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Introduction
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The latest routine international evaluation for udder traits took place
as scheduled at the Interbull Centre. Data from twentysix (26) countries were
included in this evaluation.

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



Changes in national procedures
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Changes in the national genetic evaluation of udder health traits  are as
follows:

NOR (RDC)           Some bulls occasionally loose EDC although the number of daughters stay the
same due to the rolling definition
                    of hys causing the daughters to distribute somewhat differently over hys-
classes at each evaluation.
ZAF (JER)           Included data for ARC herds since 2012 that were previously not available.
ZAF (HOL)           Corrected error in reliability calculation
ZAF (RDC)           Inclusion of heterosis and recombination in the model and new calculation of
reliability based on PEVs
ISR (HOL)           Correction of a bug with respect to handling missing test day records. The
correction caused decrease in information
KOR (HOL)           Correction of pedigrees.
DEA (BSW, SIM)      Base change
POL (HOL)           Base change
EST (HOL, RDC)      Decrease in number of daughters of some bulls is due to  pedigree check of cows
SVN (HOL, BSW, SIM) Changes in number of information are mostly consequences of changes in data
base related to the pedigree completness and
                    phenotypic data improvement
HRV (HOL, SIM)      Pedigree corrections
DEU (HOL, JER, RDC) New editings of data: all cows must have data in production and udder health
and all cows must have at least 2 test day records
                    per lactation
CHE (BSW)           Pedigree changes: Each animal with unverified pedigree got a missing dam, sire
or both
ITA (SIM)           Change in heritability, correction of genetic base and fixing a bug on
calculating number of herds
HUN (HOL, SIM)      Base change
CHE (HOL, SIM)      Change in type of proofs and publication rules
USA (SIM)           First time participating
USA (ALL)           Changed unknown parent group definitions
PRT (HOL)           New variance components and new heritabilities.
SVK (HOL, SIM)      Base chnage



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

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

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

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

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

Table 2 presents the date of evaluation as supplied by each country
in the 01x-proof file.

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

SCIENTIFIC LITERATURE

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

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

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

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

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

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

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

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

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

NEXT ROUTINE INTERNATIONAL EVALUATION

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

NEXT TEST INTERNATIONAL EVALUATION

Dates for the next test run can be found on
http://www.interbull.org/ib/servicecalendar.
PUBLICATION OF INTERBULL TEST RUN

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

^LTable 1. National evaluation data considered in the Interbull
evaluation for udder health (December Routine Evaluation 2015).
Number of records for milk somatic cells by breed

Country	BSW	GUE	HOL	JER	RDC	SIM
AUS		122	6913	1387	606	
BEL			994			
CAN	202	91	10728	593	731	
CHE	2817		2920			2887
CZE			3425			
DEA	5189					20459
DEU			25376		391	
DFS			12105	1935	7257	
ESP			3131			
EST			932		379	
FRA	336		15729			361
FRM						3863
FRR			224			
GBR	99	256	5893	623	418	79
HUN			2397			149
IRL			2074			
ISR			1229			
ITA	1664		9347			1257
JPN			5218			
KOR			984			
LTU			631		386	
LVA			528		564	
NLD	159		14150	114	61	287
NOR					3749	
NZL	41	57	6708	3992	1165	
POL			7613			
PRT			2027			
SVK			967			509
SVN	311		397			509
URY						
USA	961	658	33678	3785	590	35
ZAF		16	1095	515	121	
HRV			599			703
=================						
No.Records	11779	1200	178012	12944	16418	31098
Pub. Proofs	9664	942	140625	10785	15899	28223

BSW   scs

        CAN   FRA   NLD   USA   CHE   DEA   NZL   ITA   GBR   SVN
CAN   0.25
FRA   0.92   1.02
NLD   0.89   0.93   4.12
USA   0.91   0.91   0.87   0.21
CHE   0.93   0.96   0.92   0.88   10.51
DEA   0.92   0.96   0.91   0.88   0.97   11.94
NZL   0.82   0.84   0.86   0.81   0.85   0.83   0.38
ITA   0.92   0.91   0.87   0.89   0.95   0.93   0.81   12.88
GBR   0.92   0.96   0.96   0.91   0.94   0.95   0.87   0.89   13.09
SVN   0.87   0.87   0.87   0.89   0.89   0.87   0.82   0.87   0.87   10.54

BSW   mas

        CAN   FRA   NLD   USA   CHE   DEA   NZL   ITA   GBR   SVN
CAN   0.25
FRA   0.70   1.07
NLD   0.83   0.78   3.62
USA   0.87   0.83   0.87   0.21
CHE   0.90   0.81   0.88   0.89   10.51
DEA   0.89   0.62   0.87   0.86   0.95   11.94
NZL   0.77   0.66   0.72   0.79   0.81   0.74   0.38
ITA   0.89   0.69   0.86   0.87   0.94   0.93   0.78   12.88
GBR   0.84   0.67   0.88   0.88   0.88   0.90   0.83   0.87   13.09
SVN   0.76   0.61   0.76   0.79   0.82   0.85   0.69   0.84   0.77   10.54

GUE   scs

        CAN   GBR   USA   AUS   NZL   ZAF
CAN   0.25
GBR   0.92   13.43
USA   0.93   0.90   0.25
AUS   0.85   0.92   0.87   29.06
NZL   0.82   0.87   0.81   0.96   0.63
ZAF   0.90   0.91   0.90   0.88   0.86   24.10

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HOL     scs
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          CAN     CHE     DEU     DFS     EST     FRA     FRR     GBR     NLD     USA     ISR
ITA     AUS     HUN     BEL     JPN     ESP     ZAF     NZL     IRL     CZE     SVK     POL     LTU
LVA     PRT     KOR     SVN     HRV
CAN      0.27
CHE      0.87   10.87
DEU      0.92    0.93   12.74
DFS      0.91    0.91    0.96   11.93
EST      0.86    0.86    0.92    0.90   13.18
FRA      0.93    0.92    0.95    0.97    0.88    1.20
FRR      0.86    0.86    0.90    0.88    0.83    0.91    1.12
GBR      0.93    0.93    0.94    0.94    0.89    0.96    0.87   12.83
NLD      0.91    0.92    0.95    0.95    0.89    0.94    0.92    0.97    4.69
USA      0.94    0.88    0.88    0.88    0.89    0.90    0.80    0.90    0.87    0.21
ISR      0.83    0.76    0.81    0.80    0.80    0.82    0.70    0.78    0.77    0.85    0.23
ITA      0.90    0.88    0.94    0.92    0.91    0.92    0.84    0.90    0.88    0.89    0.83
5.88
AUS      0.84    0.91    0.88    0.88    0.83    0.89    0.79    0.92    0.92    0.85    0.78
0.82   30.10
HUN      0.88    0.88    0.91    0.90    0.89    0.90    0.78    0.89    0.87    0.91    0.84
0.93    0.83    1.42
BEL      0.91    0.92    0.96    0.95    0.93    0.95    0.90    0.94    0.94    0.89    0.79
0.94    0.87    0.92    0.49
JPN      0.88    0.85    0.86    0.88    0.83    0.90    0.79    0.87    0.87    0.87    0.75
0.85    0.83    0.85    0.85    0.42
ESP      0.92    0.91    0.95    0.94    0.92    0.95    0.85    0.93    0.91    0.91    0.84
0.95    0.84    0.93    0.96    0.86   11.62
ZAF      0.90    0.88    0.90    0.90    0.86    0.92    0.77    0.91    0.88    0.90    0.83
0.91    0.87    0.91    0.91    0.85    0.94   26.41
NZL      0.81    0.86    0.84    0.85    0.79    0.85    0.73    0.87    0.88    0.81    0.75
0.76    0.96    0.80    0.83    0.82    0.82    0.84    0.40
IRL      0.87    0.92    0.92    0.93    0.87    0.93    0.83    0.96    0.94    0.86    0.77
0.88    0.95    0.86    0.93    0.85    0.91    0.90    0.92    0.11
CZE      0.87    0.86    0.89    0.88    0.88    0.88    0.82    0.85    0.85    0.88    0.80
0.90    0.79    0.90    0.89    0.85    0.90    0.87    0.80    0.84   16.45
SVK      0.85    0.85    0.89    0.87    0.84    0.88    0.78    0.85    0.85    0.87    0.75
0.88    0.80    0.93    0.88    0.85    0.91    0.87    0.79    0.83    0.88    0.42
POL      0.89    0.87    0.93    0.92    0.90    0.92    0.86    0.88    0.87    0.88    0.79
0.93    0.84    0.90    0.93    0.86    0.93    0.88    0.82    0.88    0.88    0.86   10.31
LTU      0.84    0.81    0.87    0.84    0.81    0.82    0.74    0.84    0.83    0.86    0.73
0.85    0.80    0.85    0.82    0.83    0.86    0.82    0.77    0.81    0.84    0.82    0.85
0.37
LVA      0.86    0.85    0.92    0.90    0.91    0.88    0.81    0.87    0.87    0.86    0.73
0.90    0.84    0.86    0.92    0.84    0.88    0.84    0.81    0.87    0.85    0.82    0.92
0.84    0.48
PRT      0.88    0.88    0.88    0.88    0.85    0.88    0.78    0.88    0.86    0.88    0.81
0.87    0.85    0.88    0.88    0.86    0.88    0.88    0.81    0.86    0.88    0.87    0.88
0.86    0.86    0.48
KOR      0.87    0.85    0.86    0.88    0.85    0.87    0.75    0.86    0.84    0.88    0.75
0.88    0.81    0.86    0.86    0.85    0.90    0.86    0.80    0.83    0.85    0.84    0.90
0.83    0.86    0.87    0.34
SVN      0.85    0.83    0.85    0.84    0.82    0.83    0.75    0.83    0.83    0.85    0.74
0.85    0.79    0.85    0.84    0.84    0.84    0.83    0.76    0.81    0.84    0.81    0.85
0.76    0.79    0.85    0.81   10.61
HRV      0.85    0.84    0.86    0.84    0.83    0.84    0.77    0.84    0.84    0.86    0.76
0.86    0.80    0.86    0.85    0.84    0.85    0.84    0.78    0.79    0.85    0.82    0.86
0.83    0.85    0.87    0.81    0.83   11.98


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HOL    mas
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        CAN     CHE     DEU     DFS     EST     FRA     FRR     GBR     NLD     USA     ISR
ITA     AUS     HUN     BEL     JPN     ESP     ZAF     NZL     IRL     CZE     SVK     POL     LTU
LVA     PRT     KOR     SVN     HRV
CAN     9.07
CHE     0.78   10.86
DEU     0.82    0.92   12.74
DFS     0.92    0.78    0.84   12.26
EST     0.76    0.81    0.89    0.79   13.18
FRA     0.95    0.78    0.83    0.93    0.76    1.22
FRR     0.57    0.58    0.66    0.63    0.59    0.64    1.02
GBR     0.77    0.92    0.94    0.80    0.86    0.78    0.50   12.83
NLD     0.85    0.87    0.94    0.86    0.88    0.86    0.69    0.90    4.88
USA     0.87    0.87    0.88    0.87    0.85    0.86    0.47    0.89    0.89    0.21
ISR     0.69    0.69    0.75    0.71    0.72    0.71    0.44    0.74    0.76    0.78    0.23
ITA     0.82    0.88    0.94    0.84    0.88    0.85    0.62    0.89    0.91    0.89    0.78
5.88
AUS     0.69    0.89    0.87    0.72    0.78    0.69    0.43    0.92    0.83    0.84    0.73
0.82   30.10
HUN     0.81    0.85    0.91    0.84    0.85    0.83    0.48    0.88    0.89    0.91    0.78
0.92    0.82    1.42
BEL     0.83    0.91    0.96    0.84    0.90    0.84    0.64    0.94    0.94    0.88    0.73
0.94    0.85    0.91    0.49
JPN     0.73    0.84    0.85    0.75    0.80    0.75    0.45    0.86    0.80    0.87    0.71
0.85    0.82    0.85    0.85    0.42
ESP     0.83    0.89    0.95    0.85    0.87    0.87    0.58    0.93    0.92    0.91    0.78
0.95    0.84    0.92    0.95    0.86   11.62
ZAF     0.81    0.86    0.88    0.81    0.80    0.82    0.48    0.91    0.87    0.88    0.76
0.90    0.86    0.89    0.90    0.85    0.93   26.31
NZL     0.69    0.85    0.84    0.73    0.75    0.70    0.41    0.87    0.76    0.81    0.71
0.76    0.95    0.80    0.82    0.82    0.81    0.84    0.40
IRL     0.76    0.91    0.91    0.79    0.82    0.77    0.51    0.96    0.88    0.85    0.73
0.87    0.94    0.85    0.93    0.84    0.90    0.89    0.91    0.11
CZE     0.78    0.84    0.89    0.80    0.84    0.80    0.58    0.85    0.87    0.87    0.75
0.90    0.79    0.89    0.88    0.85    0.90    0.84    0.79    0.83   16.45
SVK     0.75    0.82    0.88    0.78    0.79    0.79    0.50    0.83    0.85    0.84    0.64
0.86    0.78    0.91    0.86    0.83    0.88    0.83    0.76    0.80    0.87    0.41
POL     0.82    0.87    0.93    0.83    0.85    0.85    0.69    0.88    0.90    0.88    0.72
0.93    0.83    0.89    0.93    0.85    0.92    0.86    0.81    0.88    0.88    0.84   10.31
LTU     0.71    0.74    0.85    0.73    0.73    0.69    0.46    0.80    0.78    0.81    0.63
0.82    0.76    0.79    0.78    0.79    0.82    0.75    0.72    0.76    0.80    0.77    0.82
0.37
LVA     0.72    0.80    0.90    0.76    0.86    0.74    0.56    0.83    0.85    0.84    0.65
0.87    0.79    0.82    0.88    0.82    0.84    0.79    0.75    0.82    0.81    0.77    0.88
0.80    0.48
PRT     0.86    0.86    0.88    0.87    0.80    0.86    0.48    0.88    0.84    0.88    0.73
0.87    0.83    0.87    0.87    0.86    0.88    0.86    0.81    0.85    0.87    0.83    0.88
0.79    0.82    0.48
KOR     0.79    0.82    0.84    0.80    0.77    0.83    0.48    0.85    0.82    0.87    0.67
0.87    0.79    0.85    0.84    0.85    0.88    0.84    0.78    0.81    0.83    0.81    0.87
0.76    0.80    0.85    0.34
SVN     0.71    0.79    0.82    0.76    0.76    0.73    0.52    0.80    0.79    0.80    0.66
0.82    0.76    0.80    0.81    0.81    0.81    0.78    0.72    0.77    0.80    0.73    0.81
0.66    0.71    0.80    0.73   10.61
HRV     0.68    0.80    0.85    0.71    0.78    0.71    0.50    0.83    0.81    0.83    0.69
0.84    0.79    0.83    0.83    0.81    0.84    0.79    0.73    0.75    0.83    0.76    0.83
0.80    0.81    0.83    0.74    0.78   11.98


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JER    scs
--------------------------------------------------------------------------------
         CAN     DFS     GBR     NLD     USA     AUS     ZAF     NZL
CAN     0.22
DFS     0.89   12.49
GBR     0.91    0.91   11.27
NLD     0.92    0.94    0.96    4.38
USA     0.91    0.88    0.89    0.87    0.19
AUS     0.81    0.87    0.88    0.91    0.86   28.90
ZAF     0.88    0.86    0.88    0.91    0.88    0.90   20.68
NZL     0.81    0.82    0.85    0.85    0.81    0.96    0.85    0.38


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JER    mas
--------------------------------------------------------------------------------
         CAN     DFS     GBR     NLD     USA     AUS     ZAF     NZL
CAN     8.60
DFS     0.88   12.42
GBR     0.66    0.74   11.28
NLD     0.81    0.84    0.88    4.09
USA     0.86    0.86    0.88    0.87    0.19
AUS     0.62    0.66    0.88    0.83    0.85   28.92
ZAF     0.69    0.75    0.87    0.88    0.88    0.88   20.68
NZL     0.62    0.65    0.84    0.75    0.81    0.95    0.85    0.38


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RDC    scs
--------------------------------------------------------------------------------
         CAN     DFS     GBR     NOR     USA     DEU     AUS     EST     ZAF     NZL     LTU
LVA    NLD
CAN     0.26
DFS     0.92   12.68
GBR     0.93    0.92   11.51
NOR     0.91    0.91    0.88   11.98
USA     0.93    0.88    0.89    0.89    0.24
DEU     0.92    0.94    0.94    0.89    0.89   13.59
AUS     0.87    0.92    0.91    0.89    0.86    0.90   31.24
EST     0.88    0.93    0.91    0.90    0.91    0.94    0.89   11.86
ZAF     0.89    0.90    0.90    0.93    0.89    0.91    0.88    0.90   25.45
NZL     0.82    0.87    0.85    0.86    0.81    0.85    0.96    0.85    0.83    0.41
LTU     0.87    0.87    0.88    0.88    0.89    0.88    0.84    0.91    0.91    0.84    0.35
LVA     0.88    0.87    0.89    0.88    0.89    0.93    0.89    0.95    0.89    0.87    0.89
0.43
NLD     0.91    0.93    0.96    0.91    0.87    0.95    0.92    0.91    0.89    0.87    0.87
0.88    4.05


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RDC    mas
--------------------------------------------------------------------------------
         CAN     DFS     GBR     NOR     USA     DEU     AUS     EST     ZAF     NZL     LTU
LVA    NLD
CAN     8.84
DFS     0.86   13.28
GBR     0.74    0.76   11.54
NOR     0.69    0.63    0.83   11.98
USA     0.87    0.87    0.89    0.85    0.24
DEU     0.79    0.79    0.92    0.81    0.88   13.59
AUS     0.66    0.67    0.89    0.88    0.84    0.87   31.31
EST     0.70    0.73    0.80    0.81    0.86    0.90    0.82   11.86
ZAF     0.85    0.85    0.89    0.75    0.89    0.89    0.84    0.80   25.57
NZL     0.65    0.74    0.85    0.82    0.81    0.84    0.94    0.80    0.84    0.41
LTU     0.65    0.70    0.83    0.84    0.84    0.86    0.85    0.87    0.76    0.81    0.35
LVA     0.65    0.69    0.80    0.83    0.84    0.91    0.86    0.92    0.77    0.82    0.87
0.43
NLD     0.84    0.85    0.88    0.79    0.87    0.92    0.82    0.85    0.88    0.75    0.77
0.81    3.75


--------------------------------------------------------------------------------
```

```
SIM     scs
--------------------------------------------------------------------------------
        FRM     FRA     ITA     NLD     CHE     DEA     HUN     SVK     SVN     GBR     HRV
USA
FRM     1.09
FRA     0.92    1.00
ITA     0.96    0.90    14.08
NLD     0.92    0.94    0.87    4.28
CHE     0.93    0.92    0.90    0.91    10.30
DEA     0.93    0.92    0.88    0.91    0.90    12.15
HUN     0.92    0.91    0.93    0.87    0.89    0.93    15.87
SVK     0.88    0.88    0.89    0.88    0.88    0.86    0.93    0.38
SVN     0.88    0.87    0.89    0.87    0.88    0.86    0.88    0.87    9.09
GBR     0.91    0.95    0.89    0.95    0.90    0.92    0.89    0.87    0.86    10.88
HRV     0.92    0.86    0.88    0.86    0.87    0.86    0.88    0.87    0.87    0.86    10.17
USA     0.89    0.90    0.89    0.88    0.89    0.90    0.92    0.89    0.89    0.90    0.88
0.22


--------------------------------------------------------------------------------
SIM     mas
--------------------------------------------------------------------------------
        FRM     FRA     ITA     NLD     CHE     DEA     HUN     SVK     SVN     GBR     HRV
USA
FRM     1.08
FRA     0.89    1.00
ITA     0.96    0.88    14.08
NLD     0.87    0.86    0.88    3.83
CHE     0.92    0.82    0.89    0.85    10.30
DEA     0.93    0.91    0.88    0.88    0.89    12.15
HUN     0.91    0.86    0.93    0.89    0.88    0.91    15.87
SVK     0.87    0.86    0.90    0.85    0.88    0.86    0.92    0.38
SVN     0.87    0.85    0.89    0.81    0.87    0.86    0.87    0.86    9.09
GBR     0.92    0.79    0.89    0.90    0.90    0.89    0.89    0.85    0.84    10.88
HRV     0.88    0.84    0.88    0.76    0.85    0.86    0.87    0.86    0.87    0.83    10.17
USA     0.89    0.88    0.89    0.89    0.89    0.90    0.92    0.89    0.89    0.90    0.89
0.22
```

```
---------
^LAPPENDIX II. Number of common bulls
--------------------------------------------------------------------------------------------------
---------
BSW
--------
 common bulls below diagonal
 common three quarter sib group above diagonal
       CAN   FRA   NLD   USA   CHE   DEA   NZL   ITA   GBR   SVN
      --------------------------------------------------------------------------
   CAN     0    73    46   141   106   110    19    97    55    22
   FRA    66     0    75   114   139   182    17   155    47    45
   NLD    42    61     0    70    79   125    18   105    34    34
   USA   138    75    60     0   285   281    23   192    71    30
   CHE    87    99    69   268     0   505    18   362    59    55
   DEA    96   136   115   248   405     0    26   508    61    77
   NZL    19    13    11    21    14    21     0    18    13     4
   ITA    84   121    83   129   312   410    13     0    57    72
   GBR    56    39    27    69    47    42    11    40     0    17
   SVN    20    45    35    24    55    73     3    73    13     0
      --------------------------------------------------------------------------
BSW
--------
 common bulls below diagonal
 common three quarter sib group above diagonal
       CAN   FRA   NLD   USA   CHE   DEA   NZL   ITA   GBR   SVN
      --------------------------------------------------------------------------
   CAN     0    65    42   141   106   110    19    97    55    22
   FRA    59     0    56   100   135   165    13   143    44    42
   NLD    36    47     0    61    69   104    18    88    31    31
   USA   138    67    48     0   285   281    23   192    71    30
   CHE    87    99    60   268     0   505    18   362    59    55
   DEA    96   125    92   248   405     0    26   508    61    77
   NZL    19    10    11    21    14    21     0    18    13     4
   ITA    84   115    66   129   312   410    13     0    57    72
   GBR    56    39    24    69    47    42    11    40     0    17
   SVN    20    42    31    24    55    73     3    73    13     0
      --------------------------------------------------------------------------
GUE
--------
 common bulls below diagonal
 common three quarter sib group above diagonal
       CAN   GBR   USA   AUS   NZL   ZAF
      --------------------------------------------------------------------------
   CAN     0    26    60    42    13     1
   GBR    21     0    74    32    13     3
   USA    51    77     0    55    29     6
   AUS    40    27    51     0    26     3
   NZL    11    11    29    26     0     2
   ZAF     0     2     3     2     0     0
      --------------------------------------------------------------------------
```

```
HOL
--------
 common bulls below diagonal
 common three quarter sib group above diagonal
      CAN CHE DEU DFS EST FRA FRR GBR NLD USA ISR ITA AUS HUN BEL JPN ESP ZAF
NZL IRL CZE SVK POL LTU LVA PRT KOR SVN HRV
 --------------------------------------------------------------------------
  CAN    0 650 1925 1042  171 1131   13 1208 1079 2454   78 1319 1020  733  386 1082 1013  412
573 363 797 339 924 156 191 800 480 134 202
  CHE  485    0  951  559  117  505   38  544  716  773   46  588  476  363  339  374  444  222
321 279 418 178 501  89 138 420 183 102 156
  DEU 1036  786    0 2394  313 2123  128 1740 2928 3038  121 2296 1380 1027  656 1285 1289  516
824 641 1517 632 1786 372 306 1044 471 213 469
  DFS  706  475 1313    0  213 1384   48 1252 1685 1673  112 1378 1030  732  463  812  832  436
691 543 990 354 1181 227 210 777 367 175 290
  EST   88   65  210  122    0  185   21  182  280  259   41  205  163  148   88  156  147   81
106  95 193  90 225  56  88 146  77  61  86
  FRA  634  426  921  606   75    0   27 1278 1630 2148  102 1593 1046  762  514 1033  926  408
678 539 982 335 1189 171 177 762 380 139 207
  FRR    7   26  100   32   18   21    0   24   89   29    4   28   24    9   34    7   15   11
11   9  37  25  85   1  23  13   2  14  16
  GBR 1288  496 1136  832   99  698   17    0 1406 1699  100 1300 1101  691  468  852  864  445
747 664 799 306 975 184 179 788 369 153 249
  NLD  860  683 2410 1270  199  874   52 1110    0 2028  115 1508 1195  781  683  878  902  447
862 644 1153 451 1317 215 225 889 355 177 335
  USA 2260  671 1729 1057  167 1004   15 1332 1596    0  121 2271 1471 1029  493 1654 1253  560
902 552 1276 446 1492 234 259 1070 641 164 273
  ISR   45   32  100   88   26   52    3   68   96  102    0  109   80   82   44   78   85   52
84  64  88  36 101  32  28  84  43  32  49
  ITA  778  508 1316  884  113  713   23  876 1070 1207   81    0 1016  844  459 1047 1075  450
662 487 1045 348 1226 212 225 867 462 176 288
  AUS  900  398  884  647   74  631   17  874  974 1306   55  635    0  571  425  714  691  414
988 519 657 248 765 155 163 647 317 129 212
  HUN  609  292  789  553   91  489    8  592  631  954   63  686  414    0  296  587  613  337
418 315 724 266 736 146 139 598 347 122 192
  BEL  328  300  562  370   51  453   28  387  712  370   25  361  325  224    0  294  367  208
293 270 324 156 397  78  97 367 148  95 143
  JPN  472  232  466  402   54  333    5  402  425  664   36  420  367  333  170    0  749  371
468 316 665 261 758 141 149 589 413 120 159
  ESP  532  348  775  575   69  627    8  671  769  738   56  741  471  486  324  335    0  388
443 363 670 260 794 158 165 697 341 132 214
  ZAF  346  178  391  323   42  275    7  381  376  529   38  334  348  276  160  257  341    0
322 253 308 152 339  79  94 369 216  76 116
  NZL  568  266  608  455   57  366    8  619  775  827   69  464  966  328  216  243  329  256
0 525 476 208 516 124 112 470 233  98 159
  IRL  278  250  474  383   46  358    7  596  527  423   47  354  397  251  227  175  319  201
404   0 335 149 400  94  95 349 139  76 124
  CZE  475  269 1026  551  120  515   29  467  919  857   61  623  356  614  205  259  408  195
298 191   0 361 989 163 182 615 359 150 255
  SVK  219   89  463  173   42  173   13  162  290  281   15  188  120  189   79   90  126   86
126  73 264   0 347  67  95 266 153  52  99
  POL  615  396 1379  855  153  630   88  706 1074 1196   78  854  508  621  306  360  525  245
361 273 714 222   0 226 245 785 415 170 331
  LTU   67   30  351  112   23   39    0   76  112  139   14  104   53   80   24   34   66   27
54  35  99  32 165   0  73 151  94  36 104
  LVA  109   78  207  130   63   78   19  102  147  207   20  152   77   99   54   66   92   55
54  53 118  46 183  50   0 190  98  44 112
  PRT  780  360  921  654  100  622   13  703  871 1073   65  780  478  573  334  351  651  327
377 287 483 179 779  94 143   0 365 123 236
  KOR  425  121  292  243   40  202    0  268  230  712   26  365  220  286   78  241  230  161
163  82 246  91 326  43  59 294   0  71  96
  SVN   95   72  191  144   39   90   13  110  146  127   25  144   91   95   74   67   98   55
70  53 110  32 149  16  27  97  39   0  73
  HRV   96  102  479  217   63  117   16  173  295  201   34  220  131  143  117   74  168   80
88  80 182  48 287  71  91 189  41  57   0
 --------------------------------------------------------------------------
```

```
HOL
--------
 common bulls below diagonal
 common three quarter sib group above diagonal
      CAN  CHE  DEU  DFS  EST  FRA  FRR  GBR  NLD  USA  ISR  ITA  AUS  HUN  BEL  JPN  ESP  ZAF
NZL  IRL  CZE  SVK  POL  LTU  LVA  PRT  KOR  SVN  HRV
 ---------------------------------------------------------------------------
  CAN    0  412 1047  486   89  535    0  613  519 1268   45  811  496  446  244  582  618  186
266  186  495  175  631  102  109  469  307   92  139
  CHE  320    0  948  511  117  425   23  543  676  771   46  586  475  363  339  373  443  222
320  278  418  176  501   89  136  418  182  102  156
  DEU  640  785    0 2252  313 1580   69 1737 2743 3029  121 2293 1376 1027  656 1283 1286  513
821  641 1517  623 1785  371  304 1035  466  213  469
  DFS  393  425 1126    0  202 1019   25 1184 1471 1552  106 1294  967  693  443  767  794  423
660  528  915  320 1100  219  201  732  338  167  278
  EST   52   65  210  111    0  144   15  182  269  258   41  205  163  148   88  155  147   80
105   95  193   89  225   56   88  145   77   61   86
  FRA  335  353  632  446   64    0   12  978 1174 1457   86 1259  784  647  432  767  765  325
514  437  846  256 1029  146  145  642  308  123  179
  FRR    0   20   51   22   14    9    0   15   55   19    3   18   17    5   22    2   10    8
5    5   27   18   69    0   17   11    1   11   15
  GBR  546  496 1136  741   99  549   11    0 1339 1697  100 1300 1101  691  468  852  864  442
745  664  799  299  975  183  177  781  366  153  249
  NLD  441  626 2154 1000  189  599   36 1017    0 1901  114 1418 1141  746  661  834  854  430
838  629 1102  427 1252  205  211  836  342  173  316
  USA 1152  671 1727  884  167  590   11 1332 1407    0  121 2269 1468 1028  493 1652 1251  556
897  552 1276  439 1491  233  258 1058  635  164  273
  ISR   31   32  100   79   26   47    3   68   92  102    0  109   80   82   44   78   85   52
84   64   88   35  101   32   28   84   43   32   49
  ITA  512  508 1315  782  113  536   17  876  941 1206   81    0 1015  844  458 1047 1074  448
662  487 1044  343 1224  212  224  861  460  176  287
  AUS  481  398  884  560   74  491   12  874  900 1306   55  635    0  570  425  714  691  413
986  519  657  240  765  154  162  642  313  129  212
  HUN  404  292  789  508   91  417    5  592  577  954   63  686  414    0  296  587  613  336
417  315  724  264  736  146  138  594  346  122  192
  BEL  219  300  562  346   51  372   20  387  673  370   25  361  325  224    0  294  367  208
293  270  324  152  397   78   96  367  148   95  143
  JPN  348  232  466  361   54  286    2  402  391  664   36  420  367  333  170    0  749  370
465  316  665  255  758  141  147  584  410  120  159
  ESP  325  348  775  532   69  540    7  671  695  738   56  741  471  486  324  335    0  388
443  363  670  256  794  157  164  696  341  132  214
  ZAF  173  178  391  306   42  236    6  381  349  529   38  334  348  276  160  257  341    0
322  253  308  150  337   79   93  368  214   76  115
  NZL  242  266  607  420   56  291    4  619  741  827   69  464  966  328  216  243  329  256
0  524  475  205  516  124  111  467  231   98  159
  IRL  173  250  474  360   46  313    5  596  498  423   47  354  397  251  227  175  319  201
404    0  335  147  399   94   94  349  139   76  124
  CZE  317  269 1026  480  120  404   21  467  848  857   61  623  356  614  205  259  408  195
298  191    0  360  989  163  182  611  356  150  255
  SVK  114   89  462  152   42  125   11  162  272  281   15  187  119  189   79   90  126   86
126   73  264    0  345   67   94  264  153   52   99
  POL  478  396 1379  758  153  543   76  706  997 1196   78  854  508  621  306  360  525  245
361  273  714  222    0  226  245  783  415  170  331
  LTU   50   30  351  103   23   34    0   76   98  139   14  104   53   80   24   34   66   27
54   35   99   32  165    0   72  150   93   36  104
  LVA   66   78  207  121   63   68   15  102  129  207   20  152   77   99   54   66   92   55
54   53  118   46  183   50    0  189   98   44  112
  PRT  445  359  921  600  100  535   11  703  812 1071   65  778  478  573  334  351  651  327
377  287  483  179  779   94  143    0  363  123  235
  KOR  275  121  292  216   40  166    0  268  206  712   26  365  220  286   78  241  230  161
163   82  246   91  326   43   59  294    0   71   96
  SVN   69   72  191  132   39   81   10  110  142  127   25  144   91   95   74   67   98   55
70   53  110   32  149   16   27   97   39    0   73
  HRV   78  102  479  197   63  104   15  173  270  201   34  220  131  143  117   74  168   80
88   80  182   48  287   71   91  189   41   57    0
 ---------------------------------------------------------------------------
```

```
JER
--------
 common bulls below diagonal
 common three quarter sib group above diagonal
      CAN   DFS   GBR   NLD   USA   AUS   ZAF   NZL
----------------------------------------------------------------------------
   CAN    0    65   123    28   309   193   114   139
   DFS   49     0   126    64   138   105   110   105
   GBR  124   113     0    64   188   166   135   167
   NLD   22    62    58     0    66    53    56    56
   USA  316   110   204    70     0   392   228   299
   AUS  194    70   170    46   422     0   181   340
   ZAF  109    86   133    51   238   170     0   166
   NZL  153    79   171    48   372   385   172     0
----------------------------------------------------------------------------
JER
--------
 common bulls below diagonal
 common three quarter sib group above diagonal
      CAN   DFS   GBR   NLD   USA   AUS   ZAF   NZL
----------------------------------------------------------------------------
   CAN    0    24    50     9   111    70    42    50
   DFS   19     0   121    50   127    95   101    96
   GBR   49   108     0    51   186   166   134   166
   NLD    4    43    46     0    55    46    49    47
   USA   97    89   204    59     0   392   228   299
   AUS   60    58   170    42   422     0   181   339
   ZAF   35    75   133    44   238   170     0   166
   NZL   48    67   171    39   372   384   172     0
----------------------------------------------------------------------------
RDC
--------
 common bulls below diagonal
 common three quarter sib group above diagonal
      CAN   DFS   GBR   NOR   USA   DEU   AUS   EST   ZAF   NZL   LTU   LVA   NLD
----------------------------------------------------------------------------
   CAN    0   111    60     4   165    11    85     1    68    70    14     7     5
   DFS  107     0    50    94   136    57   142    76    49   139   104    90    36
   GBR   60    49     0    18    70     5    47     1    33    47    12     5    15
   NOR    4    71    19     0    49    17    46    11     0    33    23    16    27
   USA  150   135    66    49     0    21    98    11    56    88    28    12    27
   DEU   10    48     5    17    21     0    33    21     2    15    31    28    13
   AUS   85   118    45    38    99    32     0    16    31   114    40    26    20
   EST    1    66     1    11    10    20    16     0     0     4    21    34     9
   ZAF   70    46    29     0    51     2    31     0     0    31     5     1     3
   NZL   69   137    44    32    88    15   116     3    27     0    24    12    11
   LTU   13    89    11    18    22    29    36    20     5    20     0    36    12
   LVA    7    59     5    14    10    23    25    28     1    10    32     0     9
   NLD    5    36    15    26    25    13    18     8     3    11    11     8     0
----------------------------------------------------------------------------
RDC
--------
 common bulls below diagonal
 common three quarter sib group above diagonal
      CAN   DFS   GBR   NOR   USA   DEU   AUS   EST   ZAF   NZL   LTU   LVA   NLD
----------------------------------------------------------------------------
   CAN    0    62    28     3    64     5    27     0    35    26    10     4     3
   DFS   59     0    46    95   128    57   160    76    45   136   102    91    31
   GBR   28    45     0    18    68     5    45     1    30    45    12     5    12
   NOR    3    71    19     0    49    17    46    11     0    33    23    16    23
   USA   66   127    66    49     0    21    96    11    52    86    28    12    23
   DEU    5    48     5    17    21     0    33    21     2    15    31    28    13
   AUS   27   139    44    38    98    32     0    16    29   113    40    26    17
   EST    0    66     1    11    10    20    16     0     0     4    21    34     9
   ZAF   37    44    28     0    51     2    31     0     0    29     5     1     2
   NZL   27   132    44    32    88    15   115     3    27     0    24    12     8
   LTU    9    87    11    18    22    29    36    20     5    20     0    36    11
   LVA    4    59     5    14    10    23    25    28     1    10    32     0     7
   NLD    3    31    12    22    21    13    15     8     2     8    10     6     0
----------------------------------------------------------------------------
```

```
SIM
--------
 common bulls below diagonal
 common three quarter sib group above diagonal
       FRM   FRA   ITA   NLD   CHE   DEA   HUN   SVK   SVN   GBR   HRV   USA
     -------------------------------------------------------------------------
   FRM    0     2   142   102   157   200     2    54    17    63     2    22
   FRA    1     0    96    40     9   174     3    41    39     0    66     0
   ITA  171    85     0   142    74   652     7   121    79    42   181    18
   NLD  124    39   138     0    72   193     2    49    36    46    69    14
   CHE  205     6    76    75     0   255     2    30     5    50     0    17
   DEA  241   132   558   202   224     0    26   323   144    45   418    15
   HUN    0     2     6     2     1    14     0     6     5     0     6     0
   SVK   54    35   103    41    22   329     5     0    37     9    70     3
   SVN   17    36    75    34     5   129     4    37     0     0    59     0
   GBR   79     0    46    45    56    47     0     4     0     0     0    17
   HRV    1    60   171    66     0   439     6    53    49     0     0     0
   USA   35     0    24    17    17    20     0     3     0    24     0     0
     -------------------------------------------------------------------------
SIM
--------
 common bulls below diagonal
 common three quarter sib group above diagonal
       FRM   FRA   ITA   NLD   CHE   DEA   HUN   SVK   SVN   GBR   HRV   USA
     -------------------------------------------------------------------------
   FRM    0     2   142    91   156   198     2    54    17    63     2    22
   FRA    1     0    86    29     9   158     3    39    34     0    57     0
   ITA  171    75     0   121    74   652     7   121    79    42   181    18
   NLD  110    27   118     0    67   155     2    43    29    42    62    14
   CHE  204     6    76    68     0   255     2    30     5    50     0    17
   DEA  238   121   558   163   224     0    26   323   144    45   418    15
   HUN    0     2     6     2     1    14     0     6     5     0     6     0
   SVK   54    31   103    36    22   329     5     0    37     9    70     3
   SVN   17    29    75    29     5   129     4    37     0     0    59     0
   GBR   79     0    46    41    56    47     0     4     0     0     0    17
   HRV    1    50   171    59     0   439     6    53    49     0     0     0
   USA   35     0    24    17    17    20     0     3     0    24     0     0
     -------------------------------------------------------------------------
```