

Introduction

The latest international evaluation for dairy **production traits** took place as scheduled at the Interbull Centre. Data from twenty nine (29) countries were included in this evaluation.

International genetic evaluations for milk, fat and protein yields of bulls from Australia, Austria-Germany, Belgium, Canada, 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:

DEA BSW/SIM The base group is shifted by 4 month for all traits in every evaluation

NOR RDC The rolling definition of hys is causing the daughters to distribute somewhat differently over hys-classes at each evaluation. Therefore some bulls occasionally may lose EDC although the number of daughters stay the same. Reliability changes is a function of the EDC changes

DFS HOL/RDC Some bulls have lost EDC' s or herds or daughters. But is is only very few animals and less than 1% even if number of animals is big.

JPN HOL Little changes in proofs caused by additional records and modification of pedigree

ZAF RDC Data since Dec 2011 has now been included for herds participating in Milk Recording at the ARC.

SVN HOL/BSW There are still some bulls losing informations (herds/daughters/EDC) from run to run, SIM but in most cases there are changes only for one or two herds, daughters or EDC. These changes are mostly consequences of changes in data base related to the pedigree completeness as well as phenotypic data improvement.

AUS ALL The decrease in number of daughters and herds in all production traits is due to either or both reasons: 1) daughters wrongly allocated to them or adjustments in some of the herd-year -seasons. 2) different cut off dates in previous and current run.

IRL HOL/RDC Introduced the new genetic base as tested in January. SIM/JER

EST HOL/RDC Decrease in number of daughters/herds and reliability of some bulls is due to the pedigree check of cows and due to additional data check.

CHE HOL/BSW Decrease in information due to continuous work on the raw data by herd-book organizations. Some SIM bulls are missing in the current proof files. This is because the information changed based on which we define the publication criterion. Some bulls changed from TOP 12 to 11. This is related to changes in the database by the herdbook organizations resulting in a lower number of daughters of these bulls.

INTERBULL CHANGES COMPARED TO THE APRIL ROUTINE RUN

None

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 analyzed 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 dairy production traits (August Routine Evaluation 2016). Number of records for milk yield by breed

Country	BSW	GUE	HOL	JER	RDC	SIM
AUS	178	128	7065	1581	643	
BEL			1111			
CAN	209	93	11065	616	750	
CHE	2733		3017			2963
CZE			3926			
DEA	5628					22303
DEU			25935	160	399	
DFS			12308	2001	7293	
ESP			3242			
EST			980		394	
FRA	351		15974			421
FRM						4287
FRR			215			
GBR	135	317	6440	843	539	89
HUN			2942			200
IRL			2203	130	42	91
ISR			1263			
ITA	1963		9073	166		1477
JPN			5297			
KOR			1132			
LTU			681		399	
LVA			946		677	
NLD	163		14263	121	58	292
NOR					3848	
NZL	44	58	6769	4380	1254	
POL			9049			
PRT			2092			
SVK			1025			549
SVN	326		440			544
URY			926			
USA	1014	751	34746	4035	648	37
ZAF		36	1235	656	140	
HRV			649			743
No. Records	12744	1383	186009	14689	17084	33996
Pub. Proofs	10415	1109	144799	12047	15392	30864

^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	610.82										
FRA	0.89	640.69									
USA	0.93	0.89	624.28								
CHE	0.90	0.89	0.87	487.06							
ITA	0.89	0.83	0.87	0.87	588.68						
DEA	0.87	0.84	0.86	0.93	0.90	463.00					
NLD	0.89	0.88	0.87	0.85	0.84	0.86	567.07				
SVN	0.83	0.84	0.82	0.81	0.81	0.84	0.84	10.02			
NZL	0.70	0.76	0.72	0.76	0.70	0.74	0.74	0.75	349.41		
GBR	0.85	0.87	0.85	0.85	0.82	0.84	0.87	0.85	0.71	256.28	
AUS	0.77	0.79	0.75	0.73	0.72	0.73	0.78	0.76	0.84	0.76	401.84

BSW fat

	CAN	FRA	USA	CHE	ITA	DEA	NLD	SVN	NZL	GBR	AUS
CAN	26.21										
FRA	0.89	27.31									
USA	0.91	0.89	23.48								
CHE	0.86	0.88	0.83	19.22							
ITA	0.89	0.83	0.85	0.88	22.49						
DEA	0.85	0.85	0.83	0.93	0.88	17.48					
NLD	0.87	0.87	0.87	0.85	0.84	0.87	24.86				
SVN	0.83	0.84	0.82	0.81	0.81	0.84	0.84	10.09			
NZL	0.71	0.74	0.71	0.74	0.70	0.84	0.71	0.75	14.94		
GBR	0.86	0.88	0.85	0.86	0.82	0.84	0.87	0.85	0.72	9.69	
AUS	0.75	0.77	0.74	0.71	0.71	0.73	0.75	0.76	0.84	0.74	14.76

BSW pro

	CAN	FRA	USA	CHE	ITA	DEA	NLD	SVN	NZL	GBR	AUS
CAN	22.34										
FRA	0.84	20.74									
USA	0.90	0.87	18.80								
CHE	0.85	0.85	0.82	15.29							
ITA	0.85	0.82	0.83	0.86	20.63						
DEA	0.84	0.83	0.82	0.91	0.89	14.40					
NLD	0.86	0.85	0.84	0.83	0.82	0.84	18.89				
SVN	0.83	0.84	0.82	0.81	0.81	0.84	0.84	9.97			
NZL	0.70	0.72	0.71	0.72	0.70	0.76	0.71	0.75	10.61		
GBR	0.85	0.86	0.83	0.83	0.81	0.84	0.87	0.85	0.71	7.43	
AUS	0.71	0.74	0.70	0.71	0.69	0.73	0.74	0.76	0.82	0.74	11.81

GUE mil

	CAN	USA	AUS	GBR	ZAF	NZL
CAN	733.23					
USA	0.94	713.79				
AUS	0.83	0.79	471.22			
GBR	0.86	0.83	0.78	238.78		
ZAF	0.85	0.85	0.82	0.84	349.31	
NZL	0.70	0.70	0.84	0.70	0.72	331.29

GUE fat

	CAN	USA	AUS	GBR	ZAF	NZL
CAN	30.52					
USA	0.93	25.37				
AUS	0.80	0.78	17.48			
GBR	0.86	0.84	0.77	10.03		
ZAF	0.81	0.81	0.74	0.84	13.48	
NZL	0.72	0.71	0.84	0.70	0.72	16.65

GUE pro

	CAN	USA	AUS	GBR	ZAF	NZL
CAN	22.26					
USA	0.92	19.63				
AUS	0.74	0.71	13.70			
GBR	0.85	0.83	0.75	6.50		
ZAF	0.81	0.81	0.76	0.84	10.49	
NZL	0.70	0.69	0.82	0.70	0.71	11.00

HOL pro

	CAN	DEU	DFS	FRA	ITA	NLD	USA	CHE	GBR	NZL	AUS	BEL	IRL	
ESP	CZE	SVN	EST	ISR	FRR	HUN	POL	ZAF	JPN	LVA	SVK	LTU	PRT	KOR
URY	HRV													
CAN	21.19													
DEU	0.88	17.79												
DFS	0.92	0.92	10.77											
FRA	0.87	0.84	0.91	18.39										
ITA	0.87	0.84	0.88	0.85	17.65									
NLD	0.88	0.90	0.90	0.86	0.83	18.47								
USA	0.92	0.87	0.92	0.89	0.89	0.86	17.43							
CHE	0.85	0.85	0.90	0.91	0.85	0.85	0.85	17.16						
GBR	0.85	0.83	0.88	0.87	0.82	0.87	0.84	0.87	7.20					
NZL	0.68	0.70	0.70	0.70	0.72	0.70	0.70	0.70	0.70	9.09				
AUS	0.72	0.72	0.74	0.75	0.71	0.74	0.71	0.75	0.75	0.82	10.57			
BEL	0.80	0.83	0.83	0.83	0.82	0.84	0.80	0.83	0.83	0.70	0.73	13.94		
IRL	0.74	0.73	0.77	0.81	0.73	0.79	0.75	0.77	0.78	0.83	0.83	0.75	4.76	
ESP	0.90	0.87	0.90	0.88	0.86	0.87	0.90	0.86	0.84	0.70	0.74	0.83	0.77	
15.84														
CZE	0.80	0.82	0.83	0.83	0.82	0.83	0.80	0.83	0.83	0.70	0.72	0.83	0.71	
0.83	16.53													
SVN	0.81	0.82	0.83	0.83	0.82	0.83	0.81	0.84	0.83	0.72	0.73	0.84	0.72	
0.83	0.83	11.59												
EST	0.81	0.83	0.86	0.83	0.83	0.83	0.81	0.84	0.83	0.72	0.73	0.84	0.72	
0.83	0.83	0.84	18.61											
ISR	0.83	0.80	0.81	0.83	0.81	0.80	0.83	0.81	0.80	0.66	0.68	0.81	0.67	
0.82	0.80	0.82	0.82	9.82										
FRR	0.83	0.82	0.84	0.85	0.83	0.83	0.82	0.84	0.84	0.76	0.76	0.86	0.75	
0.84	0.87	0.86	0.88	0.84	18.81									
HUN	0.83	0.83	0.86	0.86	0.88	0.82	0.88	0.83	0.82	0.70	0.71	0.82	0.71	
0.84	0.82	0.83	0.83	0.81	0.85	20.64								
POL	0.84	0.84	0.85	0.80	0.82	0.83	0.83	0.80	0.80	0.68	0.70	0.80	0.69	
0.85	0.80	0.81	0.84	0.83	0.85	0.83	10.83							
ZAF	0.80	0.82	0.82	0.82	0.82	0.82	0.80	0.82	0.82	0.70	0.76	0.82	0.73	
0.82	0.82	0.83	0.83	0.83	0.86	0.82	0.80	13.54						
JPN	0.91	0.86	0.92	0.87	0.87	0.87	0.91	0.86	0.84	0.72	0.74	0.82	0.75	
0.88	0.82	0.83	0.84	0.82	0.85	0.83	0.86	0.82	17.33					
LVA	0.80	0.82	0.82	0.82	0.82	0.82	0.80	0.83	0.82	0.71	0.72	0.82	0.71	
0.82	0.82	0.83	0.83	0.81	0.84	0.82	0.80	0.83	0.82	13.02				
SVK	0.80	0.82	0.84	0.83	0.83	0.83	0.80	0.84	0.83	0.71	0.73	0.83	0.71	
0.83	0.83	0.85	0.85	0.83	0.86	0.85	0.80	0.83	0.83	0.83	11.15			
LTU	0.81	0.82	0.83	0.84	0.82	0.83	0.81	0.85	0.83	0.72	0.74	0.84	0.72	
0.83	0.83	0.85	0.85	0.83	0.90	0.83	0.81	0.84	0.83	0.83	0.85	10.65		
PRT	0.80	0.80	0.80	0.80	0.81	0.80	0.80	0.80	0.80	0.70	0.68	0.80	0.70	
0.80	0.80	0.81	0.81	0.83	0.83	0.80	0.80	0.80	0.81	0.80	0.80	0.81	20.08	
KOR	0.82	0.82	0.83	0.83	0.82	0.83	0.80	0.83	0.83	0.70	0.72	0.83	0.71	
0.83	0.83	0.85	0.84	0.82	0.90	0.82	0.80	0.82	0.82	0.83	0.84	0.84	0.80	
13.09														
URY	0.80	0.80	0.80	0.80	0.82	0.80	0.80	0.81	0.80	0.71	0.71	0.80	0.71	
0.80	0.80	0.82	0.82	0.84	0.88	0.80	0.80	0.80	0.82	0.81	0.81	0.82	0.80	
0.80	5.39													
HRV	0.81	0.82	0.83	0.83	0.82	0.83	0.80	0.84	0.83	0.71	0.73	0.83	0.71	
0.83	0.83	0.84	0.84	0.81	0.85	0.82	0.80	0.83	0.83	0.82	0.84	0.84	0.80	
0.84	0.82	12.02												

JER mil

	CAN	DFS	USA	NZL	AUS	GBR	NLD	ZAF	ITA	DEU	IRL
CAN	559.98										
DFS	0.94	9.26									
USA	0.92	0.93	614.67								
NZL	0.75	0.71	0.71	281.37							
AUS	0.85	0.78	0.78	0.85	486.24						
GBR	0.86	0.85	0.82	0.70	0.76	210.06					
NLD	0.93	0.93	0.90	0.72	0.80	0.86	594.66				
ZAF	0.89	0.88	0.84	0.78	0.83	0.82	0.83	371.76			
ITA	0.88	0.87	0.89	0.75	0.78	0.84	0.86	0.86	526.27		
DEU	0.89	0.90	0.88	0.71	0.78	0.83	0.91	0.83	0.88	485.03	
IRL	0.82	0.81	0.79	0.83	0.85	0.79	0.84	0.80	0.79	0.82	180.50

RDC pro

	CAN	NOR	USA	NZL	AUS	GBR	DFS	DEU	ZAF	EST	LVA	LTU	IRL
NLD													
CAN	17.65												
NOR	0.87	11.41											
USA	0.90	0.84	19.06										
NZL	0.69	0.73	0.69	9.40									
AUS	0.70	0.79	0.71	0.80	11.95								
GBR	0.83	0.83	0.83	0.69	0.74	6.55							
DFS	0.89	0.88	0.89	0.69	0.74	0.86	10.37						
DEU	0.88	0.92	0.86	0.70	0.75	0.83	0.90	18.39					
ZAF	0.81	0.88	0.81	0.70	0.75	0.81	0.81	0.81	16.01				
EST	0.82	0.84	0.83	0.75	0.76	0.85	0.84	0.84	0.83	15.69			
LVA	0.82	0.83	0.82	0.73	0.73	0.84	0.83	0.83	0.83	0.84	8.46		
LTU	0.83	0.83	0.82	0.73	0.74	0.85	0.84	0.83	0.85	0.85	0.83	9.39	
IRL	0.74	0.73	0.76	0.82	0.83	0.78	0.78	0.74	0.74	0.76	0.76	0.79	4.02
NLD	0.88	0.91	0.86	0.70	0.76	0.87	0.90	0.90	0.81	0.85	0.84	0.85	0.80
22.55													

SIM mil

	CHE	DEA	FRM	ITA	SVN	FRA	HUN	NLD	IRL	SVK	GBR	HRV	USA
CHE	564.44												
DEA	0.86	510.17											
FRM	0.95	0.89	633.08										
ITA	0.86	0.82	0.82	499.89									
SVN	0.85	0.83	0.86	0.83	8.79								
FRA	0.93	0.90	0.90	0.87	0.84	687.26							
HUN	0.85	0.84	0.90	0.88	0.85	0.88	407.09						
NLD	0.89	0.93	0.90	0.84	0.84	0.90	0.86	710.39					
IRL	0.79	0.73	0.78	0.75	0.76	0.88	0.77	0.79	140.66				
SVK	0.84	0.83	0.84	0.83	0.85	0.84	0.86	0.84	0.77	338.94			
GBR	0.88	0.89	0.89	0.83	0.84	0.87	0.83	0.87	0.78	0.84	303.20		
HRV	0.84	0.83	0.90	0.82	0.84	0.84	0.84	0.84	0.75	0.84	0.83	10.58	
USA	0.90	0.83	0.88	0.89	0.82	0.92	0.90	0.90	0.82	0.82	0.85	0.81	553.84

SIM fat

	CHE	DEA	FRM	ITA	SVN	FRA	HUN	NLD	IRL	SVK	GBR	HRV	USA
CHE	22.64												
DEA	0.88	19.36											
FRM	0.94	0.91	24.92										
ITA	0.85	0.84	0.82	19.84									
SVN	0.85	0.83	0.86	0.83	9.26								
FRA	0.91	0.93	0.90	0.87	0.84	27.86							
HUN	0.83	0.84	0.89	0.89	0.85	0.88	15.23						
NLD	0.88	0.92	0.90	0.83	0.84	0.89	0.84	27.61					
IRL	0.75	0.73	0.76	0.73	0.75	0.85	0.72	0.79	5.23				
SVK	0.84	0.83	0.84	0.83	0.85	0.84	0.85	0.84	0.75	13.16			
GBR	0.90	0.88	0.87	0.83	0.84	0.89	0.83	0.87	0.77	0.84	10.72		
HRV	0.83	0.83	0.90	0.82	0.84	0.84	0.84	0.84	0.75	0.84	0.83	10.67	
USA	0.86	0.83	0.84	0.90	0.81	0.92	0.91	0.89	0.79	0.81	0.86	0.81	24.94

SIM pro

	CHE	DEA	FRM	ITA	SVN	FRA	HUN	NLD	IRL	SVK	GBR	HRV	USA
CHE	16.72												
DEA	0.85	15.56											
FRM	0.93	0.89	19.64										
ITA	0.83	0.82	0.82	15.94									
SVN	0.85	0.83	0.86	0.83	9.03								
FRA	0.90	0.87	0.90	0.84	0.84	21.88							
HUN	0.84	0.84	0.89	0.86	0.85	0.86	12.47						
NLD	0.84	0.92	0.88	0.83	0.84	0.85	0.83	22.61					
IRL	0.76	0.73	0.77	0.72	0.75	0.81	0.72	0.76	4.61				
SVK	0.84	0.83	0.84	0.83	0.85	0.84	0.86	0.84	0.75	10.24			
GBR	0.86	0.90	0.89	0.83	0.84	0.87	0.82	0.87	0.76	0.84	8.30		
HRV	0.84	0.83	0.90	0.82	0.84	0.84	0.84	0.84	0.75	0.84	0.84	10.75	
USA	0.86	0.83	0.84	0.87	0.81	0.89	0.88	0.86	0.76	0.81	0.84	0.81	15.12

^LAPPENDIX II. Number of common bulls

BSW

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common bulls below diagonal
common three quarter sib group above diagonal
  CAN  FRA  USA  CHE  ITA  DEA  NLD  SVN  NZL  GBR  AUS
-----
CAN    0   77  149  110  104  113   46   22   20   65   78
FRA   69    0  117  145  167  189   76   46   17   54   53
USA  145   78    0  296  219  294   72   32   24   87  114
CHE   89  108  278    0  394  514   83   57   19   69   98
ITA   91  133  152  339    0  620  111   73   22   74   97
DEA   95  142  258  408  524    0  125   83   26   74  108
NLD   42   62   63   74   91  117    0   35   18   38   49
SVN   20   46   25   58   74   76   36    0    4   19   21
NZL   20   13   21   14   16   21   11    3    0   17   22
GBR   64   43   78   53   52   51   30   14   15    0   52
AUS   77   41  104   59   65   73   37   17   17   41    0
  
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BSW

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common bulls below diagonal
common three quarter sib group above diagonal
  CAN  FRA  USA  CHE  ITA  DEA  NLD  SVN  NZL  GBR  AUS
-----
CAN    0   77  149  110  104  113   46   22   20   65   78
FRA   69    0  117  145  167  189   76   46   17   54   53
USA  145   78    0  296  219  294   72   32   24   87  114
CHE   89  108  278    0  394  514   83   57   19   69   98
ITA   91  133  152  339    0  620  111   73   22   74   97
DEA   95  142  258  408  524    0  125   83   26   74  108
NLD   42   62   63   74   91  117    0   35   18   38   49
SVN   20   46   25   58   74   76   36    0    4   19   21
NZL   20   13   21   14   16   21   11    3    0   17   22
GBR   64   43   78   53   52   51   30   14   15    0   52
AUS   77   41  104   59   65   73   37   17   17   41    0
  
```

BSW

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common bulls below diagonal
common three quarter sib group above diagonal
  CAN  FRA  USA  CHE  ITA  DEA  NLD  SVN  NZL  GBR  AUS
-----
CAN    0   77  149  110  104  113   46   22   20   65   78
FRA   69    0  117  145  167  189   76   46   17   54   53
USA  145   78    0  296  219  294   72   32   24   87  114
CHE   89  108  278    0  394  514   83   57   19   69   98
ITA   91  133  152  339    0  620  111   73   22   74   97
DEA   95  142  258  408  524    0  125   83   26   74  108
NLD   42   62   63   74   91  117    0   35   18   38   49
SVN   20   46   25   58   74   76   36    0    4   19   21
NZL   20   13   21   14   16   21   11    3    0   17   22
GBR   64   43   78   53   52   51   30   14   15    0   52
AUS   77   41  104   59   65   73   37   17   17   41    0
  
```

GUE

```

common bulls below diagonal
common three quarter sib group above diagonal
  CAN  USA  AUS  GBR  ZAF  NZL
-----
CAN    0   61  43   27   4   14
USA   52    0   55  83   10  31
AUS   40   50    0   34   5   27
GBR   22   85  29    0   4   15
ZAF    1    7   4    3   0   5
NZL   10   28  26   13   3   0
  
```

GUE

common bulls below diagonal
common three quarter sib group above diagonal
CAN USA AUS GBR ZAF NZL

CAN 0 61 43 27 4 14
USA 52 0 55 83 10 31
AUS 40 50 0 34 5 27
GBR 22 85 29 0 4 15
ZAF 1 7 4 3 0 5
NZL 10 28 26 13 3 0

GUE

common bulls below diagonal
common three quarter sib group above diagonal
CAN USA AUS GBR ZAF NZL

CAN 0 60 43 27 3 13
USA 51 0 55 83 10 31
AUS 40 50 0 34 5 27
GBR 22 85 29 0 4 15
ZAF 1 7 4 3 0 5
NZL 10 28 26 13 3 0

JER

```

common bulls below diagonal
common three quarter sib group above diagonal

```

	CAN	DFS	USA	NZL	AUS	GBR	NLD	ZAF	ITA	DEU	IRL
CAN	0	68	323	143	195	134	28	125	66	58	6
DFS	53	0	142	115	105	133	71	113	95	100	17
USA	331	114	0	310	400	202	66	254	97	98	28
NZL	155	89	384	0	354	178	59	175	83	77	80
AUS	192	69	421	393	0	166	53	194	75	65	32
GBR	131	116	216	181	156	0	66	143	100	86	35
NLD	22	69	71	52	40	59	0	57	52	50	14
ZAF	119	89	262	181	177	143	53	0	89	77	21
ITA	62	92	103	81	70	102	51	83	0	71	10
DEU	55	93	99	72	54	84	47	74	73	0	12
IRL	3	14	28	87	27	36	14	20	11	13	0

JER

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common bulls below diagonal
common three quarter sib group above diagonal

```

	CAN	DFS	USA	NZL	AUS	GBR	NLD	ZAF	ITA	DEU	IRL
CAN	0	68	323	143	195	134	28	125	66	58	6
DFS	53	0	142	115	105	133	71	113	95	100	17
USA	331	114	0	310	400	202	66	254	97	98	28
NZL	155	89	384	0	354	178	59	175	83	77	80
AUS	192	69	421	393	0	166	53	194	75	65	32
GBR	131	116	216	181	156	0	66	143	100	86	35
NLD	22	69	71	52	40	59	0	57	52	50	14
ZAF	119	89	262	181	177	143	53	0	89	77	21
ITA	62	92	103	81	70	102	51	83	0	71	10
DEU	55	93	99	72	54	84	47	74	73	0	12
IRL	3	14	28	87	27	36	14	20	11	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
CAN	0	68	323	143	195	134	28	125	66	58	6
DFS	53	0	142	115	105	133	71	113	95	100	17
USA	331	114	0	310	400	202	66	254	97	98	28
NZL	155	89	384	0	354	178	59	175	83	77	80
AUS	192	69	421	393	0	166	53	194	75	65	32
GBR	131	116	216	181	156	0	66	143	100	86	35
NLD	22	69	71	52	40	59	0	57	52	50	14
ZAF	119	89	262	181	177	143	53	0	89	77	21
ITA	62	92	103	81	70	102	51	83	0	71	10
DEU	55	93	99	72	54	84	47	74	73	0	12
IRL	3	14	28	87	27	36	14	20	11	13	0

RDC

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common bulls below diagonal
common three quarter sib group above diagonal

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	CAN	NOR	USA	NZL	AUS	GBR	DFS	DEU	ZAF	EST	LVA	LTU	IRL	NLD
CAN	0	4	178	71	87	66	119	11	73	1	9	14	2	4
NOR	4	0	55	36	51	23	103	17	0	15	20	25	39	28
USA	162	56	0	96	103	75	147	21	62	13	21	30	18	27
NZL	70	35	95	0	118	50	148	15	36	5	14	24	5	11
AUS	86	42	103	120	0	49	147	36	35	22	33	42	8	21
GBR	64	24	68	47	49	0	59	5	35	2	9	13	8	16
DFS	117	76	143	145	125	56	0	58	50	83	115	109	12	31
DEU	10	17	21	15	35	5	48	0	2	23	33	32	5	14
ZAF	75	0	56	31	34	30	47	2	0	0	2	5	0	2
EST	1	15	12	4	21	2	72	22	0	0	46	23	0	9
LVA	9	18	18	12	31	8	79	28	2	41	0	48	3	11
LTU	13	20	24	20	38	12	93	30	5	22	43	0	4	11
IRL	2	38	18	5	7	8	10	5	0	0	3	4	0	9
NLD	4	27	26	11	19	15	30	14	2	8	10	10	8	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
CAN	0	4	178	71	87	66	119	11	73	1	9	14	2	4
NOR	4	0	55	36	51	23	104	18	0	16	21	25	39	28
USA	162	56	0	96	103	74	147	21	62	13	21	30	18	27
NZL	70	35	95	0	118	50	148	15	36	5	14	24	5	11
AUS	86	42	103	120	0	49	147	36	35	22	33	42	8	21
GBR	64	24	68	47	49	0	59	5	35	2	9	13	8	16
DFS	117	77	143	145	125	56	0	58	50	83	115	109	12	30
DEU	10	18	21	15	35	5	48	0	2	23	33	32	5	14
ZAF	75	0	56	31	34	30	47	2	0	0	2	5	0	2
EST	1	16	12	4	21	2	72	22	0	0	46	23	0	9
LVA	9	19	18	12	31	8	79	28	2	41	0	48	3	11
LTU	13	20	24	20	38	12	93	30	5	22	43	0	4	11
IRL	2	38	18	5	7	8	10	5	0	0	3	4	0	9
NLD	4	27	26	11	19	15	30	14	2	8	10	10	8	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
CAN	0	4	178	71	87	66	119	11	73	1	9	14	2	4
NOR	4	0	55	36	51	23	104	18	0	16	21	25	39	28
USA	162	56	0	96	103	74	147	21	62	13	21	30	18	27
NZL	70	35	95	0	118	50	148	15	36	5	14	24	5	11
AUS	86	42	103	120	0	49	147	36	35	22	33	42	8	21
GBR	64	24	68	47	49	0	59	5	35	2	9	13	8	16
DFS	117	77	143	145	125	56	0	58	50	83	115	109	12	30
DEU	10	18	21	15	35	5	48	0	2	23	33	32	5	14
ZAF	75	0	56	31	34	30	47	2	0	0	2	5	0	2
EST	1	16	12	4	21	2	72	22	0	0	46	23	0	9
LVA	9	19	18	12	31	8	79	28	2	41	0	48	3	11
LTU	13	20	24	20	38	12	93	30	5	22	43	0	4	11
IRL	2	38	18	5	7	8	10	5	0	0	3	4	0	9
NLD	4	27	26	11	19	15	30	14	2	8	10	10	8	0

SIM

common bulls below diagonal
common three quarter sib group above diagonal

	CHE	DEA	FRM	ITA	SVN	FRA	HUN	NLD	IRL	SVK	GBR	HRV	USA
CHE	0	282	161	77	6	12	2	73	51	31	54	1	17
DEA	251	0	228	738	157	223	44	206	54	346	52	451	16
FRM	210	274	0	148	17	3	3	104	65	55	70	2	23
ITA	79	644	182	0	87	125	18	145	52	129	46	196	19
SVN	6	143	17	82	0	50	9	40	1	43	0	64	0
FRA	10	184	1	112	47	0	11	49	1	50	0	83	0
HUN	1	29	1	14	7	8	0	3	1	12	0	15	0
NLD	74	211	125	140	38	49	3	0	47	51	50	75	14
IRL	48	47	70	49	1	1	1	42	0	11	37	3	12
SVK	23	353	55	110	42	43	10	42	4	0	10	81	3
GBR	62	54	89	52	0	0	0	50	32	5	0	0	17
HRV	1	474	1	187	53	77	15	75	2	64	0	0	0
USA	18	22	37	26	0	0	0	17	12	3	24	0	0

SIM

common bulls below diagonal
common three quarter sib group above diagonal

	CHE	DEA	FRM	ITA	SVN	FRA	HUN	NLD	IRL	SVK	GBR	HRV	USA
CHE	0	282	161	77	6	12	2	73	51	31	54	1	17
DEA	251	0	228	738	157	223	44	206	54	346	52	449	16
FRM	210	274	0	148	17	3	3	104	65	55	70	2	23
ITA	79	644	182	0	87	125	18	145	52	129	46	194	19
SVN	6	143	17	82	0	50	9	40	1	43	0	64	0
FRA	10	184	1	112	47	0	11	49	1	50	0	83	0
HUN	1	29	1	14	7	8	0	3	1	12	0	15	0
NLD	74	211	125	140	38	49	3	0	47	51	50	75	14
IRL	48	47	70	49	1	1	1	42	0	11	37	3	12
SVK	23	353	55	110	42	43	10	42	4	0	10	79	3
GBR	62	54	89	52	0	0	0	50	32	5	0	0	17
HRV	1	472	1	185	53	77	15	75	2	62	0	0	0
USA	18	22	37	26	0	0	0	17	12	3	24	0	0

SIM

common bulls below diagonal
common three quarter sib group above diagonal

	CHE	DEA	FRM	ITA	SVN	FRA	HUN	NLD	IRL	SVK	GBR	HRV	USA
CHE	0	282	161	77	6	12	2	73	51	31	54	1	17
DEA	251	0	228	738	157	223	44	206	54	346	52	450	16
FRM	210	274	0	148	17	3	3	104	65	55	70	2	23
ITA	79	644	182	0	87	125	18	145	52	129	46	195	19
SVN	6	143	17	82	0	50	9	40	1	43	0	64	0
FRA	10	184	1	112	47	0	11	49	1	50	0	83	0
HUN	1	29	1	14	7	8	0	3	1	12	0	15	0
NLD	74	211	125	140	38	49	3	0	47	51	50	75	14
IRL	48	47	70	49	1	1	1	42	0	11	37	3	12
SVK	23	353	55	110	42	43	10	42	4	0	10	80	3
GBR	62	54	89	52	0	0	0	50	32	5	0	0	17
HRV	1	473	1	186	53	77	15	75	2	63	0	0	0
USA	18	22	37	26	0	0	0	17	12	3	24	0	0
