INTERNATIONAL EVALUATION

---

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

PUBLICATION OF INTERBULL TEST RUN

---

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

^LTable 1. National evaluation data considered in the Interbull evaluation for udder health (December Routine Evaluation 2016). Number of records for milk somatic cells by breed

Country	BSW	GUE	HOL	JER	RDC	SIM
AUS		122	7146	1438	629	
BEL			1063			
CAN	211	92	11192	626	752	
CHE	2747		3050			2981
CZE			3585			
DEA	5292					20968
DEU			26133		402	
DFS			12526	2008	7461	
ESP			3356			
EST			1000		391	
FRA	351		16090			414
FRM						3960
GBR	105	263	6103	642	435	80
HUN			2513			152
IRL			2203			
ISR			1284			
ITA	1780		9451			1316
JPN			5447			
KOR			1057			
LTU			694		402	
LVA			528		564	
NLD	167		14272	126	66	304
NOR					3876	
NZL	38	57	6710	4000	1155	
POL			9232			
PRT			2148			
SVK			1005			523
SVN	321		445			544
URY						
USA	996	670	34947	3984	619	38
ZAF		16	1136	535	121	
HRV			654			750
FRR			241			
=====						
No. Records	12008	1220	185211	13359	16873	32030
Pub. Proofs	9827	957	145209	11108	16316	28972
=====						

^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	0.24									
FRA	0.94	1.02								
NLD	0.90	0.93	4.19							
USA	0.92	0.91	0.88	0.21						
CHE	0.92	0.95	0.93	0.88	10.35					
DEA	0.93	0.96	0.91	0.88	0.97	11.95				
NZL	0.87	0.86	0.87	0.84	0.87	0.86	0.37			
ITA	0.91	0.90	0.88	0.88	0.95	0.91	0.87	17.78		
GBR	0.92	0.96	0.96	0.91	0.94	0.95	0.88	0.89	12.92	
SVN	0.89	0.88	0.88	0.89	0.89	0.88	0.86	0.89	0.88	10.38
=====										

BSW mas

---

	CAN	FRA	NLD	USA	CHE	DEA	NZL	ITA	GBR	SVN
CAN	0.24									
FRA	0.79	1.06								
NLD	0.85	0.83	3.67							
USA	0.87	0.84	0.88	0.21						
CHE	0.91	0.86	0.89	0.88	10.35					
DEA	0.90	0.75	0.88	0.86	0.96	11.95				
NZL	0.83	0.79	0.81	0.83	0.84	0.80	0.37			
ITA	0.89	0.87	0.89	0.88	0.96	0.91	0.85	17.78		
GBR	0.87	0.80	0.88	0.88	0.90	0.89	0.86	0.88	12.92	
SVN	0.80	0.73	0.82	0.80	0.86	0.86	0.74	0.87	0.83	10.38

---

GUE scs

---

	CAN	GBR	USA	AUS	NZL	ZAF
CAN	0.24					
GBR	0.93	13.44				
USA	0.94	0.90	0.25			
AUS	0.88	0.92	0.87	29.00		
NZL	0.87	0.88	0.84	0.96	0.63	
ZAF	0.90	0.91	0.90	0.89	0.86	24.10

---





JER scs

	CAN	DFS	GBR	NLD	USA	AUS	ZAF	NZL
CAN	0.22							
DFS	0.91	12.54						
GBR	0.92	0.91	11.28					
NLD	0.92	0.94	0.96	4.25				
USA	0.91	0.88	0.89	0.88	0.19			
AUS	0.87	0.88	0.89	0.92	0.86	29.02		
ZAF	0.89	0.87	0.88	0.91	0.88	0.90	21.23	
NZL	0.87	0.85	0.86	0.87	0.84	0.96	0.86	0.38

JER mas

	CAN	DFS	GBR	NLD	USA	AUS	ZAF	NZL
CAN	7.39							
DFS	0.91	12.37						
GBR	0.80	0.83	11.29					
NLD	0.87	0.87	0.89	4.10				
USA	0.87	0.87	0.88	0.88	0.19			
AUS	0.79	0.76	0.89	0.88	0.85	29.05		
ZAF	0.81	0.81	0.88	0.89	0.88	0.89	21.23	
NZL	0.83	0.80	0.87	0.86	0.84	0.95	0.86	0.38

RDC scs

	CAN	DFS	GBR	NOR	USA	DEU	AUS	EST	ZAF	NZL	LTU	LVA
NLD												
CAN	0.25											
DFS	0.94	12.68										
GBR	0.94	0.92	11.36									
NOR	0.92	0.94	0.90	14.22								
USA	0.93	0.88	0.89	0.89	0.24							
DEU	0.93	0.95	0.94	0.90	0.89	13.57						
AUS	0.89	0.93	0.91	0.92	0.86	0.90	31.38					
EST	0.89	0.94	0.91	0.90	0.91	0.94	0.90	11.71				
ZAF	0.89	0.90	0.90	0.93	0.89	0.92	0.88	0.90	25.07			
NZL	0.87	0.88	0.87	0.88	0.84	0.86	0.96	0.87	0.86	0.41		
LTU	0.90	0.87	0.89	0.90	0.89	0.88	0.86	0.91	0.91	0.86	0.34	
LVA	0.90	0.88	0.90	0.90	0.89	0.93	0.90	0.95	0.89	0.88	0.89	0.44
NLD	0.91	0.94	0.96	0.91	0.88	0.95	0.92	0.91	0.90	0.87	0.89	0.89

RDC mas

	CAN	DFS	GBR	NOR	USA	DEU	AUS	EST	ZAF	NZL	LTU	LVA
NLD												
CAN	7.97											
DFS	0.90	13.18										
GBR	0.83	0.84	11.38									
NOR	0.91	0.88	0.89	14.22								
USA	0.88	0.87	0.88	0.89	0.24							
DEU	0.85	0.83	0.90	0.90	0.88	13.57						
AUS	0.81	0.77	0.89	0.90	0.85	0.88	31.43					
EST	0.82	0.80	0.85	0.89	0.87	0.92	0.86	11.71				
ZAF	0.87	0.87	0.89	0.92	0.89	0.91	0.86	0.86	25.16			
NZL	0.84	0.84	0.88	0.91	0.85	0.86	0.95	0.84	0.86	0.41		
LTU	0.81	0.78	0.87	0.89	0.86	0.87	0.86	0.89	0.85	0.85	0.34	
LVA	0.81	0.78	0.86	0.89	0.86	0.92	0.88	0.94	0.84	0.86	0.89	0.44
NLD	0.87	0.88	0.89	0.90	0.88	0.93	0.88	0.90	0.89	0.86	0.86	0.88

SIM	scs											
	FRM	FRA	ITA	NLD	CHE	DEA	HUN	SVK	SVN	GBR	HRV	USA
FRM	1.09											
FRA	0.93	1.01										
ITA	0.96	0.90	13.87									
NLD	0.92	0.94	0.88	4.44								
CHE	0.93	0.92	0.90	0.91	10.34							
DEA	0.93	0.92	0.88	0.90	0.89	12.16						
HUN	0.93	0.91	0.93	0.88	0.89	0.93	15.66					
SVK	0.88	0.89	0.89	0.90	0.89	0.87	0.93	0.38				
SVN	0.89	0.88	0.89	0.88	0.89	0.87	0.89	0.88	9.12			
GBR	0.91	0.96	0.89	0.95	0.90	0.92	0.89	0.88	0.87	11.10		
HRV	0.92	0.87	0.88	0.87	0.88	0.87	0.89	0.88	0.88	0.87	10.14	
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	0.91	1.00										
ITA	0.96	0.88	13.87									
NLD	0.88	0.88	0.89	3.75								
CHE	0.92	0.85	0.90	0.87	10.34							
DEA	0.92	0.92	0.88	0.88	0.89	12.16						
HUN	0.92	0.87	0.93	0.90	0.88	0.92	15.66					
SVK	0.88	0.87	0.90	0.88	0.89	0.87	0.93	0.38				
SVN	0.88	0.87	0.89	0.86	0.88	0.87	0.88	0.88	9.12			
GBR	0.91	0.85	0.89	0.89	0.89	0.90	0.89	0.88	0.87	11.10		
HRV	0.90	0.86	0.88	0.84	0.87	0.87	0.88	0.87	0.88	0.86	10.14	
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	77	47	150	112	114	16	105	57	23
FRA	70	0	78	117	145	189	14	165	49	46
NLD	43	63	0	72	84	127	15	112	34	35
USA	147	78	61	0	296	288	20	205	74	32
CHE	91	108	75	278	0	516	17	389	61	57
DEA	98	142	118	253	415	0	22	550	63	82
NZL	16	10	8	18	13	17	0	19	10	3
ITA	91	132	92	141	336	458	14	0	63	73
GBR	56	39	27	69	47	42	8	44	0	17
SVN	21	46	36	25	58	76	2	74	13	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	69	44	150	112	114	16	105	57	23
FRA	63	0	60	103	142	172	11	151	46	43
NLD	37	50	0	65	74	110	15	95	32	32
USA	147	70	51	0	296	288	20	205	74	32
CHE	91	107	66	278	0	516	17	389	61	57
DEA	98	130	95	253	415	0	22	550	63	82
NZL	16	8	8	18	13	17	0	19	10	3
ITA	91	123	73	141	336	458	14	0	63	73
GBR	56	39	24	69	47	42	8	44	0	17
SVN	21	43	32	25	58	76	2	74	13	0



GUE

-----

common bulls below diagonal

common three quarter sib group above diagonal

CAN GBR USA AUS NZL ZAF

---

CAN	0	25	61	41	13	1
GBR	20	0	79	31	13	3
USA	52	81	0	55	29	6
AUS	39	26	51	0	26	3
NZL	11	11	29	26	0	2
ZAF	0	2	3	2	0	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	FRR										
CAN	0	700	2028	1120	187	1204	1263	1123	2618	87	1392	1083	786	415	1126	1071	441	581	380
842	361	1019	179	191	850	516	153	219	16										
CHE	530	0	1004	607	129	537	576	754	817	48	628	500	382	358	397	477	242	328	296
438	197	555	97	138	447	207	116	168	40										
DEU	1183	843	0	2506	339	2215	1803	3015	3173	131	2367	1449	1085	696	1334	1349	546	831	666
1574	658	1964	417	307	1107	501	242	517	132										
DFS	791	523	1463	0	235	1440	1316	1788	1764	120	1438	1088	775	497	852	880	465	706	565
1040	372	1314	254	210	823	392	198	318	51										
EST	95	72	227	134	0	197	193	294	277	43	224	173	161	97	167	161	88	112	100
208	99	248	59	90	163	83	72	95	21										
FRA	698	465	993	656	84	0	1323	1661	2217	109	1621	1083	803	541	1071	975	432	685	555
1025	357	1284	188	177	804	404	157	221	31										
GBR	1363	529	1222	901	110	753	0	1451	1768	106	1349	1147	720	494	887	898	470	759	687
829	325	1048	200	179	825	395	173	267	26										
NLD	928	725	2585	1414	210	928	1173	0	2071	125	1553	1224	811	710	899	941	464	858	662
1204	475	1417	237	228	929	372	198	364	93										
USA	2515	718	1900	1164	178	1067	1415	1582	0	133	2344	1544	1082	521	1704	1326	591	909	572
1344	472	1623	265	259	1136	680	182	296	32										
ISR	53	34	109	95	28	57	71	105	115	0	117	86	88	47	83	90	54	90	69
93	39	108	33	28	89	45	37	52	4										
ITA	884	551	1400	954	120	751	935	1135	1324	87	0	1059	887	488	1080	1129	469	664	500
1096	370	1327	234	224	911	489	200	315	29										
AUS	985	432	960	708	80	677	924	1012	1399	57	689	0	593	451	742	729	433	999	536
689	265	811	168	163	676	340	142	232	25										
HUN	671	310	832	583	100	517	620	656	1012	69	731	436	0	314	622	651	363	425	328
754	280	791	159	139	632	366	135	211	9										
BEL	360	326	620	412	58	494	427	746	402	28	397	359	241	0	317	395	224	308	283
349	169	431	86	99	397	164	111	156	37										
JPN	507	255	497	433	59	355	431	449	707	41	449	394	358	188	0	790	391	475	331
693	277	819	157	149	625	437	135	174	7										
ESP	591	385	840	626	76	686	718	814	799	57	801	511	516	363	359	0	413	454	379
701	279	862	172	166	732	365	151	234	16										
ZAF	370	194	413	342	44	291	399	388	558	38	352	366	289	174	271	359	0	336	267
329	164	376	86	98	394	233	84	128	12										
NZL	573	273	607	465	58	377	631	762	835	75	468	979	337	233	249	342	263	0	543
480	214	533	129	110	486	241	99	173	11										
IRL	301	271	509	414	50	382	628	560	449	51	377	421	263	249	191	341	213	426	0
352	156	429	101	95	366	147	84	130	9										
CZE	524	290	1083	598	131	555	501	997	937	66	675	392	655	232	283	450	205	307	213
0	386	1064	186	182	655	378	165	279	37										
SVK	236	98	487	186	46	182	180	313	302	16	206	125	201	88	99	137	87	127	75
292	0	380	75	95	281	163	65	108	25										
POL	699	440	1554	960	169	686	791	1186	1362	86	929	548	676	352	397	583	269	376	307
784	249	0	257	250	861	446	191	365	91										
LTU	82	34	392	128	25	43	87	124	163	15	112	58	92	28	39	70	31	53	40
115	37	191	0	74	165	106	39	115	1										
LVA	109	78	207	130	63	78	102	149	207	20	151	77	99	55	66	93	57	54	53
118	46	185	52	0	190	99	44	114	23										
PRT	829	384	993	704	108	660	746	914	1152	67	824	507	602	368	378	687	346	390	304
517	187	849	104	143	0	392	137	262	14										
KOR	460	136	320	261	43	222	284	247	759	30	382	239	305	94	259	253	175	168	89
260	96	353	47	59	321	0	79	103	2										
SVN	109	85	225	165	46	109	123	167	141	29	165	102	105	86	77	112	57	70	60
125	37	171	18	27	105	45	0	81	16										
HRV	107	110	533	241	70	130	190	328	218	40	240	144	159	128	83	186	87	102	89
204	55	317	80	91	215	47	67	0	16										
FRR	7	26	102	33	18	24	18	54	15	3	24	17	8	30	5	8	7	8	7
29	13	96	0	19	14	0	15	15	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	FRR										
CAN	0	457	1156	564	111	611	679	591	1406	55	900	563	505	272	638	684	218	284	205
552	196	735	127	113	530	354	116	160	3										
CHE	367	0	1001	553	129	461	575	715	815	48	626	499	382	358	396	476	242	327	295
438	195	555	97	136	445	206	116	168	24										
DEU	774	842	0	2358	339	1664	1800	2819	3163	131	2365	1445	1085	696	1332	1346	543	828	666
1574	649	1963	416	305	1098	496	242	517	72										
DFS	492	467	1268	0	221	1071	1240	1542	1640	114	1358	1020	734	475	811	843	453	672	551
979	344	1224	245	202	779	364	192	305	29										
EST	62	72	227	121	0	160	193	282	276	43	224	173	161	97	166	161	87	111	100
208	98	248	59	90	162	83	72	95	16										
FRA	405	390	700	498	71	0	1020	1220	1519	92	1303	827	688	462	805	808	347	527	455
887	278	1108	161	145	690	336	142	193	16										
GBR	625	529	1222	803	110	597	0	1389	1766	106	1349	1147	720	494	887	898	467	757	687
829	318	1048	199	177	818	392	173	267	18										
NLD	526	666	2301	1090	198	656	1087	0	1928	120	1451	1170	774	692	857	895	447	837	648
1149	450	1345	222	211	880	363	191	339	57										
USA	1370	718	1898	994	178	654	1415	1377	0	133	2342	1541	1081	521	1702	1324	587	904	572
1344	465	1622	264	258	1124	674	182	296	20										
ISR	39	34	109	85	28	51	71	99	115	0	117	86	88	47	83	90	54	90	69
93	38	108	33	28	89	45	37	52	3										
ITA	610	551	1400	853	120	589	935	1003	1324	87	0	1058	887	487	1080	1129	467	664	500
1095	365	1325	234	223	905	487	200	315	20										
AUS	563	432	960	622	80	542	924	939	1399	57	689	0	592	451	742	729	432	997	536
689	257	811	167	162	671	336	142	232	18										
HUN	466	310	832	542	100	446	620	605	1012	69	731	436	0	314	622	651	362	424	328
754	278	791	159	138	628	365	135	211	5										
BEL	252	326	620	382	58	412	427	714	402	28	397	359	241	0	317	395	224	308	283
349	165	431	86	98	397	164	111	156	23										
JPN	390	255	497	395	59	314	431	419	707	41	449	394	358	188	0	790	390	472	331
693	271	819	157	147	620	434	135	174	3										
ESP	389	385	840	585	76	596	718	744	799	57	801	511	516	363	359	0	413	454	379
701	275	862	171	165	731	365	151	234	10										
ZAF	199	194	413	329	44	251	399	364	558	38	352	366	289	174	271	359	0	336	267
329	162	374	86	97	393	231	84	127	9										
NZL	258	273	606	432	57	307	631	733	835	75	468	979	337	233	249	342	263	0	542
479	211	533	129	109	483	239	99	173	5										
IRL	198	271	509	390	50	338	628	534	449	51	377	421	263	249	191	341	213	426	0
352	154	428	101	94	366	147	84	130	5										
CZE	373	290	1083	538	131	442	501	921	937	66	675	392	655	232	283	450	205	307	213
0	385	1064	186	182	651	375	165	279	29										
SVK	125	98	486	167	46	135	180	297	302	16	205	124	201	88	99	137	87	127	75
292	0	378	75	94	279	163	65	108	18										
POL	575	440	1554	854	169	603	791	1101	1362	86	929	548	676	352	397	583	269	376	307
784	249	0	257	250	859	446	191	365	77										
LTU	68	34	392	117	25	37	87	105	163	15	112	58	92	28	39	70	31	53	40
115	37	191	0	73	164	105	39	115	0										
LVA	71	78	207	121	63	68	102	129	207	20	151	77	99	55	66	93	57	54	53
118	46	185	52	0	189	99	44	114	18										
PRT	508	383	993	650	108	577	746	855	1150	67	822	507	602	368	378	687	346	390	304
517	187	849	104	143	0	390	137	260	13										
KOR	322	136	320	236	43	189	284	226	759	30	382	239	305	94	259	253	175	168	89
260	96	353	47	59	321	0	79	103	1										
SVN	88	85	225	153	46	99	123	161	141	29	165	102	105	86	77	112	57	70	60
125	37	171	18	27	105	45	0	81	13										
HRV	93	110	533	220	70	116	190	299	218	40	240	144	159	128	83	186	87	102	89
204	55	317	80	91	215	47	67	0	15										
FRR	2	21	53	24	15	13	13	37	12	3	19	13	5	21	3	7	6	4	5
23	11	86	0	16	13	0	12	14	0										

-----

JER

-----  
common bulls below diagonal  
common three quarter sib group above diagonal

	CAN	DFS	GBR	NLD	USA	AUS	ZAF	NZL
CAN	0	69	130	29	327	212	123	141
DFS	53	0	129	73	143	112	114	111
GBR	130	116	0	65	196	171	140	174
NLD	23	71	60	0	66	56	59	59
USA	337	114	213	71	0	417	243	305
AUS	213	75	174	47	446	0	190	352
ZAF	118	91	142	55	252	181	0	168
NZL	155	83	178	51	374	393	175	0

-----

JER

-----  
common bulls below diagonal  
common three quarter sib group above diagonal

	CAN	DFS	GBR	NLD	USA	AUS	ZAF	NZL
CAN	0	30	65	10	143	93	54	56
DFS	24	0	124	54	131	101	105	102
GBR	61	111	0	53	194	171	139	173
NLD	4	47	48	0	56	48	53	49
USA	130	92	213	60	0	417	243	305
AUS	81	62	174	43	446	0	190	351
ZAF	47	80	142	48	252	181	0	168
NZL	56	71	178	41	374	392	175	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
CAN	0	123	64	4	173	12	86	1	68	70	14	7	5
DFS	123	0	60	104	153	60	150	81	49	142	110	91	40
GBR	64	58	0	23	74	6	49	2	33	48	13	5	17
NOR	4	76	24	0	56	18	50	13	0	34	24	16	29
USA	159	149	70	57	0	23	100	13	57	91	30	14	28
DEU	11	50	6	18	23	0	38	23	2	15	35	28	14
AUS	86	125	47	41	101	37	0	22	31	113	41	27	22
EST	1	70	2	13	12	22	21	0	0	4	23	36	10
ZAF	70	46	29	0	51	2	31	0	0	30	5	1	3
NZL	68	139	45	32	91	15	114	3	26	0	24	12	12
LTU	13	93	12	19	24	32	37	22	5	20	0	37	13
LVA	7	59	5	14	11	23	25	28	1	10	32	0	9
NLD	5	40	16	28	27	14	20	9	3	12	12	8	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
CAN	0	70	31	3	71	6	29	0	35	29	10	4	3
DFS	70	0	54	106	144	60	167	81	45	138	109	92	36
GBR	31	52	0	23	72	6	47	2	30	47	13	5	16
NOR	3	77	24	0	56	18	50	13	0	34	24	16	26
USA	72	143	70	57	0	23	98	13	53	89	30	14	27
DEU	6	50	6	18	23	0	38	23	2	15	35	28	14
AUS	29	144	46	41	100	37	0	22	29	112	41	27	21
EST	0	70	2	13	12	22	21	0	0	4	23	36	9
ZAF	37	44	28	0	51	2	31	0	0	28	5	1	2
NZL	28	133	45	32	91	15	113	3	26	0	24	12	11
LTU	9	92	12	19	24	32	37	22	5	20	0	37	12
LVA	4	59	5	14	11	23	25	28	1	10	32	0	8
NLD	3	36	15	25	26	14	19	8	2	11	11	7	0

-----

SIM

-----  
common bulls below diagonal

common three quarter sib group above diagonal

	FRM	FRA	ITA	NLD	CHE	DEA	HUN	SVK	SVN	GBR	HRV	USA
FRM	0	3	148	105	162	210	2	55	17	63	2	24
FRA	1	0	121	49	11	224	4	50	49	0	83	0
ITA	180	108	0	151	79	684	10	126	87	43	191	19
NLD	128	49	147	0	75	207	3	52	41	46	77	14
CHE	211	9	79	77	0	264	2	30	5	50	1	17
DEA	249	185	587	215	231	0	27	337	161	46	458	16
HUN	0	3	7	3	1	15	0	6	6	0	10	0
SVK	55	43	108	43	22	343	5	0	40	10	79	3
SVN	17	46	83	39	5	147	5	39	0	0	66	0
GBR	80	0	46	45	57	49	0	5	0	0	0	17
HRV	1	77	182	77	1	481	9	62	55	0	0	0
USA	38	0	26	17	18	22	0	3	0	24	0	0

SIM

-----  
common bulls below diagonal

common three quarter sib group above diagonal

	FRM	FRA	ITA	NLD	CHE	DEA	HUN	SVK	SVN	GBR	HRV	USA
FRM	0	2	147	93	159	205	2	55	17	63	2	24
FRA	1	0	86	29	8	159	3	39	34	0	58	0
ITA	179	75	0	132	79	684	10	126	87	43	191	19
NLD	113	28	128	0	69	172	3	47	34	42	69	14
CHE	208	5	79	70	0	264	2	30	5	50	1	17
DEA	245	122	587	180	231	0	27	337	161	46	458	16
HUN	0	2	7	3	1	15	0	6	6	0	10	0
SVK	55	31	108	39	22	343	5	0	40	10	79	3
SVN	17	29	83	34	5	147	5	39	0	0	66	0
GBR	80	0	46	41	57	49	0	5	0	0	0	17
HRV	1	51	182	69	1	481	9	62	55	0	0	0
USA	38	0	26	17	18	22	0	3	0	24	0	0