Introduction

The latest routine international evaluation for females fertility traits took place as scheduled at the Interbull Centre. Data from twentyone (21) countries were included in this evaluation.

International genetic evaluations for female fertility traits of bulls from Australia, Austria, Belgium, Canada, Czech Republic, Denmark-Finland-Sweden, France, Germany, Ireland, Israel, Italy, Netherlands, New Zealand, Norway, Poland, Spain, Switzerland, South Africa, the United Kingdom, Uruguay, Japan and the United States of America and Slovenia were computed. Brown Swiss, Guernsey, Holstein, Jersey, Red Dairy Cattle and Simmental breed data were included in this evaluation.

Based on a decision made by Interbull Steering committee in August 2007, female fertility traits are classified as follows:

T1 (HC): Maiden (H)eifer's ability to (C)onceive. A measure of confirmed conception, such as conception rate (CR), will be considered for this trait group. In the absence of confirmed conception an alternative measure, such as interval first-last insemination (FL), interval first insemination-conception (FC), number of inseminations (NI), or non-return rate (NR,preferably NR56) can be submitted;

T2 (CR): Lactating (C)ow's ability to (R)ecycle after calving. The interval calving-first insemination (CF) is an example for this ability. In the abscence of such a trait, a measure of the interval calving-conception, such as says oprn (DO) or calving interval (CI) can be submitted;

T3 (C1): Lactating (C)ow's ability to conceive (1), expressed as a rate trait. Traits like conception rate (CR) and non-return rate (NR, preferably NR56) will be considered for this trait group;

T4 (C2): Lactating (C)ow's ability to conceive (2), expressed as an interval trait. The interval first insemination-conception (FC) or interval first-last insemination (FL) will be considered for this trait group. As an alternative, number of inseminations (NI) can be submitted. In the abscence of any of these traits, a measure of interval calving-conception such as days open (DO), or calving interval (CI) can be submitted. All countries are expected to submit data for this trait group, and as a last resort the trait submitted under T3 can be submitted for T4 as well.

T5 (IT): Lactating cow's measurements of (I)nterval (T)raits calving-conception, such as days open (DO) and calving interval (CI).

Based on the above trait definitions the following traits have been submitted for international genetic evaluation of female fertility traits.

Country	Traits	Submitted traits and their definitions
AUS	T4=C2	Calving interval converted to 42 days pregnancy rate
	T5=IT	Calving interval converted to 42 days pregnancy rate
BEL	T2=CY	PR=Pregnancy Rate (=[21/(DO-45+11)]*100, with DO=days open)
	T4=C2	PR=Pregnancy Rate (=[21/(DO-45+11)]*100, with DO=days open)
	T5=IT	PR=Pregnancy Rate (=[21/(DO-45+11)]*100, with DO=days open)
CAN	T1=HC	NR=Non Return Rate after 56 Days in heifers (NRR), %
	T2=CY	CF=Interval from Calving to First Service in cows(CF)
	T3=C1	NR=Non Return Rate after 56 Days in cows(NRR), %
	T4=C2	FC=Interval first insemination-conception in cows
	T5=IT	DO=Days open
CHE	T1=HC	CR=Heifers' Conception rate
	T2=CR	CF=Interval from Calving to First Service (ICF), days
	T3=C1	NR=Non Return Rate after 56 Days (NRR), %
	T4=C2	FL=Interval from first to last insemination cows
CZE	T1=HC	CR=Heifers' Conception rate (pregnant or not after 3 months)

	T3=C1	CR=Cows’ Conception rate (pregnant or not after 3 months)
	T4=C2	CR=Cows’ Conception rate (pregnant or not after 3 months)
AUT/DEU	T1=HC	NR=Heifers’ Non Return Rate after 56 days
	T2=CY	CF=Interval from calving to first insemination cows (days)
	T3=C1	NR=Cows’ Non Return Rate after 56 days
	T4=C2	FL=Interval from first to last insemination cows (days)
	T5=IT	DO=Days open (days)
DFS	T1=HC	CR=Heifers’ Conception rate for maiden heifers
	T2=CY	CF=Interval from calving to first insemination cows (days)
	T3=C1	CR=Cows’ conception rate for cows
	T4=C2	FL=Interval from first to last insemination cows (days)
	T5=IT	DO=Days open (days)
ESP	T2=CY	Interval from Calving to First Service (ICF)
	T4=C2	Interval first insemination to conception
	T5=IT	Days Open
FRA	T1=HC	CR=Heifers’ Conception rate (binary trait) for maiden heifers
	T2=CY	Interval between calving and first AI
	T3=C1	CR=Cows’ Conception rate (binary trait)
	T4=C2	FL=Interval from first to last insemination cows (days)
	T5=IT	FL=Interval from first to last insemination cows (days)
GBR	T2=CY	CI=days between 1st and 2nd calvings
	T3=C1	NR=1st lactation non return at 56 days
	T4=C2	CI=days between 1st and 2nd calvings
	T5=IT	CI=days between 1st and 2nd calvings
IRL	T2=CY	CI=Calving interval
	T4=C2	CI=Calving interval
	T5=IT	CI=Calving interval
ISR	T3=C1	CR=Inverse of the number of insemination to conception (%)
	T4=C2	CR=Inverse of the number of insemination to conception (%)
ITA	T1=HC	NR= non-return rate 56 days (heifers)
	T2=CY	CF=Days to first service
	T3=C1	CR=Conception rate at first service
	T4=C2	FL=Interval from first to last insemination cows (days)
	T5=IT	DO=days open (days)
ITA(BSW)	T1=HC	CR=Conception rate
	T2=CY	CF=Interval calving to first insemination
	T3=C1	CR=Conception rate
	T4=C2	DO=Days Open
	T5=IT	CI=Calving interval
NLD	T1=HC	CR=Heifers’ Conception rate
	T2=CY	CF=Interval calving to first insemination (days)
	T3=C1	CR=Cows’ Conception rate (binary trait) for cows
	T4=C2	FL=Interval from first to last insemination cows (days)
	T5=IT	CI=Days Open
NOR	T1=HC	NI=Number of inseminations (heifers)
	T2=CY	CF=Days from calving to first insemination (days)
	T3=C1	NI=Number of inseminations (cows)
	T4=C2	NI=Number of inseminations (cows)
	T5=IT	CF=Days from calving to first insemination (days)
NZL	T2=CY	PM=Lactating cow’s ability to start cycling
	T4=C2	PR42: confirmed pregnant within 6 weeks of planned start of mating (PSM), (in days)
	T5=IT	PR42: confirmed pregnant within 6 weeks of planned start of mating (PSM), (in days)
POL	T1=HC	CR=Conception Rate (heifer)
	T2=CR	CF=Interval from calving to first insemination
	T3=C1	CR=Conception Rate (cow)
	T4=C2	FL=Interval from first to last insemination cows (days)

	T5=IT	DO=Days open
URY	T4=C2	Days open expressed as Daughter Pregnancy Rate
	T5=IT	Days open expressed as Daughter Pregnancy Rate
USA	T1=HC	CR=Conception rate (heifer)
	T3=C1	CR=Conception rate (cow)
	T4=C2	DP=Daughter Pregnancy Rate
	T5=IT	DP=Daughter Pregnancy Rate
ZAF	T4=IT	CI=Calving Interval
	T5=IT	CI=Calving Interval
JPN	T1=HC	CR=Heifers'Conception rate
	T3=C1	CR=Cows'Conception rate
	T4=C2	DO=Days open
	T5=IT	DO=Days open
SVN	T5=IT	CI=Calving interval (days)

CHANGES IN NATIONAL PROCEDURES

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

FRA (HOL, BSW)	Base change, HOL:French Holstein breeding organisations have made the choice to suspend the publication of EBVs for bulls that entered progeny testing and produced daughters but were not subsequently placed on the market as public breeding bulls based on their progeny test results. As consequence, around 1000 bulls are now missing or their publication status have changed from official to unofficial
ITA (HOL)	Base change, applied a yearly cutoff of data causing some bulls to be missings
IRL (ALL)	Minor change in data edits where individual milk records where the sire is unknown, are excluded from the evaluation unless the cow has at least 3 tests within a given lactation.
POL (HOL)	New definition of UPG groups, pedigree pruning, new genetic base, applied new coding for status and type of proof for MACE according to new recommendation from the ITB
AUS (ALL)	Decrease in information due to pedigree updates and change in status of some bulls that do not qualify for inclusion any longer.
DFS (ALL)	Drops in information due to editings
DEA (BSW)	Base change
CAN (ALL)	Base change
ISR (HOL)	Pedigree verification causing drops in information
EST (HOL)	Small decrease in number of EDC of some bulls having the same number of daugthers/herds compare to previous evaluation due to the changed number of herd of changed location of some daughters in different dairy farms of owners
USA (ALL)	Drops in herds/daugthers/EDC are related to pedigree correctness and daughter-herd-year minimum edits.
DEU (ALL)	Base change. HOL: Traits are verified with the subsequent calving, e.g. interval first to last insemination, insemination dates must match with calving dates and result in reasonable gestation length. Herd x years with uninformative NonReturn56 (i.e. 100% NR56) are excluded causing drops in information for some bulls.
JPN (HOL)	Base change
CHE (ALL)	Base change, drops in information due to manual edits
GBR (ALL)	Base change
SVN (HOL, BSW)	Base change, Re-estimated variance components and heritability. HOL: Time period for data inclusion has been shifted forward by five years (data from 2015 to 2025 are used).
BEL (HOL)	Slight drops in information due to pedigree verification.
ITA (BSW)	Base change
NZL (ALL)	Drops in information due to pedigree verification
ESP (HOL)	Base change
NLD (ALL)	Base change
CZE (HOL)	Stopped trimming data for CC1 and CC2, data are now included from 2008.

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.

Direct Gestation Length (ges) has been added as the fifth trait in the calving evaluation starting from the August 2025 MACE routine evaluation, and therefore added in the calv{BRD}{RUNID}.itb and calv{BRD}{RUNID}.ipr.

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

DATA AND METHOD OF ANALYSIS

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

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

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

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

SCIENTIFIC LITERATURE

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

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

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

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

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

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

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

Time edits

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

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

NEXT ROUTINE INTERNATIONAL EVALUATION

Dates for the next routine evaluation can be found on
https://interbull.org/ib/servicecalendar

NEXT TEST INTERNATIONAL EVALUATION

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

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

PUBLICATION OF INTERBULL ROUTINE RUN

Results were distributed by the Interbull Centre to designated representatives in each country. The international evaluation file comprised international proofs expressed on the base and unit of each country included in the analysis. Such records readily provide more information on bull performance in various countries, thereby minimizing the need to resort to conversions.

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

PUBLICATION OF INTERBULL TEST RUN

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

^LTable 1. National evaluation data considered in the Interbull evaluation for fertility (April Routine Evaluation 2026).
Number of records for lactating cow's ability to conceive (cc2) by breed

Country	BSW	GUE	HOL	JER	RDC	SIM
AUS		151	9068	1928	841	
BEL			2283			
CAN	195	51	10953	711	629	
CHE	3165		3505	157		
CZE			3861			
DEA	5169					
DEU			26783		341	
DFS			18124	2595	10971	
ESP			7437			
EST						
FRA	471		17802			
FRM						
GBR	119	262	8288	687	510	
HUN						
IRL			3707	274	85	
ISR			1845			
ITA	2102		7388			
JPN			7046			
KOR						

LTU						
LVA						
NLD	267		17499	308	110	
NOR					3256	
NZL	62	50	9283	5324	1400	
POL			9476			
PRT						
SVK						
SVN						
URY			2142			
USA	1264	825	44323	5764	851	
ZAF			1278	773	162	
CAM						
No.Records	12814	1339	212091	18521	19156	
Pub. Proofs	11122	1107	161045	15115	18746	0

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

BSW hco

	CAN	DEA	FRA	USA	CHE	NLD	ITA
CAN	9.46						
DEA	0.86	9.88					
FRA	0.71	0.86	0.75				
USA	0.77	0.70	0.83	2.54			
CHE	0.83	0.91	0.83	0.67	13.17		
NLD	0.78	0.64	0.75	0.76	0.72	4.57	
ITA	0.73	0.64	0.80	0.83	0.69	0.70	15.73

BSW crc

	CAN	CHE	DEA	NLD	NZL	GBR	FRA	ITA
CAN	7.28							
CHE	0.79	11.42						
DEA	0.77	0.92	15.07					
NLD	0.81	0.81	0.83	3.75				
NZL	0.61	0.63	0.72	0.63	0.12			
GBR	0.72	0.68	0.61	0.73	0.64	3.87		
FRA	0.82	0.93	0.96	0.86	0.68	0.74	1.69	
ITA	0.82	0.83	0.86	0.80	0.64	0.72	0.86	16.85

BSW cc1

	CAN	CHE	DEA	NLD	USA	GBR	FRA	ITA
CAN	7.82							
CHE	0.82	11.76						
DEA	0.78	0.86	11.46					
NLD	0.72	0.68	0.67	3.68				
USA	0.75	0.67	0.67	0.75	2.90			
GBR	0.77	0.79	0.79	0.68	0.68	0.03		
FRA	0.73	0.68	0.67	0.81	0.87	0.71	0.88	
ITA	0.69	0.66	0.66	0.69	0.79	0.68	0.89	16.03

BSW cc2

	CAN	CHE	DEA	NLD	NZL	USA	GBR	FRA	ITA
CAN	7.17								
CHE	0.76	11.16							
DEA	0.75	0.90	12.34						
NLD	0.80	0.77	0.75	3.48					
NZL	0.65	0.82	0.69	0.65	0.07				
USA	0.79	0.83	0.81	0.74	0.71	2.58			

GBR	0.71	0.79	0.80	0.73	0.70	0.78	3.87		
FRA	0.87	0.87	0.91	0.84	0.67	0.82	0.79	0.88	
ITA	0.86	0.84	0.86	0.75	0.74	0.77	0.74	0.91	19.12

BSW int

	CAN	DEA	NLD	NZL	USA	GBR	ITA	SVN
CAN	8.03							
DEA	0.79	14.42						
NLD	0.80	0.87	3.47					
NZL	0.67	0.76	0.67	0.07				
USA	0.89	0.77	0.74	0.63	2.58			
GBR	0.83	0.71	0.80	0.70	0.80	3.87		
ITA	0.86	0.89	0.79	0.69	0.78	0.79	19.16	
SVN	0.72	0.73	0.71	0.69	0.73	0.74	0.78	19.72

GUE crc

	CAN	GBR	NZL
CAN	7.69		
GBR	0.75	4.56	
NZL	0.62	0.64	0.11

GUE cc1

	CAN	GBR	USA
CAN	7.69		
GBR	0.77	0.03	
USA	0.79	0.73	3.48

GUE cc2

	CAN	GBR	NZL	USA	AUS
CAN	7.29				
GBR	0.71	4.55			
NZL	0.64	0.70	0.07		
USA	0.83	0.76	0.75	2.92	
AUS	0.77	0.74	0.77	0.80	15.46

GUE int

	CAN	GBR	NZL	USA	AUS
CAN	7.76				
GBR	0.83	4.55			
NZL	0.67	0.70	0.07		
USA	0.88	0.77	0.65	2.92	
AUS	0.81	0.76	0.77	0.85	15.46

HOL hco

	CAN	CZE	DEU	DFS	FRA	USA	POL	CHE	NLD	ITA	JPN
CAN	7.65										
CZE	0.76	17.60									
DEU	0.87	0.78	15.14								
DFS	0.77	0.83	0.85	13.50							
FRA	0.74	0.77	0.80	0.88	0.70						
USA	0.82	0.82	0.84	0.86	0.84	2.38					
POL	0.62	0.56	0.65	0.69	0.62	0.67	13.72				
CHE	0.93	0.76	0.90	0.75	0.74	0.80	0.53	13.59			
NLD	0.79	0.77	0.84	0.86	0.82	0.81	0.65	0.77	5.34		
ITA	0.82	0.85	0.87	0.90	0.91	0.93	0.73	0.84	0.84	1.88	
JPN	0.85	0.70	0.85	0.71	0.69	0.83	0.62	0.82	0.75	0.83	6.22

HOL crc

	BEL	CAN	CHE	DEU	DFS	ESP	GBR	IRL	ITA	NLD	NZL	POL	FRA
BEL	4.63												
CAN	0.77	7.67											
CHE	0.77	0.82	12.30										
DEU	0.73	0.83	0.85	10.90									
DFS	0.80	0.87	0.92	0.91	11.60								
ESP	0.85	0.80	0.82	0.80	0.80	10.88							
GBR	0.89	0.75	0.73	0.71	0.78	0.86	4.56						
IRL	0.85	0.59	0.65	0.59	0.61	0.80	0.81	3.57					
ITA	0.81	0.88	0.87	0.90	0.90	0.84	0.79	0.66	1.39				
NLD	0.77	0.82	0.85	0.84	0.92	0.79	0.75	0.58	0.85	4.68			
NZL	0.64	0.62	0.62	0.60	0.66	0.68	0.65	0.61	0.68	0.57	0.09		
POL	0.74	0.86	0.85	0.82	0.84	0.79	0.75	0.59	0.88	0.76	0.69	15.78	
FRA	0.79	0.86	0.92	0.93	0.94	0.82	0.80	0.66	0.92	0.89	0.66	0.87	1.12

HOL cc1

	CAN	CHE	CZE	DEU	DFS	FRA	GBR	ISR	ITA	NLD	USA	POL	JPN
CAN	6.82												
CHE	0.89	10.84											
CZE	0.82	0.69	17.63										
DEU	0.90	0.88	0.80	14.62									
DFS	0.74	0.67	0.86	0.80	13.07								
FRA	0.77	0.69	0.90	0.77	0.87	0.96							
GBR	0.77	0.77	0.69	0.79	0.66	0.72	0.03						
ISR	0.80	0.69	0.93	0.80	0.88	0.88	0.77	3.28					
ITA	0.72	0.66	0.90	0.70	0.83	0.90	0.67	0.90	1.17				
NLD	0.73	0.68	0.84	0.78	0.88	0.90	0.68	0.84	0.80	4.56			
USA	0.78	0.66	0.95	0.76	0.82	0.86	0.68	0.92	0.87	0.79	2.83		
POL	0.77	0.66	0.86	0.78	0.75	0.77	0.66	0.83	0.80	0.72	0.79	19.34	
JPN	0.79	0.77	0.91	0.77	0.83	0.83	0.77	0.86	0.83	0.77	0.89	0.76	7.55

HOL cc2

	BEL	CAN	CHE	CZE	DEU	DFS	ESP	FRA	GBR	IRL	ISR	ITA	NLD	NZL	USA	POL	ZAF	AUS	URY	JPN
BEL	4.63																			
CAN	0.74	6.66																		
CHE	0.76	0.87	10.94																	
CZE	0.67	0.88	0.86	17.63																
DEU	0.79	0.94	0.88	0.91	13.45															
DFS	0.79	0.85	0.83	0.83	0.94	12.85														
ESP	0.82	0.82	0.86	0.89	0.87	0.82	10.86													
FRA	0.81	0.90	0.89	0.86	0.95	0.89	0.88	0.91												
GBR	0.89	0.70	0.70	0.67	0.76	0.80	0.80	0.76	4.56											
IRL	0.83	0.73	0.81	0.70	0.78	0.75	0.83	0.81	0.83	3.58										
ISR	0.63	0.76	0.71	0.88	0.80	0.80	0.83	0.76	0.67	0.64	3.28									
ITA	0.79	0.86	0.86	0.92	0.91	0.87	0.91	0.89	0.75	0.77	0.82	1.30								
NLD	0.77	0.82	0.81	0.81	0.91	0.88	0.82	0.90	0.72	0.76	0.79	0.82	4.68							
NZL	0.71	0.64	0.78	0.78	0.65	0.64	0.81	0.66	0.69	0.73	0.74	0.79	0.63	0.06						
USA	0.75	0.84	0.83	0.89	0.87	0.82	0.86	0.83	0.76	0.74	0.82	0.88	0.76	0.72	2.38					
POL	0.82	0.88	0.87	0.90	0.92	0.87	0.88	0.87	0.81	0.74	0.80	0.93	0.80	0.79	0.88	15.07				
ZAF	0.77	0.78	0.80	0.74	0.82	0.75	0.81	0.81	0.80	0.84	0.59	0.78	0.72	0.70	0.80	0.82	15.62			
AUS	0.80	0.78	0.82	0.75	0.80	0.73	0.81	0.84	0.77	0.88	0.67	0.78	0.73	0.74	0.78	0.79	0.86	12.27		
URY	0.70	0.67	0.65	0.63	0.67	0.67	0.66	0.66	0.69	0.69	0.56	0.65	0.68	0.75	0.67	0.64	0.75	0.75	1.40	
JPN	0.85	0.84	0.83	0.81	0.86	0.85	0.85	0.85	0.87	0.83	0.73	0.86	0.78	0.70	0.88	0.88	0.87	0.80	0.67	18.16

HOL int

	BEL	CAN	DEU	DFS	ESP	GBR	IRL	ITA	NLD	NZL	USA	POL	ZAF	AUS	URY	FRA	JPN	SVN
BEL	4.63																	
CAN	0.89	7.21																
DEU	0.86	0.91	12.31															
DFS	0.89	0.90	0.95	12.78														

ESP	0.89	0.88	0.87	0.88	10.86													
GBR	0.90	0.84	0.86	0.89	0.86	4.56												
IRL	0.84	0.81	0.81	0.79	0.86	0.84	3.58											
ITA	0.90	0.90	0.90	0.92	0.91	0.86	0.79	2.47										
NLD	0.88	0.83	0.86	0.92	0.83	0.83	0.78	0.85	4.70									
NZL	0.72	0.67	0.66	0.63	0.70	0.70	0.75	0.69	0.62	0.06								
USA	0.81	0.90	0.86	0.86	0.92	0.80	0.77	0.87	0.76	0.60	2.38							
POL	0.84	0.83	0.82	0.85	0.83	0.84	0.71	0.91	0.77	0.67	0.74	14.19						
ZAF	0.78	0.83	0.85	0.79	0.85	0.81	0.86	0.80	0.77	0.70	0.82	0.75	15.62					
AUS	0.82	0.83	0.79	0.76	0.84	0.78	0.89	0.77	0.72	0.74	0.83	0.71	0.87	12.27				
URY	0.72	0.66	0.66	0.66	0.69	0.68	0.69	0.69	0.66	0.80	0.66	0.67	0.76	0.76	1.40			
FRA	0.82	0.89	0.85	0.84	0.88	0.77	0.82	0.82	0.79	0.60	0.87	0.70	0.80	0.84	0.66	0.91		
JPN	0.85	0.93	0.90	0.89	0.89	0.87	0.82	0.92	0.82	0.65	0.90	0.86	0.89	0.80	0.68	0.83	18.16	
SVN	0.87	0.75	0.76	0.82	0.81	0.78	0.75	0.85	0.77	0.67	0.73	0.71	0.67	0.75	0.67	0.77	0.73	18.79

JER hco

	CAN	DFS	USA	NLD
CAN	7.94			
DFS	0.70	17.56		
USA	0.72	0.82	2.71	
NLD	0.80	0.83	0.73	5.08

JER crc

	CAN	DFS	GBR	NLD	NZL	IRL	CHE
CAN	7.15						
DFS	0.81	13.30					
GBR	0.66	0.83	3.74				
NLD	0.80	0.83	0.69	3.58			
NZL	0.57	0.63	0.62	0.55	0.07		
IRL	0.61	0.61	0.78	0.60	0.57	2.51	
CHE	0.79	0.83	0.67	0.81	0.57	0.64	8.88

JER cc1

	CAN	DFS	GBR	NLD	USA	CHE
CAN	6.92					
DFS	0.70	15.60				
GBR	0.79	0.66	0.03			
NLD	0.72	0.74	0.68	3.67		
USA	0.74	0.79	0.67	0.68	2.91	
CHE	0.86	0.68	0.78	0.69	0.68	11.63

JER cc2

	CAN	DFS	GBR	NLD	NZL	USA	ZAF	AUS	IRL	CHE
CAN	6.77									
DFS	0.83	15.71								
GBR	0.70	0.73	3.73							
NLD	0.79	0.78	0.71	3.57						
NZL	0.64	0.64	0.67	0.64	0.05					
USA	0.80	0.76	0.74	0.74	0.73	2.68				
ZAF	0.69	0.68	0.76	0.66	0.76	0.81	11.19			
AUS	0.76	0.78	0.75	0.71	0.78	0.73	0.85	9.32		
IRL	0.74	0.73	0.76	0.74	0.66	0.74	0.82	0.78	2.51	
CHE	0.80	0.81	0.67	0.75	0.84	0.81	0.78	0.78	0.77	11.11

JER int

	CAN	DFS	GBR	NLD	NZL	USA	ZAF	AUS	IRL
CAN	6.78								
DFS	0.85	15.41							
GBR	0.75	0.83	3.73						

NLD	0.79	0.81	0.76	3.53					
NZL	0.64	0.63	0.67	0.62	0.05				
USA	0.83	0.83	0.75	0.73	0.64	2.68			
ZAF	0.70	0.71	0.76	0.70	0.77	0.79	11.19		
AUS	0.80	0.76	0.75	0.72	0.78	0.77	0.85	9.32	
IRL	0.77	0.73	0.75	0.74	0.63	0.76	0.83	0.78	2.51

RDC hco

	CAN	DEU	DFS	NOR	USA	NLD
CAN	8.31					
DEU	0.87	14.35				
DFS	0.71	0.83	12.20			
NOR	0.85	0.90	0.87	16.50		
USA	0.83	0.81	0.79	0.75	2.78	
NLD	0.79	0.83	0.79	0.65	0.74	5.79

RDC crc

	CAN	DEU	DFS	GBR	NOR	NZL	NLD	IRL
CAN	6.63							
DEU	0.83	10.12						
DFS	0.83	0.90	12.74					
GBR	0.80	0.71	0.68	4.11				
NOR	0.83	0.80	0.84	0.60	14.36			
NZL	0.64	0.60	0.56	0.64	0.57	0.11		
NLD	0.82	0.83	0.87	0.72	0.78	0.57	3.46	
IRL	0.61	0.60	0.62	0.80	0.61	0.61	0.60	2.91

RDC cc1

	CAN	DEU	DFS	GBR	NOR	NLD	USA
CAN	7.36						
DEU	0.90	13.71					
DFS	0.70	0.82	12.96				
GBR	0.77	0.79	0.67	0.03			
NOR	0.80	0.88	0.94	0.78	14.07		
NLD	0.73	0.77	0.83	0.68	0.69	3.81	
USA	0.78	0.76	0.76	0.68	0.72	0.78	2.91

RDC cc2

	CAN	DEU	DFS	GBR	NOR	NZL	USA	ZAF	NLD	AUS	IRL
CAN	7.06										
DEU	0.92	11.62									
DFS	0.80	0.93	12.87								
GBR	0.70	0.76	0.75	4.11							
NOR	0.76	0.80	0.88	0.71	14.07						
NZL	0.66	0.67	0.65	0.68	0.66	0.07					
USA	0.84	0.85	0.75	0.76	0.71	0.68	2.69				
ZAF	0.69	0.81	0.75	0.71	0.77	0.65	0.77	16.96			
NLD	0.82	0.91	0.85	0.72	0.72	0.67	0.75	0.73	3.64		
AUS	0.73	0.76	0.65	0.76	0.64	0.74	0.73	0.71	0.71	10.62	
IRL	0.73	0.78	0.75	0.80	0.71	0.71	0.73	0.81	0.76	0.83	2.91

RDC int

	CAN	DEU	DFS	GBR	NOR	NZL	USA	ZAF	NLD	AUS	IRL
CAN	6.79										
DEU	0.90	11.43									
DFS	0.85	0.94	13.24								
GBR	0.83	0.85	0.80	4.11							
NOR	0.76	0.72	0.67	0.68	14.36						
NZL	0.69	0.66	0.63	0.68	0.62	0.07					

USA	0.84	0.84	0.77	0.76	0.68	0.65	2.69				
ZAF	0.75	0.85	0.73	0.74	0.81	0.66	0.79	16.96			
NLD	0.83	0.86	0.91	0.80	0.69	0.63	0.75	0.77	3.43		
AUS	0.79	0.75	0.69	0.77	0.68	0.74	0.77	0.78	0.71	10.62	
IRL	0.79	0.81	0.76	0.80	0.68	0.72	0.75	0.84	0.77	0.85	2.91

^LAPPENDIX II. Number of common bulls

BSW hco

common bulls below diagonal
common three quarter sib group above diagonal

	CAN	DEA	FRA	USA	CHE	NLD	ITA
CAN	0	120	58	124	119	37	110
DEA	106	0	217	212	672	164	567
FRA	49	167	0	78	183	88	194
USA	114	171	58	0	219	64	154
CHE	102	572	141	183	0	119	486
NLD	33	152	74	60	112	0	136
ITA	96	453	151	113	428	109	0

BSW crc

common bulls below diagonal
common three quarter sib group above diagonal

	CAN	CHE	DEA	NLD	NZL	GBR	FRA	ITA
CAN	0	131	131	45	24	58	75	126
CHE	112	0	673	128	35	78	185	517
DEA	117	565	0	181	53	76	225	694
NLD	40	118	167	0	33	50	93	153
NZL	23	26	45	26	0	21	26	44
GBR	53	62	59	47	17	0	60	84
FRA	64	141	171	78	19	52	0	204
ITA	111	454	574	129	35	64	159	0

BSW cc1

common bulls below diagonal
common three quarter sib group above diagonal

	CAN	CHE	DEA	NLD	USA	GBR	FRA	ITA
CAN	0	135	134	46	151	59	80	128
CHE	114	0	669	129	288	83	192	518
DEA	118	559	0	184	261	84	237	692
NLD	41	118	167	0	77	54	98	155
USA	147	253	212	71	0	81	106	193
GBR	53	67	65	51	78	0	66	91
FRA	68	147	182	83	75	60	0	216
ITA	112	457	569	128	140	69	171	0

BSW cc2

common bulls below diagonal
common three quarter sib group above diagonal

	CAN	CHE	DEA	NLD	NZL	USA	GBR	FRA	ITA
CAN	0	120	116	40	17	142	53	74	110
CHE	98	0	660	129	28	345	78	192	494
DEA	102	555	0	184	41	335	76	235	642
NLD	36	118	167	0	28	100	50	98	150
NZL	16	23	38	22	0	28	17	21	32
USA	133	321	293	88	24	0	88	126	237
GBR	47	62	59	47	13	86	0	63	82
FRA	63	147	181	83	17	89	56	0	214
ITA	95	427	512	123	28	165	62	166	0

BSW int
----
 common bulls below diagonal
 common three quarter sib group above diagonal
      CAN DEA NLD NZL USA GBR ITA SVN

  CAN   0 122   42   17 148   56 121   29
  DEA 107   0 183   41 334   76 753   96
  NLD   38 167   0   28 100   50 159   46
  NZL   16   38   22   0   28   17   35   12
  USA 139 293   88   24   0   88 260   38
  GBR   50   59   47   13   86   0   87   24
  ITA 104 666 133   31 187   68   0   93
  SVN   26   88   45   11   32   21   88   0

GUE hco

GUE crc
----
 common bulls below diagonal
 common three quarter sib group above diagonal
      CAN GBR NZL

  CAN   0   20   3
  GBR   17   0   14
  NZL   2   12   0

GUE cc1
----
 common bulls below diagonal
 common three quarter sib group above diagonal
      CAN GBR USA

  CAN   0   21   46
  GBR   17   0   62
  USA   45   58   0

GUE cc2
----
 common bulls below diagonal
 common three quarter sib group above diagonal
      CAN GBR NZL USA AUS

  CAN   0   14   1   42   26
  GBR   11   0   12   90   40
  NZL   1   10   0   24   22
  USA   40   91   23   0   73
  AUS   22   33   21   70   0

GUE int
----
 common bulls below diagonal
 common three quarter sib group above diagonal
      CAN GBR NZL USA AUS

  CAN   0   14   1   42   26
  GBR   11   0   12   90   40
  NZL   1   10   0   24   22
  USA   40   91   23   0   73
  AUS   22   33   21   70   0

HOL hco
----
 common bulls below diagonal
 common three quarter sib group above diagonal
      CAN CZE DEU DFS FRA USA POL CHE NLD ITA JPN

  CAN   0 1212 2555 1637 1416 3423 1810 948 1674 1859 1271
  CZE 921   0 2014 1399 1282 1683 1605 527 1650 1326 892

```
  DEU 2170 1578    0 3041 2548 3374 3160 1278 3571 2580 1447
  DFS 1570  980 2444    0 1828 2073 2065  831 2553 1616 1091
  FRA 1110  809 1538 1139    0 1799 1955  787 2102 1553 1184
  USA 3971 1423 2839 1957 1142    0 2727  998 2231 2560 1633
  POL 1711 1384 3004 1839 1455 2949    0  745 2212 1993 1082
  CHE  869  369 1208  783  727  925  628    0 1002  686  511
  NLD 1677 1449 3265 2296 1461 2068 2121 1000    0 1695 1180
  ITA 1516  941 1671 1226  833 2063 1686  588 1302    0 1124
  JPN  763  428  712  613  464  946  631  336  648  559    0
 ------------------------------------------------------------------------------
HOL crc
--------
 common bulls below diagonal
 common three quarter sib group above diagonal
      BEL  CAN  CHE  DEU  DFS  ESP  GBR  IRL  ITA  NLD  NZL  POL  FRA
 ------------------------------------------------------------------------------
  BEL    0  869  675 1398 1009 1030  982  586  683 1425  566  831 1076
  CAN  879    0  980 2693 1683 1875 1906  650 1704 1822  808 1637 1508
  CHE  682  912    0 1309  834  822  864  486  646 1062  474  703  800
  DEU 1438 2264 1257    0 3186 2678 2579 1057 2216 4113 1145 2815 2780
  DFS  953 1651  797 2513    0 1833 1843  869 1369 2599  969 1859 1843
  ESP 1109 1726  782 2441 1698    0 1739  799 1555 2106  813 1835 2028
  GBR  972 2015  830 2082 1524 1624    0 1248 1440 2188 1101 1614 1746
  IRL  573  647  497  944  749  820 1306    0  485 1068  876  637  820
  ITA  684 1499  582 1605 1193 1372 1199  434    0 1531  509 1659 1286
  NLD 1617 1867 1068 3930 2409 2234 2002 1024 1365    0 1256 2101 2249
  NZL  465  754  396  912  721  694  969  779  432 1155    0  652  858
  POL  769 1563  588 2639 1653 1729 1476  538 1476 2031  517    0 1796
  FRA 1068 1199  737 1682 1143 1982 1197  677  841 1551  544 1312    0
 ------------------------------------------------------------------------------
HOL cc1
--------
 common bulls below diagonal
 common three quarter sib group above diagonal
      CAN  CHE  CZE  DEU  DFS  FRA  GBR  ISR  ITA  NLD  USA  POL  JPN
 ------------------------------------------------------------------------------
  CAN    0  986 1151 2728 1728 1529 1959  171 1723 1852 3718 1803 1427
  CHE  915    0  469 1315  840  807  872   69  647 1065 1067  749  546
  CZE  914  333    0 1763 1211 1079 1031  146 1160 1495 1620 1544  802
  DEU 2275 1256 1448    0 3224 2804 2630  205 2233 4113 3652 3173 1646
  DFS 1668  799  949 2533    0 1857 1898  182 1392 2620 2238 2085 1154
  FRA 1218  746  694 1696 1153    0 1777  137 1298 2263 2021 1930 1321
  GBR 2074  840  756 2124 1559 1220    0  187 1460 2234 2545 1745 1221
  ISR  120   39  114  159  135   74  142    0  143  197  264  184  137
  ITA 1511  582  929 1604 1196  849 1224   96    0 1542 2374 1800 1020
  NLD 1884 1068 1384 3917 2416 1574 2050  156 1367    0 2537 2333 1260
  USA 4375 1004 1398 2988 2082 1277 2568  261 2026 2384    0 2664 1841
  POL 1678  638 1398 3075 1886 1416 1588  148 1584 2287 2797    0 1128
  JPN  891  378  448  807  690  533  683   68  601  750 1099  677    0
 ------------------------------------------------------------------------------
HOL cc2
--------
 common bulls below diagonal
 common three quarter sib group above diagonal
      BEL  CAN  CHE  CZE  DEU  DFS  ESP  FRA  GBR  IRL  ISR  ITA  NLD  NZL  USA  POL  ZAF  AUS  URY  JPN
 ------------------------------------------------------------------------------
  BEL    0  867  676  600 1393 1012 1034 1074  988  589   93  686 1429  556 1108  837  335  820  388  579
  CAN  869    0  968 1132 2650 1690 1889 1489 1887  643  166 1696 1801  765 3810 1682  449 1491  845 1314
  CHE  683  890    0  469 1307  841  825  796  868  486   70  647 1065  459 1161  708  264  720  353  507
  CZE  481  885  333    0 1759 1211 1203 1071 1027  456  146 1160 1495  515 1662 1450  276  740  515  764
  DEU 1429 2182 1245 1440    0 3215 2717 2770 2584 1054  206 2223 4086 1125 4196 2881  562 1921  928 1554
  DFS  953 1620  800  949 2522    0 1879 1846 1870  874  184 1393 2625  946 2625 1909  515 1467  740 1080
  ESP 1111 1701  783 1013 2445 1726    0 2044 1761  803  170 1576 2129  815 2624 1893  522 1358  760 1249
  FRA 1061 1164  731  687 1647 1130 1971    0 1750  825  140 1282 2243  858 2705 1829  484 1404  647 1258
  GBR  972 1976  830  753 2064 1531 1627 1189    0 1251  188 1444 2198 1070 2856 1649  508 1670  811 1158
  IRL  573  627  497  352  934  749  820  673 1307    0  126  486 1074  861  968  653  339  850  433  498
  ISR   56  113   39  114  157  135  129   73  140  102    0  143  199  130  289  179   61  133   99  132
  ITA  684 1476  582  929 1593 1196 1376  836 1199  435   96    0 1540  495 2398 1702  261  963  559  958
  NLD 1620 1825 1068 1384 3865 2418 2240 1540 2008 1026  156 1366    0 1215 3104 2134  506 1681  789 1184
```

NZL	453	689	382	389	869	689	673	525	929	761	105	409	1099	0	1265	668	355	1329	601	609
USA	1002	4402	1096	1424	3249	2219	2429	1551	2732	908	279	2043	2838	1222	0	2588	640	2258	1341	2124
POL	764	1539	585	1260	2638	1668	1749	1311	1473	542	136	1479	2019	520	2661	0	327	1150	686	1021
ZAF	281	412	222	199	431	381	479	337	447	297	39	205	423	285	616	260	0	480	321	414
AUS	717	1530	640	530	1495	1115	1141	981	1486	743	87	788	1480	1322	2335	918	421	0	766	980
URY	281	789	260	346	674	514	652	378	652	334	55	405	625	490	1618	557	269	599	0	629
JPN	376	750	328	400	694	599	642	465	598	319	57	527	646	307	952	569	260	537	326	0

HOL int

common bulls below diagonal
common three quarter sib group above diagonal

	BEL	CAN	DEU	DFS	ESP	GBR	IRL	ITA	NLD	NZL	USA	POL	ZAF	AUS	URY	FRA	JPN	SVN
BEL	0	869	1391	1012	1034	988	589	685	1429	556	1108	843	335	820	388	1074	579	144
CAN	873	0	2655	1698	1895	1896	649	1699	1809	770	3823	1702	453	1499	852	1497	1319	193
DEU	1428	2191	0	3212	2716	2584	1054	2224	4082	1124	4192	2908	562	1920	929	2770	1554	334
DFS	953	1630	2520	0	1879	1870	874	1393	2623	946	2625	1929	515	1467	741	1846	1080	236
ESP	1111	1717	2445	1726	0	1761	803	1576	2127	815	2621	1912	522	1357	760	2043	1247	233
GBR	972	1989	2064	1531	1627	0	1251	1445	2198	1070	2856	1663	508	1670	810	1750	1158	187
IRL	573	635	934	749	820	1306	0	486	1073	861	968	658	339	850	433	825	498	107
ITA	684	1482	1593	1196	1376	1199	435	0	1542	495	2399	1723	261	964	559	1285	959	212
NLD	1620	1838	3863	2417	2240	2008	1026	1367	0	1214	3102	2155	506	1680	790	2242	1183	258
NZL	453	693	869	689	673	928	760	409	1099	0	1265	673	355	1329	600	858	609	104
USA	1002	4431	3249	2219	2429	2732	908	2043	2838	1222	0	2617	640	2258	1342	2705	2124	222
POL	776	1566	2684	1694	1769	1489	545	1501	2054	525	2702	0	328	1159	695	1841	1027	273
ZAF	281	419	431	381	479	447	297	205	423	285	616	261	0	480	321	484	414	48
AUS	717	1535	1495	1115	1141	1486	743	788	1480	1322	2335	927	421	0	767	1404	980	142
URY	281	795	674	514	652	652	334	405	625	490	1618	566	269	599	0	648	629	85
FRA	1061	1172	1647	1130	1971	1189	673	836	1540	525	1551	1323	337	981	378	0	1258	177
JPN	376	753	694	599	642	598	319	527	646	307	952	575	260	537	326	465	0	142
SVN	116	151	331	190	203	137	86	177	226	71	183	233	34	100	42	133	77	0

JER hco

common bulls below diagonal
common three quarter sib group above diagonal

	CAN	DFS	USA	NLD
CAN	0	132	386	45
DFS	128	0	187	123
USA	379	179	0	92
NLD	37	121	90	0

JER crc

common bulls below diagonal
common three quarter sib group above diagonal

	CAN	DFS	GBR	NLD	NZL	IRL	CHE
CAN	0	132	173	58	198	19	54
DFS	127	0	209	192	193	66	86
GBR	174	203	0	117	259	98	94
NLD	50	192	114	0	113	47	52
NZL	200	169	268	105	0	165	80
IRL	17	62	101	46	190	0	36
CHE	50	85	92	45	72	32	0

JER cc1

common bulls below diagonal
common three quarter sib group above diagonal

	CAN	DFS	GBR	NLD	USA	CHE
CAN	0	135	182	59	462	56
DFS	129	0	212	195	207	88
GBR	177	205	0	119	260	95
NLD	52	195	114	0	127	56
USA	470	200	277	129	0	113

CHE	50	86	89	48	113	0				

JER cc2

common bulls below diagonal
common three quarter sib group above diagonal

	CAN	DFS	GBR	NLD	NZL	USA	ZAF	AUS	IRL	CHE
CAN	0	127	174	54	185	455	142	248	18	55
DFS	121	0	213	196	191	258	170	186	66	88
GBR	169	205	0	120	259	286	187	254	98	96
NLD	46	196	114	0	111	143	87	90	47	57
NZL	184	166	264	102	0	443	225	491	164	84
USA	461	238	311	148	514	0	343	556	59	115
ZAF	142	152	190	83	234	356	0	265	46	72
AUS	244	159	259	83	535	603	252	0	77	81
IRL	16	62	101	46	188	62	47	73	0	36
CHE	49	86	92	48	72	116	63	69	32	0

JER int

common bulls below diagonal
common three quarter sib group above diagonal

	CAN	DFS	GBR	NLD	NZL	USA	ZAF	AUS	IRL
CAN	0	129	175	54	187	460	144	250	18
DFS	123	0	213	196	191	258	170	186	66
GBR	171	205	0	120	259	286	187	254	98
NLD	47	196	114	0	111	143	87	90	47
NZL	187	166	264	102	0	443	225	491	164
USA	468	238	311	148	514	0	343	556	59
ZAF	144	152	190	83	234	356	0	265	46
AUS	247	159	259	83	535	603	252	0	77
IRL	16	62	101	46	188	62	47	73	0

RDC hco

common bulls below diagonal
common three quarter sib group above diagonal

	CAN	DEU	DFS	NOR	USA	NLD
CAN	0	10	200	7	111	6
DEU	10	0	73	21	26	14
DFS	210	64	0	151	186	65
NOR	6	20	131	0	77	50
USA	106	24	178	77	0	43
NLD	6	14	62	50	41	0

RDC crc

common bulls below diagonal
common three quarter sib group above diagonal

	CAN	DEU	DFS	GBR	NOR	NZL	NLD	IRL
CAN	0	13	201	89	8	73	7	7
DEU	12	0	78	16	21	26	20	8
DFS	211	66	0	136	168	207	67	27
GBR	90	15	132	0	81	90	46	33
NOR	7	20	142	85	0	61	55	67
NZL	74	25	203	89	60	0	30	21
NLD	7	20	64	45	55	29	0	16
IRL	7	8	22	32	66	19	16	0

RDC cc1

common bulls below diagonal
common three quarter sib group above diagonal

	CAN	DEU	DFS	GBR	NOR	NLD	USA

CAN	0	13	201	89	8	7	159
DEU	12	0	78	16	21	20	30
DFS	211	66	0	138	158	67	221
GBR	90	15	134	0	85	46	118
NOR	7	20	136	89	0	53	89
NLD	7	20	64	45	53	0	48
USA	157	28	216	112	89	46	0

RDC cc2

common bulls below diagonal
common three quarter sib group above diagonal

	CAN	DEU	DFS	GBR	NOR	NZL	USA	ZAF	NLD	AUS	IRL
CAN	0	13	198	84	8	70	182	78	7	79	7
DEU	12	0	77	16	21	24	32	3	20	51	8
DFS	208	66	0	137	158	196	241	63	67	245	27
GBR	85	15	133	0	80	86	134	49	46	101	33
NOR	7	20	136	84	0	54	95	0	53	83	67
NZL	70	23	191	83	53	0	124	41	29	166	21
USA	187	30	239	132	95	125	0	79	52	157	37
ZAF	83	3	60	46	0	39	73	0	3	46	4
NLD	7	20	64	45	53	28	50	3	0	46	16
AUS	81	49	222	100	72	166	160	48	44	0	27
IRL	7	8	22	32	66	19	37	4	16	26	0

RDC int

common bulls below diagonal
common three quarter sib group above diagonal

	CAN	DEU	DFS	GBR	NOR	NZL	USA	ZAF	NLD	AUS	IRL
CAN	0	13	198	86	8	70	183	79	7	80	7
DEU	12	0	77	16	21	24	32	3	20	51	8
DFS	208	66	0	137	168	196	241	63	67	245	27
GBR	87	15	133	0	81	86	134	49	46	101	33
NOR	7	20	142	85	0	55	95	0	55	87	67
NZL	70	23	191	83	54	0	124	41	29	166	21
USA	188	30	239	132	95	125	0	79	52	157	37
ZAF	84	3	60	46	0	39	73	0	3	46	4
NLD	7	20	64	45	55	28	50	3	0	46	16
AUS	82	49	222	100	76	166	160	48	44	0	27
IRL	7	8	22	32	66	19	37	4	16	26	0

SIM hco

SIM crc

SIM cc1

SIM cc2

SIM int