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Introduction
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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 absence 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.

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Country  Traits  Submitted traits and their definitions
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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)
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         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=IT    DO=Days open
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        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)
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CHANGES IN NATIONAL PROCEDURES

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

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ITA (HOL)         The decrease in information is due to strict editing criteria.
NLD (HOL, JER)    Reduction in information due to pedigree verification.
ISR (HOL)         Reduction in information due to data edits.
CHE (BSW, HOL)    Reduction in information is due to data edits.
BEL (HOL)         The observed decreases in information is attributed to the existence of breeds alias or errors/corrections in the pedigree.
DEU (HOL)         Reduction in information due to routine data editing/selection procedures.
AUS (HOL, JER)    Reduction in information is a result of data clean-up and pedigree verification.
DEA (BSW)         Base change.
JPN (HOL)         Reduction in information due to pedigree verification.
USA (ALL)         Drops in information due to pedigree varification and data edits. No longer participating in the CRC evaluation.
GBR (ALL)         Drops in information due to data changes and edits.
NZL (ALL)         Pedigree verification due to genomic information, causing change in information for many animals.
ITA (BSW)         Reduction in information due to data editings.
CZE (HOL)         Reduction in information due to cut half year of old data (cc1, cc2).
URY (HOL)         Reduction in information due to pedigree verification.
HUN (HOL)         First data submission since 2021. Revision of scope of data used in breeding value estimation, data editing cut-off changed cows having their first lactation from 2000 onwards.
ESP (HOL)         Reduction in daughters due to pedigree verification.
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INTERBULL CHANGES COMPARED TO THE PREVIOUS ROUTINE RUN

In 2020 new post-processing windowsâ\200\231 correlations for all breeds and traits have been applied: 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. The previousy lower value adopted (based on
the 25th percentile) had been found too high causing estimated and post-processed correlations to differ significantly from each other. It is a recommendation from the Interbull Technical Committee to
review such windows every 5 years. 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. More information can be read on https://interbull.org/ib/rg_procedure

Since 2021 a new trait group has been added to the MACE evaluation, called stcm (SNP Training for clinical mastitis) evaluating the trait cma (pure clinical mastitis). New trait group codes have been
issued as follows: 041 for international ebv files (.itb), 071 for parent average (ipr).

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 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 (December Routine Evaluation 2024).
Number of records for lactating cow's ability to conceive (cc2) by breed

Country	BSW	GUE	HOL	JER	RDC	SIM
AUS		151	8907	1891	819	
BEL			2176			
CAN	187	50	10622	676	613	
CHE	3087		3381			
CZE			3446			
DEA	5046					
DEU			26201		328	
DFS			17757	2552	10795	
ESP			7024			
EST						
FRA	455		17516			
FRM						
GBR	116	256	7907	657	495	
HUN						
IRL			3482	260	79	
ISR			1743			
ITA	2038		7462			
JPN			6849			
KOR						
LTU						
LVA						
NLD	240		17029	277	104	
NOR					3188	
NZL	58	50	9002	5171	1374	
POL			9663			
PRT						
SVK						
SVN						
URY			2082			
USA	1230	809	43187	5540	817	
ZAF			1277	761	160	
HRV						
CAM						
No.Records	12457	1316	206713	17785	18772	
Pub. Proofs	10908	1088	161956	14654	18457	0

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

         CAN   DEA   FRA   USA   CHE   NLD   ITA
CAN   9.34

```
DEA     0.86    9.88
FRA     0.76    0.89    0.75
USA     0.79    0.79    0.86    2.58
CHE     0.91    0.95    0.86    0.81    13.14
NLD     0.82    0.70    0.78    0.79    0.76    4.34
ITA     0.76    0.73    0.85    0.87    0.78    0.78    15.53
```

BSW   crc

```
        CAN     CHE     DEA     NLD     NZL     GBR     FRA     ITA
CAN     7.21
CHE     0.81    11.40
DEA     0.77    0.95    14.98
NLD     0.82    0.84    0.83    3.53
NZL     0.60    0.64    0.73    0.62    0.12
GBR     0.71    0.69    0.62    0.73    0.65    3.94
FRA     0.82    0.97    0.96    0.86    0.66    0.74    1.68
ITA     0.82    0.84    0.87    0.80    0.62    0.72    0.87    16.96
```

BSW   cc1

```
        CAN     CHE     DEA     NLD     USA     GBR     FRA     ITA
CAN     7.33
CHE     0.83    11.71
DEA     0.79    0.95    11.45
NLD     0.74    0.69    0.67    3.73
USA     0.75    0.67    0.67    0.78    2.87
GBR     0.77    0.80    0.79    0.69    0.68    0.03
FRA     0.73    0.69    0.67    0.82    0.86    0.71    0.88
ITA     0.68    0.66    0.66    0.69    0.78    0.67    0.88    16.20
```

BSW   cc2

```
        CAN     CHE     DEA     NLD     NZL     USA     GBR     FRA     ITA
CAN     6.72
CHE     0.77    11.13
DEA     0.75    0.94    12.31
NLD     0.81    0.79    0.76    3.20
NZL     0.65    0.81    0.76    0.66    0.10
USA     0.81    0.81    0.82    0.77    0.69    2.53
GBR     0.70    0.79    0.79    0.72    0.71    0.81    3.94
FRA     0.87    0.89    0.90    0.84    0.69    0.83    0.78    0.88
ITA     0.84    0.87    0.86    0.76    0.77    0.77    0.74    0.91    19.23
```

BSW   int

```
        CAN     DEA     NLD     NZL     USA     GBR     ITA     SVN
CAN     7.65
DEA     0.79    14.33
NLD     0.83    0.86    3.09
NZL     0.70    0.80    0.69    0.10
USA     0.90    0.79    0.76    0.66    2.53
GBR     0.82    0.70    0.81    0.72    0.81    3.94
ITA     0.86    0.89    0.80    0.74    0.74    0.80    19.29
SVN     0.71    0.68    0.71    0.71    0.69    0.75    0.70    19.64
```

GUE   crc

```
        CAN     GBR     NZL     AUS
CAN     7.62
GBR     0.74    4.81
NZL     0.60    0.64    0.11
AUS     0.67    0.78    0.91    6.97
```

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-----------------------------------------------------------------------------
GUE    cc1
-----------------------------------------------------------------------------
          CAN     GBR     USA
CAN      7.53
GBR      0.77    0.03
USA      0.80    0.73    3.48


-----------------------------------------------------------------------------
GUE    cc2
-----------------------------------------------------------------------------
          CAN     GBR     NZL     USA     AUS
CAN      7.17
GBR      0.69    4.81
NZL      0.64    0.71    0.07
USA      0.84    0.79    0.71    2.87
AUS      0.68    0.67    0.73    0.72   10.25


-----------------------------------------------------------------------------
GUE    int
-----------------------------------------------------------------------------
          CAN     GBR     NZL     USA     AUS
CAN      7.72
GBR      0.82    4.81
NZL      0.68    0.72    0.07
USA      0.90    0.79    0.69    2.87
AUS      0.71    0.68    0.74    0.73   10.25


-----------------------------------------------------------------------------
HOL    hco
-----------------------------------------------------------------------------
          CAN     CZE     DEU     DFS     FRA     USA     POL     CHE     NLD     ITA     JPN
CAN      7.80
CZE      0.76   17.44
DEU      0.90    0.79   15.15
DFS      0.78    0.84    0.84   13.53
FRA      0.75    0.77    0.80    0.88    0.70
USA      0.83    0.84    0.84    0.86    0.84    2.38
POL      0.62    0.53    0.64    0.60    0.54    0.61   19.49
CHE      0.96    0.78    0.92    0.77    0.78    0.78    0.52   13.60
NLD      0.83    0.79    0.86    0.88    0.84    0.85    0.57    0.81    5.10
ITA      0.82    0.85    0.87    0.91    0.91    0.93    0.65    0.86    0.88    1.98
JPN      0.85    0.71    0.85    0.71    0.70    0.82    0.62    0.84    0.76    0.82    6.25


-----------------------------------------------------------------------------
HOL    crc
-----------------------------------------------------------------------------
          BEL     CAN     CHE     DEU     DFS     ESP     GBR     IRL     ITA     NLD     NZL     POL     FRA
BEL      4.65
CAN      0.76    7.41
CHE      0.79    0.83   12.30
DEU      0.72    0.83    0.87   10.92
DFS      0.79    0.87    0.94    0.91   11.59
ESP      0.81    0.79    0.82    0.80    0.81   10.93
GBR      0.89    0.74    0.77    0.71    0.78    0.81    4.57
IRL      0.85    0.59    0.66    0.59    0.61    0.75    0.81    3.57
ITA      0.80    0.87    0.89    0.89    0.90    0.85    0.79    0.64    1.37
NLD      0.78    0.83    0.89    0.85    0.92    0.79    0.75    0.59    0.86    4.43
NZL      0.63    0.60    0.63    0.58    0.63    0.64    0.65    0.59    0.65    0.56    0.09
POL      0.74    0.88    0.88    0.83    0.84    0.80    0.73    0.61    0.89    0.77    0.66   13.15
FRA      0.77    0.85    0.94    0.93    0.94    0.82    0.79    0.64    0.91    0.89    0.64    0.88    1.13

-----------------------------------------------------------------------------
HOL    cc1
-----------------------------------------------------------------------------
          CAN     CHE     CZE     DEU     DFS     FRA     GBR     ISR     ITA     NLD     USA     POL     JPN
CAN      6.65
CHE      0.92   10.81
CZE      0.82    0.72   17.38
```

	BEL	CAN	CHE	DEU	DFS	FRA	GBR	ISR	ITA	NLD	USA	POL	JPN
DEU	0.91	0.91	0.80	14.66									
DFS	0.74	0.68	0.86	0.79	13.12								
FRA	0.77	0.74	0.89	0.76	0.87	0.96							
GBR	0.77	0.77	0.68	0.79	0.66	0.72	0.03						
ISR	0.79	0.70	0.93	0.78	0.87	0.89	0.76	3.29					
ITA	0.70	0.66	0.89	0.68	0.81	0.88	0.66	0.89	1.31				
NLD	0.76	0.73	0.86	0.79	0.89	0.91	0.69	0.87	0.80	4.56			
USA	0.80	0.71	0.95	0.75	0.82	0.85	0.68	0.92	0.87	0.82	2.83		
POL	0.74	0.69	0.78	0.75	0.65	0.66	0.66	0.74	0.68	0.66	0.71	19.61	
JPN	0.79	0.77	0.90	0.77	0.83	0.83	0.77	0.85	0.82	0.79	0.92	0.70	7.57

HOL   cc2

	BEL	CAN	CHE	CZE	DEU	DFS	ESP	FRA	GBR	IRL	ISR	ITA	NLD	NZL	USA	POL	ZAF	AUS	URY	JPN
BEL	4.65																			
CAN	0.74	6.30																		
CHE	0.82	0.90	10.95																	
CZE	0.66	0.86	0.88	17.38																
DEU	0.79	0.93	0.92	0.91	13.47															
DFS	0.80	0.84	0.88	0.82	0.94	12.85														
ESP	0.80	0.78	0.86	0.87	0.83	0.79	10.91													
FRA	0.81	0.90	0.93	0.85	0.95	0.88	0.83	0.91												
GBR	0.88	0.69	0.74	0.65	0.76	0.79	0.79	0.75	4.57											
IRL	0.83	0.74	0.84	0.70	0.79	0.76	0.80	0.82	0.82	3.58										
ISR	0.61	0.72	0.72	0.87	0.81	0.77	0.80	0.65	0.65		3.29									
ITA	0.78	0.85	0.89	0.90	0.90	0.86	0.89	0.88	0.75	0.78	0.82	1.36								
NLD	0.79	0.85	0.88	0.82	0.93	0.89	0.79	0.91	0.72	0.78	0.78	0.84	4.31							
NZL	0.74	0.64	0.77	0.76	0.66	0.63	0.82	0.67	0.71	0.75	0.72	0.79	0.63	0.06						
USA	0.79	0.86	0.84	0.88	0.91	0.85	0.83	0.84	0.81	0.80	0.80	0.89	0.80	0.68	2.37					
POL	0.80	0.78	0.81	0.74	0.80	0.77	0.77	0.79	0.79	0.74	0.72	0.83	0.74	0.73	0.83	12.13				
ZAF	0.77	0.77	0.81	0.72	0.81	0.75	0.78	0.81	0.78	0.85	0.59	0.78	0.73	0.71	0.86	0.80	15.62			
AUS	0.69	0.67	0.73	0.63	0.70	0.64	0.69	0.74	0.68	0.83	0.59	0.68	0.64	0.69	0.72	0.64	0.78	8.48		
URY	0.72	0.68	0.66	0.64	0.68	0.68	0.66	0.66	0.69	0.69	0.57	0.64	0.68	0.78	0.69	0.67	0.76	0.66	1.40	
JPN	0.84	0.82	0.86	0.78	0.85	0.84	0.82	0.84	0.86	0.84	0.70	0.86	0.78	0.70	0.92	0.87	0.87	0.70	0.69	18.22

HOL   int

	BEL	CAN	DEU	DFS	ESP	GBR	IRL	ITA	NLD	NZL	USA	POL	ZAF	AUS	URY	FRA	JPN	SVN
BEL	4.65																	
CAN	0.88	6.83																
DEU	0.86	0.91	12.30															
DFS	0.89	0.91	0.95	12.77														
ESP	0.88	0.84	0.85	0.85	10.91													
GBR	0.89	0.83	0.86	0.89	0.85	4.57												
IRL	0.84	0.81	0.82	0.80	0.86	0.82	3.58											
ITA	0.88	0.90	0.90	0.92	0.89	0.86	0.79	2.53										
NLD	0.89	0.86	0.89	0.93	0.83	0.84	0.79	0.88	4.25									
NZL	0.74	0.68	0.67	0.65	0.73	0.71	0.76	0.73	0.65	0.06								
USA	0.80	0.92	0.91	0.86	0.86	0.81	0.80	0.87	0.80	0.64	2.37							
POL	0.82	0.84	0.80	0.82	0.80	0.82	0.72	0.89	0.77	0.70	0.76	12.13						
ZAF	0.79	0.83	0.85	0.80	0.85	0.80	0.87	0.81	0.79	0.72	0.86	0.79	15.62					
AUS	0.71	0.71	0.70	0.67	0.72	0.68	0.83	0.66	0.66	0.83	0.72	0.67	0.80	8.48				
URY	0.73	0.67	0.67	0.67	0.69	0.67	0.71	0.69	0.66	0.83	0.67	0.70	0.78	0.68	1.40			
FRA	0.81	0.89	0.84	0.83	0.82	0.75	0.81	0.81	0.80	0.61	0.83	0.69	0.81	0.74	0.66	0.91		
JPN	0.85	0.93	0.90	0.90	0.88	0.87	0.83	0.91	0.85	0.68	0.92	0.87	0.89	0.71	0.71	0.82	18.22	
SVN	0.88	0.74	0.75	0.82	0.78	0.78	0.73	0.84	0.79	0.71	0.69	0.70	0.66	0.67	0.69	0.75	0.75	19.35

JER   hco

	CAN	DFS	USA	NLD
CAN	7.87			
DFS	0.73	17.37		
USA	0.73	0.83	2.73	
NLD	0.83	0.83	0.72	4.75

```
JER    crc
-------------------------------------------------------------------------------------------
         CAN     DFS     GBR     NLD     NZL     IRL
CAN      7.01
DFS      0.81   13.33
GBR      0.65    0.82    3.83
NLD      0.81    0.83    0.69    3.39
NZL      0.58    0.64    0.63    0.55    0.07
IRL      0.61    0.61    0.79    0.60    0.57    2.41


-------------------------------------------------------------------------------------------
JER    cc1
-------------------------------------------------------------------------------------------
         CAN     DFS     GBR     NLD     USA
CAN      6.86
DFS      0.71   15.48
GBR      0.78    0.67    0.03
NLD      0.74    0.75    0.68    3.65
USA      0.75    0.79    0.67    0.70    2.91


-------------------------------------------------------------------------------------------
JER    cc2
-------------------------------------------------------------------------------------------
         CAN     DFS     GBR     NLD     NZL     USA     ZAF     AUS     IRL
CAN      6.62
DFS      0.81   15.65
GBR      0.70    0.73    3.81
NLD      0.81    0.79    0.71    3.28
NZL      0.64    0.64    0.68    0.64    0.05
USA      0.80    0.78    0.77    0.76    0.72    2.66
ZAF      0.66    0.65    0.73    0.67    0.78    0.84   11.23
AUS      0.64    0.64    0.64    0.64    0.67    0.64    0.70    6.52
IRL      0.74    0.73    0.76    0.75    0.66    0.76    0.78    0.72    2.41


-------------------------------------------------------------------------------------------
JER    int
-------------------------------------------------------------------------------------------
         CAN     DFS     GBR     NLD     NZL     USA     ZAF     AUS     IRL
CAN      6.59
DFS      0.83   15.36
GBR      0.74    0.82    3.81
NLD      0.81    0.82    0.77    3.18
NZL      0.65    0.65    0.68    0.63    0.05
USA      0.83    0.80    0.77    0.74    0.71    2.66
ZAF      0.70    0.71    0.74    0.71    0.78    0.84   11.23
AUS      0.68    0.67    0.67    0.67    0.67    0.68    0.71    6.52
IRL      0.78    0.73    0.75    0.75    0.64    0.76    0.80    0.74    2.41


-------------------------------------------------------------------------------------------
RDC    hco
-------------------------------------------------------------------------------------------
         CAN     DEU     DFS     NOR     USA     NLD
CAN      7.87
DEU      0.89   14.40
DFS      0.71    0.82   12.22
NOR      0.84    0.87    0.87   16.67
USA      0.83    0.83    0.81    0.73    2.77
NLD      0.82    0.85    0.80    0.66    0.81    5.67


-------------------------------------------------------------------------------------------
RDC    crc
-------------------------------------------------------------------------------------------
         CAN     DEU     DFS     GBR     NOR     NZL     NLD     IRL
CAN      6.63
DEU      0.83   10.09
DFS      0.84    0.89   12.71
GBR      0.78    0.71    0.68    4.12
NOR      0.83    0.81    0.84    0.61   14.25
NZL      0.66    0.59    0.55    0.67    0.59    0.11
```

```
NLD       0.82    0.84    0.88    0.72    0.79    0.56    3.40
IRL       0.60    0.60    0.62    0.80    0.61    0.60    0.60    2.88


----------------------------------------------------------------------------------------
RDC     cc1
----------------------------------------------------------------------------------------

          CAN     DEU     DFS     GBR     NOR     NLD     USA
CAN       7.51
DEU       0.90   13.76
DFS       0.70    0.81   12.99
GBR       0.77    0.79    0.67    0.03
NOR       0.80    0.87    0.93    0.78   14.13
NLD       0.75    0.78    0.83    0.69    0.69    3.90
USA       0.81    0.75    0.76    0.68    0.74    0.81    2.82


----------------------------------------------------------------------------------------
RDC     cc2
----------------------------------------------------------------------------------------

          CAN     DEU     DFS     GBR     NOR     NZL     USA     ZAF     NLD     AUS     IRL
CAN       7.00
DEU       0.92   11.42
DFS       0.80    0.93   12.85
GBR       0.70    0.76    0.75    4.12
NOR       0.77    0.81    0.88    0.71   14.13
NZL       0.68    0.68    0.67    0.71    0.66    0.08
USA       0.86    0.89    0.78    0.79    0.71    0.71    2.61
ZAF       0.69    0.80    0.73    0.70    0.77    0.68    0.79   17.07
NLD       0.84    0.93    0.86    0.72    0.74    0.68    0.79    0.74    3.41
AUS       0.66    0.68    0.63    0.67    0.64    0.69    0.68    0.64    0.65    7.60
IRL       0.75    0.79    0.75    0.79    0.71    0.73    0.77    0.82    0.77    0.78    2.88


----------------------------------------------------------------------------------------
RDC     int
----------------------------------------------------------------------------------------

          CAN     DEU     DFS     GBR     NOR     NZL     USA     ZAF     NLD     AUS     IRL
CAN       6.70
DEU       0.90   11.26
DFS       0.87    0.94   13.20
GBR       0.82    0.84    0.79    4.12
NOR       0.76    0.73    0.67    0.68   14.25
NZL       0.76    0.68    0.67    0.72    0.63    0.08
USA       0.90    0.89    0.76    0.80    0.68    0.68    2.61
ZAF       0.75    0.84    0.74    0.73    0.81    0.68    0.81   17.07
NLD       0.86    0.88    0.91    0.81    0.71    0.66    0.78    0.78    3.22
AUS       0.70    0.70    0.67    0.68    0.68    0.69    0.70    0.72    0.67    7.60
IRL       0.81    0.81    0.77    0.79    0.69    0.73    0.77    0.85    0.78    0.80    2.88


-------------------------------------------------------------------------------------------------
^LAPPENDIX II. Number of common bulls
-------------------------------------------------------------------------------------------------
BSW
--------
 common bulls below diagonal
 common three quarter sib group above diagonal
      CAN  DEA  FRA  USA  CHE  NLD  ITA
 -------------------------------------------------------------------------------
  CAN    0  110   56  114  112   36  102
  DEA   96    0  202  204  636  155  535
  FRA   48  158    0   76  170   80  184
  USA  103  163   58    0  215   60  145
  CHE   94  537  134  180    0  112  465
  NLD   32  144   67   56  106    0  129
  ITA   88  420  145  105  407  103    0
 -------------------------------------------------------------------------------
BSW
--------
 common bulls below diagonal
 common three quarter sib group above diagonal
      CAN  CHE  DEA  NLD  NZL  GBR  FRA  ITA
```

```
    -----------------------------------------------------------------------------
    CAN     0   125   123    41    20    49    74   119
    CHE   106     0   643   117    29    64   170   496
    DEA   110   536     0   168    44    61   212   666
    NLD    36   108   155     0    29    36    86   142
    NZL    19    24    39    22     0    15    23    38
    GBR    44    48    43    30    11     0    48    70
    FRA    64   132   165    71    18    37     0   195
    ITA   105   434   547   119    32    48   153     0
    -----------------------------------------------------------------------------
BSW
--------
  common bulls below diagonal
  common three quarter sib group above diagonal
          CAN  CHE  DEA  NLD  USA  GBR  FRA  ITA
    -----------------------------------------------------------------------------
    CAN     0   129   125    42   142    49    79   122
    CHE   108     0   642   117   280    69   178   496
    DEA   111   533     0   170   250    67   224   665
    NLD    37   108   155     0    69    39    90   143
    USA   138   245   202    63     0    70   102   187
    GBR    44    52    47    32    67     0    55    76
    FRA    68   139   176    76    74    44     0   207
    ITA   106   435   544   118   135    51   165     0
    -----------------------------------------------------------------------------
BSW
--------
  common bulls below diagonal
  common three quarter sib group above diagonal
          CAN  CHE  DEA  NLD  NZL  USA  GBR  FRA  ITA
    -----------------------------------------------------------------------------
    CAN     0   114   110    38    17   134    46    73   103
    CHE    94     0   632   117    28   336    64   178   465
    DEA    98   527     0   169    39   325    61   221   608
    NLD    34   108   154     0    25    92    36    90   140
    NZL    16    23    36    20     0    26    13    20    29
    USA   126   312   283    80    23     0    77   122   230
    GBR    40    48    43    30     9    73     0    51    67
    FRA    63   139   174    76    16    88    41     0   203
    ITA    90   400   479   114    25   159    45   158     0
    -----------------------------------------------------------------------------
BSW
--------
  common bulls below diagonal
  common three quarter sib group above diagonal
          CAN  DEA  NLD  NZL  USA  GBR  ITA  SVN
    -----------------------------------------------------------------------------
    CAN     0   115    40    17   139    48   114    28
    DEA   102     0   168    39   324    61   728    86
    NLD    36   154     0    25    92    36   148    42
    NZL    16    36    20     0    26    13    33     9
    USA   131   283    80    23     0    77   255    34
    GBR    42    43    30     9    73     0    72    16
    ITA    99   646   123    29   182    51     0    83
    SVN    26    80    42     9    30    13    80     0
    -----------------------------------------------------------------------------
GUE
--------
GUE
--------
  common bulls below diagonal
  common three quarter sib group above diagonal
          CAN  GBR  NZL  AUS
    -----------------------------------------------------------------------------
    CAN     0    19     3    18
    GBR    16     0    14    28
    NZL     2    12     0    26
    AUS    13    22    23     0
    -----------------------------------------------------------------------------
```

```
GUE
--------

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

  CAN    0   20   44
  GBR   16    0   63
  USA   43   59    0
 ------------------------------------------------------------------------------

GUE
--------

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

  CAN    0   14    1   41   25
  GBR   11    0   12   87   38
  NZL    1   10    0   24   22
  USA   39   88   23    0   71
  AUS   21   31   21   68    0
 ------------------------------------------------------------------------------

GUE
--------

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

  CAN    0   14    1   41   25
  GBR   11    0   12   87   38
  NZL    1   10    0   24   22
  USA   39   88   23    0   71
  AUS   21   31   21   68    0
 ------------------------------------------------------------------------------

HOL
--------

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

  CAN    0 1171 2438 1532 1364 3244 1545  896 1569 1772 1231
  CZE  882    0 1946 1343 1258 1599 1339  512 1585 1277  866
  DEU 2042 1507    0 2866 2459 3208 2617 1216 3387 2494 1402
  DFS 1470  930 2266    0 1764 1941 1639  787 2408 1530 1052
  FRA 1059  789 1453 1080    0 1745 1634  750 2039 1523 1166
  USA 3757 1337 2662 1828 1090    0 2284  947 2100 2418 1570
  POL 1452 1108 2401 1417 1176 2473    0  597 1847 1677  917
  CHE  819  358 1144  737  696  882  496    0  961  660  491
  NLD 1567 1381 3072 2151 1401 1924 1712  956    0 1624 1140
  ITA 1426  883 1590 1145  812 1921 1370  568 1223    0 1088
  JPN  733  406  671  585  453  887  532  321  616  528    0
 ------------------------------------------------------------------------------

HOL
--------

 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  824  643 1310  939  977  933  559  652 1341  538  635 1022
  CAN  832    0  924 2569 1588 1751 1796  621 1631 1712  748 1373 1461
  CHE  654  857    0 1241  791  783  821  465  622 1014  448  556  763
  DEU 1352 2132 1186    0 3008 2523 2444 1007 2164 3881 1079 2288 2693
  DFS  889 1550  753 2333    0 1707 1755  834 1320 2443  912 1441 1769
  ESP 1055 1596  739 2289 1571    0 1652  775 1456 1980  773 1422 1923
  GBR  924 1903  788 1940 1439 1532    0 1111 1385 2082 1034 1235 1698
  IRL  553  620  477  895  714  795 1163    0  482 1020  826  465  802
  ITA  644 1412  555 1498 1119 1241 1117  420    0 1485  484 1406 1302
  NLD 1530 1740 1019 3682 2257 2096 1886  974 1282    0 1182 1709 2177
  NZL  442  699  377  853  673  660  912  728  404 1088    0  490  838
```

HOL
----

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  931 1059 2607 1626 1479 1856  151 1655 1736 3503 1487 1382
  CHE   863    0  431 1250  797  770  826   65  623 1017 1015  594  524
  CZE   841  307    0 1582 1093  975  935  126 1092 1355 1462 1262  734
  DEU  2143 1187 1300    0 3049 2716 2501  188 2188 3890 3490 2525 1608
  DFS  1563  756  862 2357    0 1784 1813  167 1340 2462 2107 1595 1111
  FRA  1169  712  641 1613 1087    0 1727  132 1313 2194 1963 1593 1304
  GBR  1967  796  685 1988 1483 1171    0  174 1409 2126 2376 1324 1193
  ISR   105   38   96  146  126   73  130    0  129  177  219  142  126
  ITA  1428  555  848 1499 1122  813 1147   86    0 1495 2300 1512 1011
  NLD  1758 1019 1281 3676 2264 1506 1942  140 1283    0 2385 1865 1217
  USA  4129  950 1248 2807 1941 1218 2392  215 1882 2213    0 2162 1783
  POL  1396  493 1084 2319 1385 1132 1127  105 1252 1754 2280    0  928
  JPN   852  361  412  767  649  520  657   61  558  707 1037  550    0
--------------------------------------------------------------------------------
```

HOL
----

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  820  644  528 1307  942  982 1023  939  562   87  656 1345  535 1048  636  335  795  373  557
  CAN  823    0  918 1043 2531 1599 1763 1446 1783  613  148 1619 1685  732 3609 1402  448 1436  823 1277
  CHE  655  844    0  431 1239  798  785  762  825  465   66  621 1017  445 1110  558  263  697  340  487
  CZE  425  809  307    0 1578 1092 1078  966  926  400  126 1089 1355  458 1490 1182  254  679  478  703
  DEU 1344 2047 1172 1290    0 3029 2554 2682 2456 1010  189 2165 3859 1079 4037 2311  561 1859  909 1515
  DFS  889 1525  757  862 2334    0 1750 1775 1782  839  169 1338 2468  913 2499 1474  514 1421  721 1042
  ESP 1058 1576  740  905 2289 1601    0 1938 1672  779  151 1475 2001  783 2445 1455  520 1305  739 1196
  FRA 1014 1120  701  633 1564 1064 1865    0 1703  809  135 1300 2173  843 2652 1503  484 1381  639 1243
  GBR  924 1868  788  681 1925 1446 1535 1141    0 1114  172 1387 2091 1028 2697 1245  507 1595  779 1129
  IRL  553  601  477  318  890  714  795  657 1164    0  120  484 1026  824  930  465  339  820  419  491
  ISR   52  102   38   96  144  126  116   72  126   94    0  129  179  125  244  134   61  126   99  125
  ITA  644 1383  555  847 1477 1119 1244  802 1117  421   86    0 1483  493 2312 1425  269  951  558  957
  NLD 1533 1695 1019 1281 3617 2266 2103 1469 1892  976  140 1272    0 1177 2956 1693  505 1623  771 1145
  NZL  433  660  369  352  827  658  648  511  890  723   99  394 1063    0 1204  504  354 1286  581  595
  USA  940 4158 1045 1265 3060 2081 2228 1490 2571  861  232 1885 2666 1157    0 2098  639 2180 1300 2077
  POL  542 1276  440  970 1990 1229 1257 1028 1024  366   93 1149 1520  382 2146    0  231  893  562  853
  ZAF  281  411  222  183  430  380  476  337  446  297   39  205  420  283  614  160    0  479  319  414
  AUS  694 1472  621  496 1429 1066 1087  957 1418  713   82  756 1422 1278 2245  692  419    0  737  955
  URY  268  765  253  323  650  499  633  368  625  324   55  391  604  474 1567  440  268  572    0  617
  JPN  358  714  313  369  659  565  596  452  572  309   52  491  608  294  900  460  260  516  316    0
--------------------------------------------------------------------------------
```

HOL
----

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  823 1305  942  982  939  562  655 1345  535 1048  635  335  795  373 1023  557  163
  CAN  828    0 2537 1608 1769 1792  620 1624 1695  738 3623 1405  452 1444  829 1454 1282  213
  DEU 1343 2057    0 3026 2553 2456 1010 2174 3856 1078 4032 2304  561 1858  909 2681 1515  350
  DFS  889 1536 2331    0 1750 1782  839 1341 2466  913 2497 1473  514 1421  721 1775 1042  258
  ESP 1058 1592 2289 1601    0 1672  779 1475 1999  783 2442 1455  520 1304  739 1937 1194  250
  GBR  924 1881 1925 1446 1535    0 1114 1389 2091 1028 2697 1245  507 1595  778 1703 1129  210
  IRL  553  610  890  714  795 1163    0  484 1025  824  930  465  339  820  419 1025  491  117
  ITA  644 1390 1481 1122 1244 1118  421    0 1493  493 2328 1424  269  951  558 1300  957  234
  NLD 1533 1709 3615 2265 2103 1892  976 1282    0 1177 2955 1690  505 1623  771 2172 1144  275
  NZL  433  665  827  658  648  889  722  394 1063    0 1204  504  354 1286  580  843  595  120
  USA  940 4188 3060 2081 2228 2571  861 1899 2666 1157    0 2095  639 2180 1300 2652 2077  248
  POL  542 1282 1986 1228 1257 1024  366 1150 1520  382 2146    0  231  893  562 1503  852  261
  ZAF  281  418  430  380  476  446  297  205  420  283  614  160    0  479  319  484  414   68
```

```
AUS   694 1477 1429 1066 1087 1418  713  756 1422 1278 2245  692  419    0  737 1381  955  161
URY   268  771  650  499  633  625  324  391  604  474 1567  440  268  572    0  639  617   96
FRA  1014 1128 1564 1064 1865 1141  657  802 1469  511 1490 1028  337  957  368    0 1243  201
JPN   358  717  659  565  596  572  309  491  608  294  900  460  260  516  316  452    0  158
SVN   127  167  343  206  221  155   90  198  239   80  204  215   48  112   49  147   84    0
     -------------------------------------------------------------------------------

JER
--------
 common bulls below diagonal
 common three quarter sib group above diagonal
        CAN  DFS  USA  NLD
     -------------------------------------------------------------------------------
 CAN    0  111  369   40
 DFS  107    0  170  105
 USA  362  161    0   84
 NLD   33  102   82    0
     -------------------------------------------------------------------------------

JER
--------
 common bulls below diagonal
 common three quarter sib group above diagonal
        CAN  DFS  GBR  NLD  NZL  IRL
     -------------------------------------------------------------------------------
 CAN    0  115  160   49  182   14
 DFS  110    0  193  170  179   61
 GBR  164  188    0  105  246   91
 NLD   42  170  101    0  105   42
 NZL  186  155  254   97    0  158
 IRL   13   57   94   41  179    0
     -------------------------------------------------------------------------------

JER
--------
 common bulls below diagonal
 common three quarter sib group above diagonal
        CAN  DFS  GBR  NLD  USA
     -------------------------------------------------------------------------------
 CAN    0  117  166   49  426
 DFS  111    0  195  175  188
 GBR  165  189    0  108  245
 NLD   43  175  103    0  113
 USA  431  180  265  116    0
     -------------------------------------------------------------------------------

JER
--------
 common bulls below diagonal
 common three quarter sib group above diagonal
        CAN  DFS  GBR  NLD  NZL  USA  ZAF  AUS  IRL
     -------------------------------------------------------------------------------
 CAN    0  112  162   46  171  428  138  237   14
 DFS  106    0  195  176  174  241  163  179   61
 GBR  160  188    0  108  243  270  183  243   91
 NLD   39  176  102    0   99  127   81   87   42
 NZL  172  150  248   91    0  417  218  471  155
 USA  433  220  297  131  490    0  335  533   56
 ZAF  137  145  186   77  226  348    0  257   44
 AUS  234  151  250   80  516  581  245    0   71
 IRL   13   57   94   41  175   58   45   68    0
     -------------------------------------------------------------------------------

JER
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 common bulls below diagonal
 common three quarter sib group above diagonal
        CAN  DFS  GBR  NLD  NZL  USA  ZAF  AUS  IRL
     -------------------------------------------------------------------------------
 CAN    0  115  163   46  173  433  140  239   14
 DFS  109    0  195  176  174  241  163  179   61
 GBR  162  188    0  108  243  270  183  243   91
 NLD   40  176  102    0   99  127   81   87   42
 NZL  175  150  248   91    0  417  218  471  155
```

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 USA  440  220  297  131  490    0  335  533   56
 ZAF  139  145  186   77  226  348    0  257   44
 AUS  237  151  250   80  516  581  245    0   71
 IRL   13   57   94   41  175   58   45   68    0
---------------------------------------------------------------------------------
RDC
--------
 common bulls below diagonal
 common three quarter sib group above diagonal
         CAN  DEU  DFS  NOR  USA  NLD
---------------------------------------------------------------------------------

 CAN    0   10  189    7  112    6
 DEU   10    0   68   19   24   14
 DFS  199   59    0  145  181   62
 NOR    6   18  125    0   76   45
 USA  106   22  173   76    0   42
 NLD    6   14   59   45   40    0
---------------------------------------------------------------------------------
RDC
--------
 common bulls below diagonal
 common three quarter sib group above diagonal
         CAN  DEU  DFS  GBR  NOR  NZL  NLD  IRL
---------------------------------------------------------------------------------

 CAN    0   13  190   85    7   73    6    5
 DEU   12    0   74   16   17   24   19    7
 DFS  200   62    0  127  157  194   65   24
 GBR   86   15  123    0   76   87   46   29
 NOR    6   16  130   80    0   55   51   63
 NZL   74   23  188   86   54    0   28   18
 NLD    6   19   62   45   51   27    0   14
 IRL    5    7   19   28   62   17   14    0
---------------------------------------------------------------------------------
RDC
--------
 common bulls below diagonal
 common three quarter sib group above diagonal
         CAN  DEU  DFS  GBR  NOR  NLD  USA
---------------------------------------------------------------------------------

 CAN    0   13  190   85    7    6  152
 DEU   12    0   73   16   17   19   24
 DFS  200   61    0  128  146   65  205
 GBR   86   15  124    0   78   46  111
 NOR    6   16  123   82    0   49   85
 NLD    6   19   62   45   49    0   45
 USA  146   22  200  107   85   43    0
---------------------------------------------------------------------------------
RDC
--------
 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  186   80    7   69  177   78    6   77    5
 DEU   12    0   70   16   17   21   26    3   19   49    7
 DFS  195   59    0  128  146  189  228   63   65  240   24
 GBR   81   15  124    0   75   84  126   47   46   98   29
 NOR    6   16  123   79    0   48   89    0   49   76   63
 NZL   69   21  183   81   47    0  121   41   25  159   17
 USA  181   24  227  124   89  122    0   77   48  144   33
 ZAF   83    3   60   44    0   39   72    0    3   46    4
 NLD    6   19   62   45   49   24   46    3    0   43   14
 AUS   79   47  216   96   65  158  146   48   41    0   23
 IRL    5    7   19   28   62   17   33    4   14   22    0
---------------------------------------------------------------------------------
RDC
--------
 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  186   82    7   69  178   78    6   77    5
   DEU   12    0   70   16   17   21   26    3   19   49    7
   DFS  195   59    0  128  157  189  228   63   65  240   24
   GBR   83   15  124    0   76   84  126   47   46   98   29
   NOR    6   16  130   80    0   49   89    0   51   80   63
   NZL   69   21  183   81   48    0  121   41   25  159   17
   USA  182   24  227  124   89  122    0   77   48  144   33
   ZAF   83    3   60   44    0   39   72    0    3   46    4
   NLD    6   19   62   45   51   24   46    3    0   43   14
   AUS   79   47  216   96   69  158  146   48   41    0   23
   IRL    5    7   19   28   62   17   33    4   14   22    0
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SIM
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SIM
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SIM
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SIM
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SIM
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