INTRODUCTION

The latest genomic routine international evaluation for conformation traits took place as scheduled at the Interbull Centre. Data from twenty (22) countries were included in this evaluation.

International genetic evaluations for calving traits of bulls from Australia, Belgium, Canada, Switzerland, Czech Republic, Germany, Denmark-Finland-Sweden, Spain, France, United Kingdom, Hungary, Ireland, Italy, Japan, Korea, The Netherlands, Norway, New Zealand, Poland, South Africa, Estonia, Slovenia, Portugal and the United States of America were computed. Holstein data were included in this evaluation.

BEL, CAN, DEU, ESP, FRA, AUS, DFS, GBR, ITA, NLD, POL, HUN submitted GEBVs.

ang: BEL, CAN, DEU, ESP, FRA, , DFS, GBR, ITA, NLD, POL, HUN
bcs: , CAN, DEU, ESP, FRA, , , GBR, ITA, NLD,
bde: BEL, CAN, DEU, ESP, FRA, , DFS, GBR, ITA, NLD, POL, HUN
cwi: BEL, CAN, DEU, ESP, FRA, , DFS, GBR, ITA, NLD, POL, HUN
fan: BEL, CAN, DEU, ESP, FRA, , DFS, GBR, ITA, NLD, POL, HUN
ftl: BEL, CAN, DEU, ESP, FRA, , DFS, GBR, ITA, NLD, POL, HUN
ftp: BEL, CAN, DEU, ESP, FRA, , DFS, GBR, ITA, NLD, POL, HUN
fua: BEL, CAN, DEU, ESP, FRA, , DFS, GBR, ITA, NLD, POL, HUN
loc: BEL, CAN, DEU, ESP, FRA, , DFS, GBR, ITA, NLD,
ocs: BEL, CAN, DEU, ESP, FRA, AUS, , GBR, ITA, NLD, POL, HUN
ofl: BEL, CAN, DEU, ESP, FRA, , DFS, GBR, ITA, NLD, POL, HUN
ous: BEL, CAN, DEU, ESP, FRA, , DFS, GBR, ITA, NLD, POL, HUN
ran: BEL, CAN, DEU, ESP, FRA, , DFS, GBR, ITA, NLD, POL, HUN
rlr: BEL, CAN, DEU, ESP, FRA, , DFS, GBR, ITA, NLD, POL, HUN
rls: BEL, CAN, DEU, ESP, FRA, , DFS, GBR, ITA, NLD, POL, HUN
rtp: BEL, CAN, DEU, ESP, FRA, , DFS, GBR, ITA, NLD, POL
ruh: BEL, CAN, DEU, ESP, FRA, , DFS, GBR, ITA, NLD, POL, HUN
rwi: BEL, CAN, DEU, ESP, FRA, , DFS, GBR, ITA, NLD, POL, HUN
sta: BEL, CAN, DEU, ESP, FRA, , DFS, GBR, ITA, NLD, POL, HUN
ude: BEL, CAN, DEU, ESP, FRA, , DFS, GBR, ITA, NLD, POL, HUN
usu: BEL, CAN, DEU, ESP, FRA, , DFS, GBR, ITA, NLD, POL, HUN

CHANGES IN NATIONAL PROCEDURES

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

NLD (HOL) New added edc from a new validation affecting GREL and SD

BEL (HOL) Same data as August but after correcting some run bugs and removing some previous adjustments

HUN (HOL) Changes affecting genomic EDC

ESP (HOL) Stopped incorporating candidates and culled bulls older than 2 years old in the genomic evaluation

INTERBULL CHANGES COMPARED TO THE AUGUST ROUTINE RUN

Starting with the December 2019 evaluation, the GMACE software was updated to ensure GMACE reliabilities are always at least 1 point higher than the corresponding reliabilities of MACE parent averages. This update affects bulls from countries with extremely low national genomic reliabilities for a given trait. The vast majority of GMACE results were unaffected by the update.

DATA AND METHOD OF ANALYSIS

Eleven Holstein populations sent GEBV data for up to 38 traits, while classical EBVs for the same traits were used in the analyses. Young bull GEBVs from the GEBV providers have been converted to the scales of all countries participating in classical MACE. A bull will get a MACE EBV or a GMACE EBV but not both.
From those eleven countries, National GEBVs of bulls less than seven years of age and with no classical MACE proofs were included for the breeding value prediction

with a further requirement of either a MACE-PA or a GMACE-PA (for young genomic bulls with young genomic sires) being available.

The parameter-space approach is used for the GMACE genetic evaluations (Sullivan, 2016)

SCIENTIFIC LITERATURE

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

Sullivan, P.G. 2016. Defining a Parameter Space for GMACE. Interbull Bulletin 50, p 85-93.

VanRaden, P.M. and Sullivan, P.G. 2010. International genomic evaluation methods for dairy cattle. Gen. Sel. Evol. 42:7

Sullivan, P.G. and Jakobsen, J.H. 2012. Robust GMACE for young bulls methodology. Interbull Bulletin 45, Article 1.

Sullivan, P.G. 2012a. GMACE reliability approximation. Report to the GMACE working group of Interbull. GMACE_rels 2013

Sullivan, P.G. 2012b. GMACE variance estimation. Report to the GMACE working group of Interbull. GMACE_vce 2013

Sullivan, P.G. 2012c. GMACE Weighting Factors. Report to the GMACE working group of Interbull. GMACE_gedcs 2013

Jakobsen, J.H. and Sullivan, P.G. 2013. Trait specific computation of shared reference population. Reference sharing Nov 2013

NEXT ROUTINE INTERNATIONAL EVALUATION

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

NEXT TEST INTERNATIONAL EVALUATION

Dates for next routine 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 minimising the need to resort to conversions.

At the same time, all recipients of Interbull results are expected to honour 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.

Table 1. National evaluation dates in GMACE run December 2019

Country	Date
BEL	20190901
CAN	20191201
DEU	20191203
DFS	20191105
ESP	20191111
FRA	20191204
GBR	20191009
ITA	20191112

NLD 20191201
HUN 20191115
POL 20191031

Table 2.

Number of bulls in reference population for sta

BEL	3142.0										
CAN	1760.0	36025.0									
DEU	1295.0	5126.0	39198.0								
DFS	1094.0	3710.0	35810.0	36808.0							
ESP	1243.0	4070.0	36387.0	36107.0	37386.0						
FRA	1273.0	3769.0	34073.0	33763.0	34297.0	36042.0					
GBR	1336.0	29851.0	5163.0	3752.0	4117.0	3795.0	31512.0				
ITA	1626.0	29916.0	4198.0	2850.0	3124.0	2925.0	28586.0	30262.0			
NLD	1219.0	3733.0	35417.0	35158.0	35656.0	33788.0	3810.0	2855.0	37421.0		
HUN	759.0	1637.0	7184.0	6874.0	7112.0	6857.0	1649.0	1493.0	7088.0	7739.0	
POL	1718.0	3958.0	31455.0	31461.0	31828.0	29969.0	3650.0	3043.0	31097.0	6951.0	33441.0

Number of bulls in reference population for cwi

BEL	3142.0										
CAN	1760.0	36019.0									
DEU	1294.0	5126.0	37984.0								
DFS	1093.0	3710.0	34606.0	35596.0							
ESP	1242.0	4070.0	35177.0	34900.0	36162.0						
FRA	1272.0	3769.0	32886.0	32583.0	33107.0	34842.0					
GBR	1336.0	29845.0	5163.0	3752.0	4117.0	3795.0	31506.0				
ITA	1626.0	29912.0	4198.0	2850.0	3124.0	2925.0	28582.0	30258.0			
NLD	1218.0	3733.0	34230.0	33969.0	34468.0	32627.0	3810.0	2855.0	36232.0		
HUN	759.0	1637.0	6648.0	6336.0	6574.0	6347.0	1649.0	1493.0	6550.0	7200.0	
POL	1717.0	3958.0	30306.0	30311.0	30678.0	28846.0	3650.0	3043.0	29955.0	6412.0	32289.0

Number of bulls in reference population for bde

BEL	3128.0										
CAN	1760.0	36025.0									
DEU	1295.0	5126.0	38640.0								
DFS	1094.0	3710.0	35252.0	36246.0							
ESP	1243.0	4070.0	35830.0	35548.0	36827.0						
FRA	1273.0	3769.0	33542.0	33231.0	33766.0	35510.0					
GBR	1336.0	29851.0	5163.0	3752.0	4117.0	3795.0	31512.0				
ITA	1626.0	29916.0	4198.0	2850.0	3124.0	2925.0	28586.0	30262.0			
NLD	1219.0	3733.0	34859.0	34598.0	35097.0	33256.0	3810.0	2855.0	36861.0		
HUN	759.0	1637.0	6673.0	6361.0	6599.0	6372.0	1649.0	1493.0	6575.0	7225.0	
POL	1718.0	3958.0	30943.0	30947.0	31314.0	29483.0	3650.0	3043.0	30583.0	6437.0	32926.0

Number of bulls in reference population for ang

BEL	3073.0										
CAN	1758.0	35584.0									
DEU	1285.0	5121.0	35429.0								
DFS	1086.0	3705.0	32073.0	33061.0							
ESP	1233.0	4065.0	32624.0	32366.0	33602.0						
FRA	1263.0	3764.0	30388.0	30105.0	30608.0	32340.0					
GBR	1315.0	29835.0	5156.0	3745.0	4110.0	3788.0	30835.0				
ITA	1624.0	29735.0	4193.0	2845.0	3119.0	2920.0	28574.0	30079.0			
NLD	1187.0	3727.0	31678.0	31438.0	31917.0	30131.0	3724.0	2849.0	33217.0		
HUN	750.0	1632.0	4116.0	3824.0	4037.0	3867.0	1642.0	1488.0	4012.0	4626.0	
POL	1706.0	3953.0	27755.0	27779.0	28123.0	26350.0	3642.0	3036.0	27406.0	3876.0	29727.0

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Number of bulls in reference population for        ran
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BEL  3143.0
CAN  1760.0 36025.0
DEU  1295.0  5126.0 39102.0
DFS  1094.0  3710.0 35714.0 36712.0
ESP  1243.0  4070.0 36296.0 36016.0 37295.0
FRA  1273.0  3769.0 33978.0 33668.0 34207.0 35947.0
GBR  1336.0 29851.0  5163.0  3752.0  4117.0  3795.0 31512.0
ITA  1626.0 29916.0  4198.0  2850.0  3124.0  2925.0 28586.0 30262.0
NLD  1219.0  3733.0 35322.0 35063.0 35566.0 33693.0  3810.0  2855.0 37326.0
HUN   759.0  1637.0  7184.0  6874.0  7112.0  6857.0  1649.0  1493.0  7088.0  7739.0
POL  1718.0  3958.0 31452.0 31458.0 31825.0 29966.0  3650.0  3043.0 31094.0  6951.0 33438.0

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Number of bulls in reference population for        rwi
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BEL  3128.0
CAN  1760.0 35203.0
DEU  1295.0  5126.0 39143.0
DFS  1094.0  3710.0 35755.0 36753.0
ESP  1243.0  4070.0 36333.0 36053.0 37332.0
FRA  1273.0  3769.0 34018.0 33708.0 34243.0 35987.0
GBR  1336.0 29851.0  5163.0  3752.0  4117.0  3795.0 31512.0
ITA  1626.0 29916.0  4198.0  2850.0  3124.0  2925.0 28586.0 30262.0
NLD  1219.0  3733.0 35362.0 35103.0 35602.0 33733.0  3810.0  2855.0 37366.0
HUN   759.0  1637.0  7175.0  6865.0  7103.0  6848.0  1649.0  1493.0  7079.0  7730.0
POL  1718.0  3958.0 31445.0 31451.0 31818.0 29959.0  3650.0  3043.0 31087.0  6942.0 33431.0

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Number of bulls in reference population for        rls
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BEL  3143.0
CAN  1760.0 36025.0
DEU  1295.0  5126.0 39199.0
DFS  1094.0  3710.0 35811.0 36809.0
ESP  1243.0  4070.0 36388.0 36108.0 37387.0
FRA  1273.0  3769.0 34074.0 33764.0 34298.0 36043.0
GBR  1336.0 29851.0  5163.0  3752.0  4117.0  3795.0 31512.0
ITA  1626.0 29916.0  4198.0  2850.0  3124.0  2925.0 28586.0 30262.0
NLD  1219.0  3733.0 35418.0 35159.0 35657.0 33789.0  3810.0  2855.0 37422.0
HUN   759.0  1637.0  7184.0  6874.0  7112.0  6857.0  1649.0  1493.0  7088.0  7739.0
POL  1718.0  3958.0 31455.0 31461.0 31828.0 29969.0  3650.0  3043.0 31097.0  6951.0 33441.0

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Number of bulls in reference population for        rlr
-----------------------------------------------------
BEL  3091.0
CAN  1757.0 35096.0
DEU  1289.0  5118.0 37099.0
DFS  1088.0  3702.0 33739.0 34727.0
ESP  1237.0  4062.0 34302.0 34031.0 35284.0
FRA  1267.0  3761.0 32012.0 31725.0 32240.0 33915.0
GBR  1313.0 29024.0  5153.0  3742.0  4107.0  3785.0 30024.0
ITA  1624.0 29082.0  4190.0  2842.0  3116.0  2917.0 27764.0 29426.0
NLD  1191.0  3724.0 33372.0 33112.0 33610.0 31780.0  3721.0  2846.0 34920.0
HUN   756.0  1635.0  6296.0  5985.0  6222.0  6004.0  1646.0  1491.0  6198.0  6847.0
POL  1712.0  3949.0 29445.0 29449.0 29815.0 27994.0  3639.0  3034.0 29099.0  6060.0 31377.0

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Number of bulls in reference population for        fan
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BEL  3103.0
CAN  1758.0 36015.0
DEU  1294.0  5126.0 37008.0
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DFS  1093.0  3710.0 33886.0 34866.0
ESP  1242.0  4070.0 34462.0 34185.0 35455.0
FRA  1272.0  3769.0 32217.0 31908.0 32440.0 34180.0
GBR  1316.0 29842.0  5163.0  3752.0  4117.0  3795.0 30850.0
ITA  1625.0 29909.0  4198.0  2850.0  3124.0  2925.0 28580.0 30255.0
NLD  1196.0  3732.0 33501.0 33244.0 33742.0 31941.0  3731.0  2854.0 35046.0
HUN   758.0  1637.0  6497.0  6186.0  6423.0  6204.0  1649.0  1493.0  6399.0  7048.0
POL  1717.0  3958.0 29591.0 29597.0 29962.0 28174.0  3650.0  3043.0 29239.0  6262.0 31571.0

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Number of bulls in reference population for        hde
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Number of bulls in reference population for        fua
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BEL  3143.0
CAN  1760.0 36024.0
DEU  1295.0  5126.0 38381.0
DFS  1094.0  3710.0 34999.0 35991.0
ESP  1243.0  4070.0 35572.0 35293.0 36563.0
FRA  1273.0  3769.0 33283.0 32977.0 33505.0 35247.0
GBR  1336.0 29850.0  5163.0  3752.0  4117.0  3795.0 31511.0
ITA  1626.0 29915.0  4198.0  2850.0  3124.0  2925.0 28585.0 30261.0
NLD  1219.0  3733.0 34618.0 34357.0 34855.0 33015.0  3810.0  2855.0 36620.0
HUN   759.0  1637.0  6650.0  6338.0  6576.0  6349.0  1649.0  1493.0  6552.0  7202.0
POL  1718.0  3958.0 30652.0 30656.0 31023.0 29192.0  3650.0  3043.0 30297.0  6414.0 32635.0

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Number of bulls in reference population for        ruh
-----------------------------------------------------
BEL  3143.0
CAN  1760.0 36024.0
DEU  1295.0  5126.0 38069.0
DFS  1094.0  3710.0 34682.0 35647.0
ESP  1243.0  4070.0 35260.0 34950.0 36225.0
FRA  1273.0  3769.0 32978.0 32667.0 33201.0 34943.0
GBR  1336.0 29850.0  5163.0  3752.0  4117.0  3795.0 31509.0
ITA  1626.0 29915.0  4198.0  2850.0  3124.0  2925.0 28585.0 30261.0
NLD  1219.0  3733.0 34307.0 34045.0 34545.0 32710.0  3810.0  2855.0 36308.0
HUN   759.0  1637.0  6664.0  6352.0  6590.0  6363.0  1649.0  1493.0  6566.0  7216.0
POL  1718.0  3958.0 30789.0 30793.0 31160.0 29329.0  3650.0  3043.0 30433.0  6429.0 32772.0

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Number of bulls in reference population for        ruw
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Number of bulls in reference population for        usu
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BEL  3143.0
CAN  1760.0 36026.0
DEU  1295.0  5126.0 39197.0
DFS  1094.0  3710.0 35809.0 36807.0
ESP  1243.0  4070.0 36386.0 36106.0 37385.0
FRA  1273.0  3769.0 34072.0 33762.0 34296.0 36041.0
GBR  1336.0 29852.0  5163.0  3752.0  4117.0  3795.0 31513.0
ITA  1626.0 29917.0  4198.0  2850.0  3124.0  2925.0 28587.0 30263.0
NLD  1219.0  3733.0 35416.0 35157.0 35655.0 33787.0  3810.0  2855.0 37420.0
HUN   759.0  1637.0  7183.0  6873.0  7111.0  6856.0  1649.0  1493.0  7087.0  7738.0
POL  1718.0  3958.0 31453.0 31459.0 31826.0 29967.0  3650.0  3043.0 31095.0  6950.0 33439.0

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Number of bulls in reference population for        ude
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BEL  3106.0
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CAN  1758.0 36021.0
DEU  1295.0  5126.0 39196.0
DFS  1094.0  3710.0 35808.0 36806.0
ESP  1243.0  4070.0 36385.0 36105.0 37384.0
FRA  1273.0  3769.0 34072.0 33762.0 34296.0 36041.0
GBR  1316.0 29847.0  5163.0  3752.0  4117.0  3795.0 30855.0
ITA  1625.0 29915.0  4198.0  2850.0  3124.0  2925.0 28585.0 30261.0
NLD  1197.0  3732.0 35415.0 35156.0 35654.0 33787.0  3731.0  2854.0 36967.0
HUN   759.0  1637.0  7184.0  6874.0  7112.0  6857.0  1649.0  1493.0  7088.0  7739.0
POL  1718.0  3958.0 31453.0 31459.0 31826.0 29968.0  3650.0  3043.0 31095.0  6951.0 33439.0

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Number of bulls in reference population for        ftp
--------------------------------------------------------
BEL  3143.0
CAN  1760.0 36025.0
DEU  1295.0  5126.0 39151.0
DFS  1094.0  3710.0 35763.0 36761.0
ESP  1243.0  4070.0 36341.0 36061.0 37340.0
FRA  1273.0  3769.0 34026.0 33716.0 34251.0 35995.0
GBR  1336.0 29851.0  5163.0  3752.0  4117.0  3795.0 31512.0
ITA  1626.0 29916.0  4198.0  2850.0  3124.0  2925.0 28586.0 30262.0
NLD  1219.0  3733.0 35370.0 35111.0 35610.0 33741.0  3810.0  2855.0 37374.0
HUN   759.0  1637.0  7183.0  6873.0  7111.0  6856.0  1649.0  1493.0  7087.0  7738.0
POL  1718.0  3958.0 31453.0 31459.0 31826.0 29967.0  3650.0  3043.0 31095.0  6950.0 33439.0

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Number of bulls in reference population for        ftl
--------------------------------------------------------
BEL  3106.0
CAN  1758.0 36010.0
DEU  1295.0  5126.0 39196.0
DFS  1094.0  3710.0 35808.0 36806.0
ESP  1243.0  4070.0 36385.0 36105.0 37384.0
FRA  1273.0  3769.0 34072.0 33762.0 34296.0 36041.0
GBR  1316.0 29848.0  5163.0  3752.0  4117.0  3795.0 30856.0
ITA  1625.0 29916.0  4198.0  2850.0  3124.0  2925.0 28586.0 30262.0
NLD  1197.0  3732.0 35415.0 35156.0 35654.0 33787.0  3731.0  2854.0 36967.0
HUN   759.0  1637.0  7184.0  6874.0  7112.0  6857.0  1649.0  1493.0  7088.0  7739.0
POL  1718.0  3958.0 31453.0 31459.0 31826.0 29968.0  3650.0  3043.0 31095.0  6951.0 33439.0

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Number of bulls in reference population for        rtp
--------------------------------------------------------
BEL  3124.0
CAN  1760.0 32912.0
DEU  1293.0  5120.0 36864.0
DFS  1092.0  3704.0 33482.0 34387.0
ESP  1241.0  4064.0 34057.0 33696.0 34971.0
FRA  1271.0  3763.0 31828.0 31467.0 31999.0 33742.0
GBR  1334.0 28004.0  5157.0  3746.0  4111.0  3789.0 29660.0
ITA  1626.0 28005.0  4193.0  2845.0  3119.0  2920.0 26842.0 28352.0
NLD  1217.0  3709.0 33111.0 32801.0 33296.0 31514.0  3786.0  2832.0 34909.0
POL  1715.0  3951.0 29944.0 29892.0 30262.0 28460.0  3643.0  3037.0 29535.0 31801.0

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Number of bulls in reference population for        ocs
--------------------------------------------------------
AUS  2899.0
BEL   438.0  3127.0
CAN  1068.0  1760.0 35994.0
DEU   752.0  1294.0  5123.0 38540.0
ESP   709.0  1242.0  4067.0 35732.0 36718.0
FRA   706.0  1272.0  3767.0 33416.0 33637.0 35369.0
GBR  1208.0  1336.0 29824.0  5161.0  4115.0  3794.0 31485.0
ITA   860.0  1626.0 29892.0  4196.0  3122.0  2924.0 28562.0 30238.0
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NLD   764.0  1218.0  3732.0 34790.0 35028.0 33161.0  3809.0  2854.0 36789.0
HUN   579.0   759.0  1637.0  7184.0  7112.0  6857.0  1649.0  1493.0  7088.0  7739.0
POL   658.0  1717.0  3955.0 30817.0 31190.0 29332.0  3648.0  3041.0 30471.0  6951.0 32802.0

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Number of bulls in reference population for        ous
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BEL  3122.0
CAN  1760.0 36024.0
DEU  1295.0  5126.0 39197.0
DFS  1094.0  3710.0 35809.0 36807.0
ESP  1243.0  4070.0 36386.0 36106.0 37385.0
FRA  1273.0  3769.0 34072.0 33762.0 34296.0 36037.0
GBR  1335.0 29850.0  5163.0  3752.0  4117.0  3795.0 31506.0
ITA  1626.0 29915.0  4198.0  2850.0  3124.0  2925.0 28585.0 30261.0
NLD  1219.0  3733.0 35418.0 35159.0 35657.0 33789.0  3810.0  2855.0 37421.0
HUN   759.0  1637.0  7184.0  6874.0  7112.0  6857.0  1649.0  1493.0  7088.0  7739.0
POL  1718.0  3958.0 31453.0 31459.0 31826.0 29967.0  3650.0  3043.0 31097.0  6951.0 33439.0

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Number of bulls in reference population for        ofl
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BEL  3085.0
CAN  1758.0 35878.0
DEU  1294.0  5127.0 38562.0
DFS  1093.0  3710.0 35183.0 36178.0
ESP  1242.0  4070.0 35753.0 35478.0 36740.0
FRA  1272.0  3769.0 33437.0 33135.0 33658.0 35390.0
GBR  1315.0 29724.0  5164.0  3752.0  4117.0  3795.0 30728.0
ITA  1625.0 29808.0  4198.0  2850.0  3124.0  2925.0 28478.0 30154.0
NLD  1196.0  3732.0 34809.0 34550.0 35048.0 33181.0  3731.0  2854.0 36336.0
HUN   759.0  1637.0  7183.0  6873.0  7111.0  6856.0  1649.0  1493.0  7087.0  7738.0
POL  1717.0  3958.0 30838.0 30845.0 31212.0 29353.0  3650.0  3043.0 30491.0  6950.0 32824.0

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Number of bulls in reference population for        loc
-------------------------------------------------------
BEL  3061.0
CAN  1750.0 29944.0
DEU  1289.0  5059.0 32454.0
DFS  1088.0  3640.0 29313.0 30054.0
ESP  1237.0  4000.0 30033.0 29585.0 30802.0
FRA  1267.0  3700.0 27879.0 27427.0 28107.0 29567.0
GBR  1310.0 27330.0  5106.0  3694.0  4059.0  3739.0 28306.0
ITA  1616.0 27316.0  4151.0  2804.0  3078.0  2881.0 26303.0 27595.0
NLD  1190.0  3669.0 29315.0 28930.0 29580.0 27691.0  3678.0  2809.0 30669.0
HUN   755.0  1631.0  5476.0  5171.0  5400.0  5208.0  1641.0  1488.0  5378.0  6022.0

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Number of bulls in reference population for        bcs
-------------------------------------------------------
BEL  2941.0
DEU  1279.0 28832.0
FRA  1257.0 24402.0 25885.0
GBR  1295.0  5073.0  3704.0 26773.0
ITA  1615.0  4137.0  2867.0 24798.0 26332.0
NLD  1177.0 25818.0 24284.0  3636.0  2788.0 27144.0
CAN  1747.0  5005.0  3638.0 25834.0 26064.0  3603.0 30237.0
ESP  1226.0 26466.0 24640.0  4024.0  3065.0 26071.0  3937.0 27171.0
HUN   753.0  6272.0  5988.0  1641.0  1485.0  6175.0  1629.0  6200.0  6822.0
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