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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 thirty-three (33) countries were
included in this evaluation.

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


Countries sending real MAS data (other countries participate to the MAS evaluation using SCS data as predictor):
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HOL : DFS, NLD, FRA, CAN, ITA, CHE, USA
RDC : DFS, NLD, CAN
BSW : NLD, FRA, CHE
JER : DFS, NLD, CAN
SIM : NLD, CHE
GUE : No evaluation for MAS yet
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Changes in national procedures
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Changes in the national genetic evaluation of udder health traits  are as
follows:

SVN (ALL)          Changes in data base related to the pedigree completness as well as phenotypic data improvement resulting in some animals loosing information.
ITA (SIM)          Decrease in information due to parentage verification
ESP (HOL)          Base change
JPN (HOL)          Pedigree verification
AUS (ALL)          Wrongly allocated parents or genetic groups have been corrected, causing some bulls to be no longer included in the evaluation as their daughters' count has fell under the minimum treshold of 10 daughters. Correction
                   of a bug in the program generating type of proof
NLD (ALL)          Corrected typo in genetic merit information from T+ to B+
EST (ALL)          Decrease in infromation due to pedigree verification
CHE (ALL)          Manual data edits and removal of data errors cause decrease in information. In BSW changes in of herd-year-season assignment causes small decrease in EDC.


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.


Window:
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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
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estimated correlations fell between the old limit of 0.30 and these new limits.DATA AND METHOD OF ANALYSIS

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

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

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

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

SCIENTIFIC LITERATURE

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

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

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

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

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

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

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

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

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

NEXT ROUTINE INTERNATIONAL EVALUATION

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

NEXT TEST INTERNATIONAL EVALUATION

Dates for the next test run can be found on

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Test evaluation results are meant for review purposes only and should not be
published.
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^LTable 1. National evaluation data considered in the Interbull
evaluation for udder health (August Routine Evaluation 2019).
Number of records for milk somatic cells by breed

Country	BSW	GUE	HOL	JER	RDC	SIM
AUS		136	8135	1630	730	
BEL			2036			
CAN	234	101	12578	751	816	
CHE	2960		3418	86		3261
CZE			3963			
DEA	5614					22470
DEU			27833		437	
DFS			13274	2144	7861	
ESP			3903			
EST			1158		431	
FRA	391		17134			461
FRM						4335
GBR	123	290	6747	695	514	84
HUN			2847			173
IRL			2570			
ISR			1446			
ITA	1934		9751			1539
JPN			6151			
KOR			1316			
LTU			811		435	
LVA			527		564	
NLD	196		15725	164	88	409
NOR					4167	
NZL	51	57	7681	4529	1309	
POL			10585			
PRT			2412			
SVK			1110			571
SVN	371		549			613
URY			1758			
USA	1077	701	38529	4603	679	62
ZAF			1190	580	124	
HRV			774			852
MEX						
CAM					38	
No.Records	12951	1285	205911	15182	18193	34830
Pub. Proofs	10520	998	155894	12483	17384	31186

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

	CAN	FRA	NLD	USA	CHE	DEA	NZL	ITA	GBR	SVN
CAN	6.14									
FRA	0.91	1.04								
NLD	0.89	0.92	3.70							
USA	0.89	0.91	0.88	0.21						
CHE	0.92	0.94	0.94	0.88	10.52					
DEA	0.92	0.96	0.92	0.88	0.97	11.92				

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NZL      0.87      0.87      0.87      0.86      0.87      0.88      0.36
ITA      0.89      0.90      0.89      0.89      0.95      0.91      0.87     16.63
GBR      0.90      0.96      0.95      0.91      0.94      0.95      0.89      0.89     12.75
SVN      0.89      0.89      0.89      0.89      0.89      0.89      0.88      0.89      0.89     10.49
```

BSW   mas

```
          CAN       FRA       NLD       USA       CHE       DEA       NZL       ITA       GBR       SVN
CAN      6.13
FRA      0.92      1.06
NLD      0.89      0.88      3.80
USA      0.88      0.88      0.88      0.21
CHE      0.92      0.90      0.91      0.90     12.50
DEA      0.93      0.87      0.89      0.88      0.91     11.93
NZL      0.90      0.89      0.89      0.87      0.91      0.87      0.36
ITA      0.89      0.88      0.89      0.88      0.90      0.91      0.87     16.62
GBR      0.89      0.89      0.88      0.89      0.92      0.90      0.89      0.89      2.93
SVN      0.89      0.89      0.89      0.89      0.90      0.89      0.88      0.89      0.89     10.49
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GUE   scs

```
          CAN       GBR       USA       AUS       NZL
CAN      5.95
GBR      0.89     13.60
USA      0.89      0.90      0.25
AUS      0.88      0.92      0.86      0.27
NZL      0.87      0.89      0.86      0.95      0.62
```

HOL   scs

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          CAN    CHE    DEU    DFS    EST    FRA    GBR    NLD    USA    ISR    ITA    AUS    HUN    BEL    JPN    ESP    ZAF    NZL    IRL    CZE    SVK    POL    LTU    LVA    PRT    KOR    SVN    HRV    URY
CAN      5.76
CHE      0.89  10.99
DEU      0.93   0.94  12.67
DFS      0.92   0.93   0.96  11.85
EST      0.88   0.89   0.94   0.92  13.54
FRA      0.94   0.93   0.95   0.97   0.91   1.19
GBR      0.94   0.94   0.95   0.94   0.90   0.96  12.77
NLD      0.91   0.94   0.95   0.94   0.91   0.94   0.96   4.19
USA      0.94   0.88   0.89   0.88   0.90   0.90   0.90   0.88   0.21
ISR      0.85   0.85   0.85   0.84   0.86   0.85   0.84   0.83   0.88   0.24
ITA      0.90   0.89   0.94   0.92   0.93   0.93   0.90   0.88   0.89   0.85   5.81
AUS      0.86   0.91   0.88   0.88   0.86   0.89   0.93   0.91   0.86   0.84   0.86   0.29
HUN      0.88   0.90   0.92   0.90   0.91   0.91   0.89   0.88   0.92   0.88   0.93   0.86   1.43
BEL      0.91   0.93   0.96   0.96   0.95   0.95   0.94   0.94   0.89   0.84   0.94   0.86   0.92   0.52
JPN      0.88   0.88   0.88   0.89   0.87   0.90   0.88   0.88   0.88   0.83   0.88   0.86   0.88   0.88   0.42
ESP      0.92   0.91   0.95   0.94   0.94   0.96   0.93   0.91   0.91   0.88   0.95   0.86   0.93   0.96   0.88  11.51
ZAF      0.90   0.89   0.92   0.90   0.89   0.93   0.92   0.89   0.89   0.87   0.92   0.88   0.91   0.91   0.88   0.95  26.40
NZL      0.86   0.86   0.86   0.86   0.86   0.86   0.89   0.86   0.86   0.83   0.85   0.96   0.86   0.86   0.86   0.86   0.86   0.40
IRL      0.88   0.93   0.93   0.93   0.90   0.93   0.95   0.93   0.86   0.83   0.88   0.95   0.86   0.93   0.86   0.92   0.91   0.92   0.11
CZE      0.88   0.88   0.90   0.88   0.88   0.89   0.88   0.88   0.88   0.84   0.90   0.86   0.89   0.89   0.88   0.91   0.88   0.86   0.86  17.17
SVK      0.88   0.89   0.91   0.89   0.88   0.90   0.88   0.88   0.88   0.84   0.90   0.86   0.95   0.91   0.88   0.91   0.88   0.86   0.86   0.88   0.42
POL      0.89   0.92   0.95   0.95   0.94   0.93   0.91   0.91   0.88   0.85   0.94   0.86   0.94   0.96   0.88   0.95   0.90   0.86   0.89   0.90   0.91  10.04
LTU      0.88   0.88   0.90   0.88   0.92   0.88   0.88   0.88   0.88   0.85   0.88   0.86   0.88   0.92   0.88   0.90   0.88   0.86   0.86   0.88   0.89   0.90   0.36
LVA      0.88   0.89   0.94   0.92   0.94   0.90   0.90   0.89   0.88   0.82   0.92   0.87   0.88   0.94   0.88   0.89   0.88   0.86   0.90   0.88   0.87   0.93   0.92   0.48
PRT      0.88   0.88   0.88   0.88   0.88   0.88   0.88   0.88   0.88   0.84   0.88   0.86   0.88   0.88   0.88   0.88   0.88   0.86   0.86   0.88   0.88   0.88   0.88   0.88   0.46
KOR      0.88   0.88   0.88   0.90   0.88   0.88   0.88   0.88   0.88   0.83   0.89   0.86   0.88   0.90   0.88   0.91   0.88   0.86   0.86   0.88   0.88   0.92   0.88   0.90   0.88   0.34
SVN      0.88   0.88   0.88   0.87   0.87   0.88   0.88   0.88   0.88   0.84   0.88   0.86   0.88   0.88   0.88   0.88   0.88   0.86   0.87   0.88   0.87   0.88   0.88   0.89   0.88   0.87  10.62
HRV      0.88   0.88   0.88   0.88   0.88   0.88   0.88   0.88   0.88   0.84   0.88   0.86   0.88   0.88   0.88   0.88   0.88   0.86   0.86   0.88   0.87   0.88   0.88   0.88   0.88   0.87   0.88  11.73
URY      0.88   0.88   0.88   0.88   0.88   0.88   0.88   0.88   0.88   0.85   0.88   0.86   0.88   0.88   0.88   0.88   0.88   0.86   0.86   0.88   0.88   0.88   0.88   0.88   0.88   0.88   0.88   0.88   0.20
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HOL   mas

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         CAN    CHE    DEU    DFS    EST    FRA    GBR    NLD    USA    ISR    ITA    AUS    HUN    BEL    JPN    ESP    ZAF    NZL    IRL    CZE    SVK    POL    LTU    LVA    PRT    KOR    SVN    HRV    URY
CAN      7.62
CHE      0.91  11.76
DEU      0.87   0.94  12.66
DFS      0.94   0.90   0.87  12.57
EST      0.86   0.90   0.93   0.86  13.54
FRA      0.96   0.92   0.87   0.94   0.86   1.20
GBR      0.88   0.91   0.89   0.88   0.88   0.88   2.48
NLD      0.88   0.93   0.93   0.88   0.91   0.88   0.88   4.81
USA      0.88   0.88   0.88   0.88   0.88   0.88   0.88   0.88   2.21
ISR      0.82   0.83   0.84   0.82   0.85   0.82   0.84   0.83   0.84   0.24
ITA      0.87   0.90   0.89   0.88   0.88   0.88   0.88   0.88   0.88   0.83   5.94
AUS      0.89   0.89   0.89   0.89   0.86   0.89   0.89   0.89   0.89   0.83   0.86   0.29
HUN      0.87   0.91   0.92   0.87   0.90   0.87   0.88   0.91   0.88   0.87   0.90   0.86   1.43
BEL      0.87   0.94   0.97   0.88   0.94   0.88   0.88   0.94   0.88   0.83   0.89   0.88   0.93   0.52
JPN      0.87   0.88   0.88   0.87   0.86   0.87   0.88   0.87   0.88   0.82   0.88   0.86   0.88   0.88   0.42
ESP      0.87   0.94   0.96   0.88   0.92   0.88   0.88   0.92   0.88   0.87   0.89   0.86   0.93   0.96   0.88  11.51
ZAF      0.87   0.90   0.92   0.87   0.88   0.87   0.88   0.89   0.88   0.86   0.89   0.89   0.91   0.92   0.88   0.95  26.12
NZL      0.87   0.87   0.86   0.87   0.84   0.87   0.89   0.88   0.89   0.82   0.85   0.96   0.85   0.86   0.86   0.85   0.86   0.39
IRL      0.88   0.92   0.93   0.88   0.88   0.88   0.89   0.89   0.89   0.82   0.86   0.95   0.86   0.93   0.86   0.92   0.91   0.92   0.11
CZE      0.87   0.89   0.91   0.87   0.88   0.87   0.88   0.88   0.88   0.83   0.88   0.86   0.90   0.89   0.88   0.91   0.88   0.85   0.86  17.09
SVK      0.86   0.88   0.91   0.86   0.88   0.86   0.88   0.88   0.88   0.83   0.89   0.86   0.95   0.90   0.87   0.90   0.88   0.88   0.85   0.88   0.41
POL      0.88   0.93   0.96   0.88   0.93   0.88   0.88   0.92   0.88   0.84   0.89   0.86   0.94   0.96   0.88   0.95   0.90   0.86   0.89   0.90   0.90  10.04
LTU      0.88   0.89   0.90   0.88   0.91   0.88   0.88   0.88   0.88   0.85   0.88   0.86   0.89   0.91   0.88   0.90   0.87   0.86   0.86   0.88   0.89   0.90   0.35
LVA      0.87   0.88   0.93   0.87   0.93   0.87   0.88   0.89   0.88   0.82   0.88   0.87   0.88   0.94   0.87   0.88   0.87   0.85   0.89   0.87   0.87   0.93   0.92   0.48
PRT      0.88   0.88   0.88   0.88   0.88   0.88   0.88   0.88   0.88   0.84   0.88   0.86   0.88   0.88   0.88   0.88   0.88   0.86   0.86   0.88   0.88   0.88   0.88   0.88   0.45
KOR      0.87   0.90   0.88   0.87   0.86   0.87   0.88   0.87   0.88   0.81   0.88   0.86   0.87   0.90   0.88   0.90   0.87   0.85   0.86   0.87   0.87   0.92   0.88   0.89   0.88   0.34
SVN      0.86   0.87   0.87   0.87   0.86   0.86   0.88   0.87   0.88   0.82   0.87   0.86   0.87   0.89   0.87   0.87   0.87   0.85   0.87   0.87   0.86   0.88   0.88   0.88   0.88   0.86  10.61
HRV      0.86   0.86   0.88   0.86   0.87   0.86   0.88   0.87   0.88   0.83   0.88   0.86   0.87   0.87   0.87   0.88   0.87   0.85   0.85   0.88   0.87   0.88   0.88   0.88   0.88   0.86   0.87  11.74
URY      0.88   0.88   0.88   0.88   0.88   0.88   0.88   0.88   0.88   0.84   0.88   0.86   0.88   0.88   0.88   0.88   0.88   0.88   0.86   0.86   0.88   0.88   0.88   0.88   0.88   0.88   0.88   0.88   0.20
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JER    scs
------------------------------------------------------------------------------------------------------------
         CAN    DFS    GBR    NLD    USA    AUS    ZAF    NZL    CHE
CAN      6.15
DFS      0.90  12.37
GBR      0.91   0.91  11.13
NLD      0.90   0.95   0.95   3.66
USA      0.89   0.88   0.89   0.88   0.19
AUS      0.88   0.89   0.90   0.91   0.86   0.27
ZAF      0.88   0.89   0.89   0.90   0.88   0.87  21.29
NZL      0.88   0.88   0.89   0.88   0.86   0.95   0.86   0.37
CHE      0.89   0.91   0.91   0.93   0.88   0.89   0.89   0.87  11.98

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JER    mas
------------------------------------------------------------------------------------------------------------
         CAN    DFS    GBR    NLD    USA    AUS    ZAF    NZL    CHE
CAN      7.53
DFS      0.94  12.28
GBR      0.88   0.89   1.83
NLD      0.88   0.88   0.88   3.98
USA      0.88   0.88   0.88   0.89   0.19
AUS      0.89   0.89   0.89   0.89   0.86   0.27
ZAF      0.88   0.88   0.88   0.89   0.88   0.88  21.30
NZL      0.89   0.89   0.89   0.89   0.86   0.95   0.86   0.37
CHE      0.90   0.89   0.89   0.89   0.89   0.87   0.89   0.87  11.98

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RDC    scs
------------------------------------------------------------------------------------------------------------
         CAN    DFS    GBR    NOR    USA    DEU    AUS    EST    ZAF    NZL    LTU    LVA    NLD    CAM
CAN      5.62
DFS      0.94  12.86
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GBR	0.93	0.92	11.36										
NOR	0.92	0.91	0.89	13.71									
USA	0.92	0.88	0.89	0.89	0.23								
DEU	0.93	0.95	0.95	0.90	0.89	13.58							
AUS	0.88	0.91	0.92	0.92	0.86	0.90	0.30						
EST	0.89	0.94	0.91	0.90	0.91	0.95	0.90	12.20					
ZAF	0.89	0.90	0.90	0.93	0.89	0.92	0.88	0.90	25.17				
NZL	0.88	0.88	0.89	0.90	0.86	0.87	0.95	0.88	0.87	0.41			
LTU	0.90	0.90	0.89	0.90	0.89	0.89	0.87	0.91	0.91	0.87	0.34		
LVA	0.90	0.89	0.90	0.90	0.89	0.93	0.89	0.96	0.89	0.88	0.90	0.44	
NLD	0.91	0.95	0.96	0.90	0.88	0.95	0.92	0.92	0.89	0.87	0.89	0.90	3.80
CAM	0.94	0.94	0.94	0.93	0.90	0.94	0.93	0.94	0.93	0.91	0.93	0.93	0.94	5.62

RDC   mas

	CAN	DFS	GBR	NOR	USA	DEU	AUS	EST	ZAF	NZL	LTU	LVA	NLD	CAM
CAN	7.66													
DFS	0.91	13.79												
GBR	0.88	0.88	1.94											
NOR	0.92	0.88	0.89	13.71										
USA	0.88	0.88	0.88	0.89	0.23									
DEU	0.88	0.87	0.89	0.90	0.88	13.58								
AUS	0.90	0.89	0.89	0.92	0.87	0.90	0.30							
EST	0.87	0.87	0.89	0.90	0.89	0.93	0.87	12.20						
ZAF	0.89	0.88	0.89	0.93	0.89	0.92	0.88	0.90	25.29					
NZL	0.88	0.88	0.89	0.90	0.86	0.87	0.95	0.87	0.87	0.41				
LTU	0.88	0.87	0.89	0.90	0.89	0.90	0.87	0.92	0.90	0.87	0.34			
LVA	0.88	0.86	0.89	0.90	0.89	0.94	0.89	0.95	0.88	0.88	0.91	0.44		
NLD	0.88	0.88	0.88	0.89	0.89	0.93	0.90	0.91	0.90	0.89	0.89	0.90	4.41	
CAM	0.93	0.93	0.93	0.93	0.90	0.94	0.93	0.94	0.93	0.92	0.93	0.94	0.94	5.62

SIM   scs

	FRM	FRA	ITA	NLD	CHE	DEA	HUN	SVK	SVN	GBR	HRV	USA
FRM	1.09											
FRA	0.93	1.02										
ITA	0.94	0.90	13.49									
NLD	0.91	0.93	0.88	3.82								
CHE	0.93	0.93	0.90	0.93	10.48							
DEA	0.91	0.93	0.88	0.90	0.89	12.18						
HUN	0.93	0.91	0.93	0.88	0.90	0.94	16.24					
SVK	0.89	0.89	0.89	0.91	0.90	0.88	0.94	0.38				
SVN	0.90	0.89	0.89	0.89	0.90	0.88	0.90	0.89	8.88			
GBR	0.91	0.96	0.89	0.95	0.91	0.93	0.89	0.89	0.88	11.60		
HRV	0.93	0.88	0.88	0.88	0.89	0.88	0.89	0.89	0.89	0.88	9.87	
USA	0.89	0.90	0.89	0.88	0.89	0.90	0.92	0.89	0.89	0.90	0.88	0.21

SIM   mas

	FRM	FRA	ITA	NLD	CHE	DEA	HUN	SVK	SVN	GBR	HRV	USA
FRM	1.08											
FRA	0.92	1.00										
ITA	0.95	0.88	13.50									
NLD	0.88	0.88	0.88	3.86								
CHE	0.93	0.92	0.91	0.93	11.71							
DEA	0.91	0.92	0.88	0.88	0.89	12.18						
HUN	0.93	0.88	0.91	0.91	0.92	0.93	16.24					
SVK	0.89	0.89	0.89	0.89	0.92	0.88	0.94	0.38				
SVN	0.90	0.89	0.89	0.88	0.90	0.88	0.90	0.89	8.88			
GBR	0.90	0.88	0.88	0.89	0.91	0.90	0.88	0.89	0.88	2.63		
HRV	0.92	0.88	0.88	0.88	0.90	0.88	0.89	0.89	0.89	0.88	9.87	
USA	0.89	0.88	0.89	0.89	0.89	0.90	0.90	0.89	0.89	0.89	0.88	0.21

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^LAPPENDIX II. Number of common bulls
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BSW
--------

 common bulls below diagonal
 common three quarter sib group above diagonal
       CAN  FRA  NLD  USA  CHE  DEA  NZL  ITA  GBR  SVN
     ----------------------------------------------------------------------------
  CAN    0   82   51  166  129  135   22  120   59   33
  FRA   72    0   83  120  159  210   21  185   52   55
  NLD   48   68    0   78   94  148   24  126   40   44
  USA  154   80   68    0  313  310   28  221   81   41
  CHE  105  116   87  291    0  573   24  438   67   77
  DEA  115  156  142  274  474    0   33  623   68  102
  NZL   20   17   17   25   19   28    0   26   17   10
  ITA  103  145  106  155  382  522   20    0   70   97
  GBR   54   42   30   74   50   46   15   48    0   22
  SVN   29   54   45   33   73   95    9   96   17    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   76   49  166   36  135   22  120   28   33
  FRA   68    0   68  104   42  195   18  173   26   55
  NLD   44   58    0   70   24  131   24  114   19   40
  USA  154   72   60    0   37  309   28  219   35   41
  CHE   31   34   23   26    0  109    6   93    9   33
  DEA  115  148  123  274  104    0   33  618   31  102
  NZL   20   15   17   25    6   28    0   26   10   10
  ITA  103  140   95  155   87  520   20    0   33   97
  GBR   26   21   15   33    5   23    8   25    0   12
  SVN   29   54   41   33   32   95    9   96   10    0
     ----------------------------------------------------------------------------
GUE
--------
 common bulls below diagonal
 common three quarter sib group above diagonal
       CAN  GBR  USA  AUS  NZL
     ----------------------------------------------------------------------------
  CAN    0   30   71   45   14
  GBR   25    0   87   35   13
  USA   62   89    0   63   29
  AUS   44   31   59    0   22
  NZL   11   11   29   26    0
     ----------------------------------------------------------------------------
GUE
--------

HOL
--------
 common bulls below diagonal
 common three quarter sib group above diagonal
       CAN  CHE  DEU  DFS  EST  FRA  GBR  NLD  USA  ISR  ITA  AUS  HUN  BEL  JPN  ESP  ZAF  NZL  IRL  CZE  SVK  POL  LTU  LVA  PRT  KOR  SVN  HRV  URY
     ----------------------------------------------------------------------------
  CAN    0  851 2424 1395  246 1435 1520 1470 3256  118 1662 1374  992  785 1323 1263  498  715  467 1031  421 1328  241  207 1015  644  196  294  743
  CHE  712    0 1146  698  160  653  662  871  970   58  705  594  429  581  461  549  265  385  339  490  228  656  119  138  497  246  134  200  305
  DEU 1697  998    0 2756  408 2531 2030 3492 3616  154 2542 1673 1223 1246 1477 1534  576  955  754 1734  721 2368  489  306 1229  590  297  603  771
  DFS 1165  616 1808    0  279 1596 1476 2040 2011  139 1579 1247  874  836  949  998  495  798  637 1154  403 1539  309  206  916  452  241  388  624
  EST  143   88  288  166    0  248  236  345  329   46  267  206  191  186  201  195  104  130  111  243  112  303   78   87  190  106   90  120  134
  FRA  933  566 1281  807  114    0 1473 1932 2431  123 1695 1238  918  911 1188 1123  466  775  619 1147  417 1590  241  186  914  478  196  285  585
  GBR 1722  602 1469 1086  132  880    0 1652 2043  129 1496 1325  829  830 1000 1027  500  858  778  942  362 1246  256  180  921  456  198  320  645
  NLD 1379  846 3188 1758  250 1160 1405    0 2417  147 1705 1428  937 1249 1042 1085  507  992  751 1369  527 1751  304  227 1033  443  248  426  651
  USA 3537  859 2400 1471  213 1250 1755 2078    0  170 2550 1825 1257  940 1914 1509  624 1023  660 1514  527 1968  329  260 1275  796  226  366 1068
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	CAN	CHE	DEU	DFS	EST	FRA	GBR	NLD	USA	ISR	ITA	AUS	HUN	BEL	JPN	ESP	ZAF	NZL	IRL	CZE	SVK	POL	LTU	LVA	PRT	KOR	SVN	HRV	URY
ISR	84	36	125	106	28	64	85	115	155	0	136	103	104	81	98	107	62	103	85	112	47	134	46	28	99	55	43	65	87
ITA	1301	626	1637	1152	147	876	1103	1385	1676	95	0	1186	1001	808	1171	1253	480	733	550	1199	390	1552	284	223	999	561	226	375	672
AUS	1366	521	1201	876	101	809	1116	1236	1784	66	854	0	708	737	877	865	473	1166	614	789	304	994	218	167	770	409	169	286	641
HUN	925	343	959	689	115	609	725	781	1208	75	843	527	0	534	700	756	387	485	371	849	307	924	205	140	700	426	155	251	498
BEL	778	591	1290	775	117	888	818	1441	830	53	783	640	459	0	538	658	328	497	437	600	291	787	162	143	649	273	169	260	344
JPN	678	301	608	509	71	419	513	546	864	45	538	486	401	346	0	890	418	546	380	776	306	966	189	149	699	516	159	216	562
ESP	799	442	977	739	92	802	818	967	959	64	926	614	597	647	418	0	439	521	424	791	310	1016	210	167	817	444	182	276	510
ZAF	452	214	444	377	53	325	432	426	604	42	378	408	309	278	293	386	0	359	285	359	179	407	104	99	423	253	95	148	321
NZL	720	322	733	554	66	450	724	906	960	86	532	1165	375	404	296	398	290	0	612	549	249	625	159	114	552	293	122	211	488
IRL	409	316	594	484	55	437	726	651	541	59	432	498	301	411	226	386	230	491	0	408	183	507	132	94	403	177	102	159	313
CZE	726	327	1268	731	151	664	598	1179	1120	81	809	493	744	449	342	514	227	373	259	0	434	1238	242	182	736	437	203	342	510
SVK	294	117	543	207	52	220	207	362	344	20	234	152	216	177	113	155	95	150	90	337	0	440	95	96	317	197	77	139	231
POL	1099	531	2072	1220	216	982	1016	1588	1828	104	1162	733	815	723	511	703	301	472	380	987	304	0	334	251	994	535	240	444	622
LTU	124	44	460	168	34	68	123	170	211	20	145	90	123	72	55	88	37	67	55	149	42	251	0	74	203	131	57	142	152
LVA	131	78	206	126	62	86	103	149	208	20	152	79	100	91	66	95	58	55	52	118	47	186	52	0	190	99	43	115	120
PRT	1058	433	1131	810	132	769	849	1035	1328	74	932	610	691	655	433	782	378	450	338	595	218	994	123	143	0	443	159	309	539
KOR	611	171	387	315	52	275	334	309	894	33	456	298	348	203	313	310	189	211	115	303	119	447	56	59	375	0	92	135	365
SVN	142	98	284	199	55	137	146	214	173	32	190	120	120	141	91	139	67	88	76	149	45	219	27	26	126	57	0	106	103
HRV	170	127	616	296	87	168	224	381	274	45	282	174	185	213	102	209	98	123	105	240	69	391	95	90	247	58	82	0	181
URY	722	234	562	447	82	348	533	526	1337	47	488	504	411	279	325	409	280	395	243	345	146	525	84	80	479	288	59	109	0

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

	CAN	CHE	DEU	DFS	EST	FRA	GBR	NLD	USA	ISR	ITA	AUS	HUN	BEL	JPN	ESP	ZAF	NZL	IRL	CZE	SVK	POL	LTU	LVA	PRT	KOR	SVN	HRV	URY
CAN	0	94	1309	677	146	747	773	770	880	72	1018	736	606	482	755	790	242	360	262	638	226	891	163	108	599	427	143	204	406
CHE	84	0	133	89	27	84	90	115	86	8	92	90	51	89	69	72	34	66	54	68	26	96	20	9	67	50	32	32	42
DEU	1004	121	0	2480	404	1906	1782	3368	1189	152	2194	1660	1201	1224	1466	1524	565	941	753	1726	698	2337	473	298	1194	556	296	599	670
DFS	646	81	1499	0	253	1192	1213	1750	750	129	1258	1140	812	751	895	943	479	738	606	1055	352	1372	294	188	853	408	225	366	514
EST	89	11	288	149	0	208	214	337	171	45	245	201	186	181	196	191	101	126	109	240	106	300	76	84	183	101	90	119	121
FRA	536	78	904	619	103	0	1086	1452	707	103	1285	967	783	753	915	949	376	604	512	999	326	1372	201	153	784	392	173	252	419
GBR	762	82	1362	904	126	688	0	1491	821	127	1271	1189	784	770	904	961	458	774	721	893	327	1177	233	155	854	418	192	303	541
NLD	760	108	3039	1381	245	892	1282	0	865	142	1454	1401	916	1221	1031	1068	496	978	745	1338	500	1697	289	219	1009	422	239	419	569
USA	997	79	1156	725	123	537	886	878	0	106	1046	769	690	469	799	684	334	431	328	713	233	960	180	151	679	496	151	198	553
ISR	48	1	125	94	28	56	84	113	98	0	123	102	101	81	96	107	60	103	85	112	46	133	42	28	99	54	43	64	79
ITA	783	87	1384	932	140	676	978	1177	1021	80	0	1034	923	719	1059	1145	418	613	479	1108	349	923	249	199	909	516	216	333	557
AUS	772	86	1199	759	101	656	1013	1210	822	66	782	0	699	724	875	862	462	1160	613	783	293	983	208	161	755	389	169	284	571
HUN	566	39	957	636	115	524	696	765	728	73	792	525	0	527	692	751	376	479	370	841	297	912	197	136	688	409	155	248	438
BEL	500	82	1281	681	117	721	779	1411	451	53	719	638	459	0	531	652	325	489	436	595	282	775	157	139	639	264	169	259	322
JPN	489	56	608	457	71	368	501	539	639	45	513	486	401	346	0	889	414	539	380	772	292	956	177	144	679	491	159	216	486
ESP	496	66	976	678	92	698	793	947	552	64	813	614	597	647	418	0	435	519	424	789	299	1009	203	164	810	432	182	275	451
ZAF	224	29	444	360	53	281	415	421	368	42	339	405	307	278	293	386	0	357	283	354	173	400	100	96	414	239	95	145	296
NZL	322	58	729	496	65	369	629	895	404	86	477	1158	374	403	296	398	289	0	611	542	243	619	152	109	544	282	122	209	441
IRL	260	51	594	440	55	392	691	644	320	59	393	497	301	411	226	386	230	491	0	407	180	505	129	92	400	171	101	158	291
CZE	464	51	1266	637	151	539	583	1153	649	81	756	492	737	449	342	514	225	369	259	0	424	1224	230	177	723	415	203	337	446
SVK	156	7	538	175	52	171	198	349	154	20	216	149	214	176	113	155	94	148	90	334	0	424	88	92	305	184	76	136	207
POL	781	80	2061	1065	216	854	988	1532	1076	104	1092	733	810	722	511	703	300	469	380	979	299	0	324	245	974	508	240	439	554
LTU	95	7	459	157	34	61	118	162	127	20	124	89	122	72	55	88	37	66	55	146	41	248	0	72	193	115	57	137	132
LVA	72	4	204	114	62	76	96	146	124	20	128	79	99	91	66	95	58	54	52	118	47	183	52	0	185	95	43	112	107
PRT	605	63	1126	745	132	678	812	1024	740	74	868	609	686	654	433	782	376	449	338	594	215	980	121	142	0	425	158	305	488
KOR	408	40	387	286	52	244	322	302	543	33	434	292	344	203	313	310	187	207	115	299	115	436	52	59	373	0	92	129	321
SVN	105	24	283	180	55	122	146	209	119	32	180	120	120	141	91	139	67	88	76	149	45	219	27	26	126	57	0	106	97
HRV	118	13	615	266	87	154	221	373	144	45	232	174	184	213	102	209	98	122	105	238	69	388	95	89	247	57	82	0	171
URY	403	31	556	391	82	283	499	512	606	46	464	501	399	278	325	409	276	392	243	338	144	510	83	76	470	278	59	108	0

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

	CAN	DFS	GBR	NLD	USA	AUS	ZAF	NZL	CHE
CAN	0	78	146	36	414	249	148	164	36
DFS	62	0	138	99	152	122	124	118	53
GBR	149	125	0	75	218	201	156	199	66

```
 NLD    31    97    68     0    81    66    69    70    38
 USA   432   122   238    86     0   468   271   342    63
 AUS   259    86   207    57   514     0   215   415    51
 ZAF   144   100   155    64   287   208     0   188    54
 NZL   172    89   202    62   413   462   196     0    49
 CHE    29    48    63    32    63    42    47    40     0
-----------------------------------------------------------------------
JER
--------
common bulls below diagonal
common three quarter sib group above diagonal
        CAN   DFS   GBR   NLD   USA   AUS   ZAF   NZL   CHE
-----------------------------------------------------------------------
 CAN     0    32    65    14   152   106    65    72    22
 DFS    26     0    89    80   138   108   113   109    52
 GBR    62    81     0    53   160   141   116   134    62
 NLD     8    73    48     0    74    64    67    65    36
 USA   141    98   171    79     0   468   271   342    63
 AUS    96    70   142    55   514     0   215   414    51
 ZAF    57    87   116    62   287   208     0   188    54
 NZL    67    77   136    57   413   461   196     0    49
 CHE    18    47    56    30    63    42    47    40     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   CAM
-----------------------------------------------------------------------
 CAN     0   156    76     6   193    15    98     2    70    81    17     7     7     0
 DFS   159     0    95   123   177    71   174    95    51   159   103    91    54     0
 GBR    76    88     0    48   102    19    78     7    37    73    26    11    33     0
 NOR     6    96    50     0    69    20    64    18     0    39    25    17    42     0
 USA   179   171    97    70     0    27   121    16    59   108    34    14    39    20
 DEU    14    60    18    19    26     0    43    27     2    22    38    29    18     0
 AUS    99   150    74    54   125    42     0    27    33   131    43    28    30    10
 EST     2    84     6    18    15    26    25     0     0     7    25    36    14     0
 ZAF    72    48    33     0    53     2    33     0     0    32     5     1     4     0
 NZL    79   154    68    38   110    21   136     6    29     0    26    13    19     9
 LTU    16    98    24    22    29    35    42    25     5    24     0    36    16     0
 LVA     7    59    11    15    10    23    25    28     1    10    32     0     9     0
 NLD     7    53    32    42    37    18    28    13     4    18    14     8     0     0
 CAM     0     0     0     0    21     0    11     0     0    10     0     0     0     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   CAM
-----------------------------------------------------------------------
 CAN     0    68    24     3    69     8    32     0    35    30    13     4     3     0
 DFS    67     0    67   124   166    71   193    95    46   157   102    92    50     0
 GBR    24    62     0    45    70    16    49     5    24    50    21     9    24     0
 NOR     3    96    47     0    69    20    64    18     0    39    25    17    34     0
 USA    68   161    69    71     0    27   119    16    54   105    34    14    34    20
 DEU     8    60    16    19    27     0    43    27     2    22    38    29    17     0
 AUS    32   170    47    54   124    42     0    27    31   130    43    28    26    10
 EST     0    84     5    18    15    26    25     0     0     7    25    36    13     0
 ZAF    36    46    23     0    52     2    33     0     0    31     5     1     3     0
 NZL    30   150    48    38   110    21   135     6    29     0    26    13    16     9
 LTU    12    97    19    22    29    35    42    25     5    24     0    36    15     0
 LVA     4    59     9    15    10    23    25    28     1    10    32     0     8     0
 NLD     3    48    24    34    34    17    24    12     3    15    13     7     0     0
 CAM     0     0     0     0    21     0    11     0     0    10     0     0     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    3  159  116  193  235    2   59   17   65    2   45
FRA    1    0  142   65   12  259    5   55   54    0   90    1
ITA  192  127    0  197   86  829   15  139  107   44  236   23
NLD  142   63  191    0   84  298    7   64   50   48  106   19
CHE  245    9   89   89    0  306    2   31    5   51    2   22
DEA  270  218  733  311  271    0   32  374  184   47  548   24
HUN    0    4   12    7    1   21    0    9    8    0   16    0
SVK   57   45  117   55   26  381    8    0   46   11   94    6
SVN   17   51  102   48    5  170    7   45    0    0   76    0
GBR   83    0   48   48   58   50    0    6    0    0    0   19
HRV    1   82  220  100    2  572   14   74   63    0    0    2
USA   60    1   29   21   21   27    0    5    0   27    2    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  155  104    0  212    2   57   17   24    2   34
FRA    1    0   86   31    1  159    3   39   34    0   58    1
ITA  189   75    0  184    0  828   15  139  107   18  236   23
NLD  126   30  177    0    0  268    7   62   46   17   98   19
CHE    0    1    0    0    0   32    0    0    0    0    0    0
DEA  257  122  733  280   28    0   32  374  184   18  548   24
HUN    0    2   12    7    0   21    0    9    8    0   16    0
SVK   57   31  117   53    0  381    8    0   46    5   94    6
SVN   17   29  102   44    0  170    7   45    0    0   76    0
GBR   32    0   22   20    0   24    0    5    0    0    0   16
HRV    1   51  220   93    0  572   14   74   63    0    0    2
USA   49    1   29   21    0   27    0    5    0   21    2    0
-----------------------------------------------------------------
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