

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:

DEU (HOL) Base change
CAN (HOL) Base change
ITA (HOL) Base change
GBR (HOL) Base change
FRA (HOL) Base change
NLD (HOL)
POL (HOL) Base change

INTERBULL CHANGES COMPARED TO THE DECEMBER ROUTINE RUN

No changes in Interbull procedures

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 April 2020

Country	Date
BEL	20190901
CAN	20200401
DEU	20200407
DFS	20200302
ESP	20200317
FRA	20200408
GBR	20200225
ITA	20200309
NLD	20200401
HUN	20200323

Table 2.

Number of bulls in reference population for sta

BEL	3169.0												
CAN	1771.0	36355.0											
DEU	1314.0	5412.0	39593.0										
DFS	1098.0	3733.0	35930.0	36787.0									
ESP	1244.0	4101.0	36549.0	36080.0	37371.0								
FRA	1280.0	3856.0	34198.0	33750.0	34269.0	36140.0							
GBR	1350.0	30140.0	5471.0	3776.0	4143.0	3874.0	31896.0						
ITA	1626.0	29848.0	4307.0	2852.0	3132.0	2930.0	28532.0	30146.0					
NLD	1232.0	3848.0	35657.0	35237.0	35714.0	33965.0	3946.0	2858.0	37697.0				
HUN	776.0	1702.0	7302.0	6940.0	7180.0	6927.0	1717.0	1525.0	7169.0	7850.0			
POL	1732.0	4063.0	31607.0	31487.0	31834.0	30062.0	3780.0	3044.0	31259.0	7030.0	33618.0		

Number of bulls in reference population for cwi

BEL	3169.0												
CAN	1771.0	36348.0											
DEU	1313.0	5411.0	38373.0										
DFS	1097.0	3733.0	34722.0	35571.0									
ESP	1243.0	4100.0	35334.0	34869.0	36142.0								
FRA	1279.0	3856.0	33007.0	32566.0	33075.0	34936.0							
GBR	1350.0	30133.0	5470.0	3776.0	4142.0	3874.0	31889.0						
ITA	1626.0	29844.0	4307.0	2852.0	3132.0	2930.0	28528.0	30142.0					
NLD	1231.0	3847.0	34465.0	34044.0	34521.0	32800.0	3945.0	2858.0	36503.0				
HUN	776.0	1702.0	6766.0	6402.0	6642.0	6417.0	1717.0	1525.0	6631.0	7311.0			
POL	1731.0	4063.0	30454.0	30333.0	30680.0	28935.0	3780.0	3044.0	30113.0	6491.0	32462.0		

Number of bulls in reference population for bde

BEL	3154.0												
CAN	1771.0	36354.0											
DEU	1314.0	5411.0	39033.0										
DFS	1098.0	3733.0	35371.0	36224.0									
ESP	1244.0	4100.0	35990.0	35520.0	36810.0								
FRA	1280.0	3856.0	33666.0	33217.0	33737.0	35607.0							
GBR	1350.0	30139.0	5470.0	3776.0	4142.0	3874.0	31895.0						
ITA	1626.0	29848.0	4307.0	2852.0	3132.0	2930.0	28532.0	30146.0					
NLD	1232.0	3847.0	35097.0	34676.0	35153.0	33432.0	3945.0	2858.0	37135.0				
HUN	776.0	1702.0	6791.0	6427.0	6667.0	6442.0	1717.0	1525.0	6656.0	7336.0			
POL	1732.0	4063.0	31094.0	30972.0	31319.0	29575.0	3780.0	3044.0	30744.0	6516.0	33102.0		

Number of bulls in reference population for ang

BEL	3098.0												
CAN	1769.0	35911.0											
DEU	1303.0	5406.0	35808.0										
DFS	1089.0	3728.0	32179.0	33026.0									
ESP	1233.0	4095.0	32771.0	32325.0	33571.0								
FRA	1269.0	3851.0	30500.0	30079.0	30567.0	32425.0							
GBR	1329.0	30121.0	5463.0	3769.0	4135.0	3867.0	31216.0						
ITA	1624.0	29666.0	4302.0	2847.0	3127.0	2925.0	28519.0	29962.0					
NLD	1198.0	3840.0	31903.0	31503.0	31959.0	30295.0	3858.0	2852.0	33475.0				
HUN	766.0	1697.0	4224.0	3880.0	4095.0	3928.0	1710.0	1520.0	4083.0	4727.0			
POL	1719.0	4058.0	27893.0	27791.0	28114.0	26430.0	3772.0	3037.0	27553.0	3945.0	29889.0		

Number of bulls in reference population for ran

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BEL 3170.0
CAN 1771.0 36354.0
DEU 1314.0 5411.0 39496.0
DFS 1098.0 3733.0 35834.0 36691.0
ESP 1244.0 4100.0 36457.0 35989.0 37279.0
FRA 1280.0 3856.0 34103.0 33655.0 34179.0 36045.0
GBR 1350.0 30139.0 5470.0 3776.0 4142.0 3874.0 31895.0
ITA 1626.0 29848.0 4307.0 2852.0 3132.0 2930.0 28532.0 30146.0
NLD 1232.0 3847.0 35561.0 35142.0 35623.0 33870.0 3945.0 2858.0 37601.0
HUN 776.0 1702.0 7302.0 6940.0 7180.0 6927.0 1717.0 1525.0 7169.0 7850.0
POL 1732.0 4063.0 31604.0 31484.0 31831.0 30059.0 3780.0 3044.0 31256.0 7030.0 33615.0

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Number of bulls in reference population for      rwi
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BEL 3154.0
CAN 1771.0 35532.0
DEU 1314.0 5411.0 39537.0
DFS 1098.0 3733.0 35875.0 36732.0
ESP 1244.0 4100.0 36494.0 36026.0 37316.0
FRA 1280.0 3856.0 34143.0 33695.0 34215.0 36085.0
GBR 1350.0 30139.0 5470.0 3776.0 4142.0 3874.0 31894.0
ITA 1626.0 29848.0 4307.0 2852.0 3132.0 2930.0 28532.0 30146.0
NLD 1232.0 3847.0 35601.0 35182.0 35659.0 33910.0 3945.0 2858.0 37641.0
HUN 776.0 1702.0 7293.0 6931.0 7171.0 6918.0 1717.0 1525.0 7160.0 7841.0
POL 1732.0 4063.0 31597.0 31477.0 31824.0 30052.0 3780.0 3044.0 31249.0 7021.0 33608.0

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Number of bulls in reference population for      rls
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BEL 3170.0
CAN 1771.0 36354.0
DEU 1314.0 5411.0 39593.0
DFS 1098.0 3733.0 35931.0 36788.0
ESP 1244.0 4100.0 36549.0 36081.0 37371.0
FRA 1280.0 3856.0 34199.0 33751.0 34270.0 36141.0
GBR 1350.0 30139.0 5470.0 3776.0 4142.0 3874.0 31895.0
ITA 1626.0 29848.0 4307.0 2852.0 3132.0 2930.0 28532.0 30146.0
NLD 1232.0 3847.0 35657.0 35238.0 35714.0 33966.0 3945.0 2858.0 37697.0
HUN 776.0 1702.0 7302.0 6940.0 7180.0 6927.0 1717.0 1525.0 7169.0 7850.0
POL 1732.0 4063.0 31607.0 31487.0 31834.0 30062.0 3780.0 3044.0 31259.0 7030.0 33618.0

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Number of bulls in reference population for      rlr
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BEL 3118.0
CAN 1768.0 35424.0
DEU 1308.0 5404.0 37486.0
DFS 1092.0 3725.0 33852.0 34699.0
ESP 1238.0 4092.0 34456.0 33997.0 35260.0
FRA 1274.0 3848.0 32131.0 31706.0 32206.0 34007.0
GBR 1327.0 29297.0 5461.0 3766.0 4132.0 3864.0 30392.0
ITA 1624.0 29014.0 4300.0 2844.0 3124.0 2922.0 27697.0 29310.0
NLD 1203.0 3837.0 33604.0 33184.0 33659.0 31951.0 3855.0 2849.0 35185.0
HUN 773.0 1700.0 6411.0 6048.0 6287.0 6072.0 1714.0 1523.0 6276.0 6955.0
POL 1726.0 4054.0 29590.0 29468.0 29813.0 28081.0 3769.0 3035.0 29253.0 6136.0 31545.0

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Number of bulls in reference population for      fan
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BEL 3130.0
CAN 1769.0 36337.0
DEU 1313.0 5411.0 37434.0
DFS 1097.0 3733.0 34036.0 34875.0
ESP 1243.0 4100.0 34653.0 34188.0 35469.0

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FRA	1279.0	3856.0	32369.0	31922.0	32439.0	34305.0				
GBR	1330.0	30123.0	5470.0	3776.0	4142.0	3874.0	31226.0			
ITA	1625.0	29835.0	4307.0	2852.0	3132.0	2930.0	28520.0	30133.0		
NLD	1208.0	3845.0	33770.0	33353.0	33829.0	32145.0	3865.0	2857.0	35349.0	
HUN	775.0	1702.0	6614.0	6251.0	6490.0	6273.0	1717.0	1525.0	6479.0	7158.0
POL	1731.0	4063.0	29772.0	29652.0	29997.0	28293.0	3780.0	3044.0	29430.0	6340.0 31777.0

Number of bulls in reference population for hde

Number of bulls in reference population for fua

BEL	3170.0									
CAN	1771.0	36353.0								
DEU	1314.0	5411.0	38773.0							
DFS	1098.0	3733.0	35118.0	35969.0						
ESP	1244.0	4100.0	35732.0	35265.0	36546.0					
FRA	1280.0	3856.0	33407.0	32963.0	33476.0	35344.0				
GBR	1350.0	30138.0	5470.0	3776.0	4142.0	3874.0	31894.0			
ITA	1626.0	29847.0	4307.0	2852.0	3132.0	2930.0	28531.0	30145.0		
NLD	1232.0	3847.0	34856.0	34435.0	34911.0	33191.0	3945.0	2858.0	36894.0	
HUN	776.0	1702.0	6768.0	6404.0	6644.0	6419.0	1717.0	1525.0	6633.0	7313.0
POL	1732.0	4063.0	30803.0	30681.0	31028.0	29284.0	3780.0	3044.0	30458.0	6493.0 32811.0

Number of bulls in reference population for ruh

BEL	3170.0									
CAN	1771.0	36353.0								
DEU	1314.0	5411.0	38462.0							
DFS	1098.0	3733.0	34801.0	35625.0						
ESP	1244.0	4100.0	35420.0	34922.0	36208.0					
FRA	1280.0	3856.0	33102.0	32653.0	33172.0	35040.0				
GBR	1350.0	30138.0	5470.0	3776.0	4142.0	3874.0	31892.0			
ITA	1626.0	29847.0	4307.0	2852.0	3132.0	2930.0	28531.0	30145.0		
NLD	1232.0	3847.0	34535.0	34113.0	34591.0	32876.0	3945.0	2858.0	36572.0	
HUN	776.0	1702.0	6781.0	6417.0	6657.0	6432.0	1717.0	1525.0	6646.0	7326.0
POL	1732.0	4063.0	30940.0	30818.0	31165.0	29421.0	3780.0	3044.0	30594.0	6508.0 32948.0

Number of bulls in reference population for ruw

Number of bulls in reference population for usu

BEL	3170.0									
CAN	1771.0	36355.0								
DEU	1314.0	5411.0	39591.0							
DFS	1098.0	3733.0	35929.0	36786.0						
ESP	1244.0	4100.0	36547.0	36079.0	37369.0					
FRA	1280.0	3856.0	34197.0	33749.0	34268.0	36139.0				
GBR	1350.0	30140.0	5470.0	3776.0	4142.0	3874.0	31896.0			
ITA	1626.0	29849.0	4307.0	2852.0	3132.0	2930.0	28533.0	30147.0		
NLD	1232.0	3847.0	35655.0	35236.0	35712.0	33964.0	3945.0	2858.0	37695.0	
HUN	776.0	1702.0	7301.0	6939.0	7179.0	6926.0	1717.0	1525.0	7168.0	7849.0
POL	1732.0	4063.0	31605.0	31485.0	31832.0	30060.0	3780.0	3044.0	31257.0	7029.0 33616.0

Number of bulls in reference population for ude

BEL	3133.0									
CAN	1769.0	36349.0								
DEU	1314.0	5411.0	39590.0							

DFS	1098.0	3733.0	35928.0	36785.0											
ESP	1244.0	4100.0	36546.0	36078.0	37368.0										
FRA	1280.0	3856.0	34197.0	33749.0	34268.0	36139.0									
GBR	1330.0	30134.0	5470.0	3776.0	4142.0	3874.0	31237.0								
ITA	1625.0	29847.0	4307.0	2852.0	3132.0	2930.0	28531.0	30145.0							
NLD	1209.0	3845.0	35654.0	35235.0	35711.0	33964.0	3865.0	2857.0	37240.0						
HUN	776.0	1702.0	7302.0	6940.0	7180.0	6927.0	1717.0	1525.0	7169.0	7850.0					
POL	1732.0	4063.0	31605.0	31485.0	31832.0	30061.0	3780.0	3044.0	31257.0	7030.0	33616.0				

Number of bulls in reference population for ftp

BEL	3170.0														
CAN	1771.0	36355.0													
DEU	1314.0	5412.0	39546.0												
DFS	1098.0	3733.0	35883.0	36740.0											
ESP	1244.0	4100.0	36502.0	36034.0	37324.0										
FRA	1280.0	3856.0	34151.0	33703.0	34223.0	36093.0									
GBR	1350.0	30140.0	5471.0	3776.0	4142.0	3874.0	31896.0								
ITA	1626.0	29849.0	4308.0	2852.0	3132.0	2930.0	28533.0	30147.0							
NLD	1232.0	3847.0	35609.0	35190.0	35667.0	33918.0	3945.0	2858.0	37649.0						
HUN	776.0	1702.0	7301.0	6939.0	7179.0	6926.0	1717.0	1525.0	7168.0	7849.0					
POL	1732.0	4063.0	31605.0	31485.0	31832.0	30060.0	3780.0	3044.0	31257.0	7029.0	33616.0				

Number of bulls in reference population for ftl

BEL	3133.0														
CAN	1769.0	36342.0													
DEU	1314.0	5414.0	39594.0												
DFS	1098.0	3733.0	35928.0	36785.0											
ESP	1244.0	4100.0	36546.0	36078.0	37368.0										
FRA	1280.0	3857.0	34197.0	33749.0	34268.0	36140.0									
GBR	1330.0	30138.0	5473.0	3776.0	4142.0	3875.0	31242.0								
ITA	1625.0	29850.0	4310.0	2852.0	3132.0	2931.0	28534.0	30149.0							
NLD	1209.0	3845.0	35654.0	35235.0	35711.0	33964.0	3865.0	2857.0	37240.0						
HUN	776.0	1704.0	7302.0	6940.0	7180.0	6928.0	1719.0	1526.0	7169.0	7852.0					
POL	1732.0	4063.0	31605.0	31485.0	31832.0	30061.0	3780.0	3044.0	31257.0	7030.0	33616.0				

Number of bulls in reference population for rtp

BEL	3151.0														
CAN	1771.0	33246.0													
DEU	1312.0	5408.0	37286.0												
DFS	1096.0	3727.0	33624.0	34388.0											
ESP	1242.0	4094.0	34240.0	33691.0	34977.0										
FRA	1278.0	3851.0	31971.0	31472.0	31989.0	33859.0									
GBR	1348.0	28296.0	5467.0	3770.0	4136.0	3869.0	30047.0								
ITA	1626.0	27939.0	4305.0	2847.0	3127.0	2926.0	26789.0	28238.0							
NLD	1230.0	3823.0	33350.0	32880.0	33353.0	31688.0	3921.0	2835.0	35183.0						
POL	1729.0	4056.0	30117.0	29939.0	30289.0	28570.0	3773.0	3038.0	29718.0	31999.0					

Number of bulls in reference population for ocs

AUS	2900.0														
BEL	438.0	3153.0													
CAN	1068.0	1771.0	36322.0												
DEU	766.0	1313.0	5407.0	38930.0											
ESP	709.0	1243.0	4097.0	35890.0	36699.0										
FRA	708.0	1279.0	3854.0	33538.0	33606.0	35464.0									
GBR	1207.0	1350.0	30111.0	5467.0	4140.0	3873.0	31867.0								
ITA	860.0	1626.0	29823.0	4304.0	3130.0	2929.0	28507.0	30121.0							
NLD	765.0	1231.0	3846.0	35026.0	35082.0	33335.0	3944.0	2857.0	37061.0						
HUN	586.0	776.0	1702.0	7302.0	7180.0	6927.0	1717.0	1525.0	7169.0	7850.0					

POL 657.0 1731.0 4060.0 30966.0 31193.0 29422.0 3778.0 3042.0 30630.0 7030.0 32976.0

Number of bulls in reference population for ous

BEL 3148.0
CAN 1771.0 36353.0
DEU 1314.0 5411.0 39591.0
DFS 1098.0 3733.0 35929.0 36786.0
ESP 1244.0 4100.0 36547.0 36079.0 37369.0
FRA 1280.0 3856.0 34197.0 33749.0 34268.0 36135.0
GBR 1349.0 30138.0 5470.0 3776.0 4142.0 3874.0 31889.0
ITA 1626.0 29847.0 4307.0 2852.0 3132.0 2930.0 28531.0 30145.0
NLD 1232.0 3847.0 35657.0 35238.0 35714.0 33966.0 3945.0 2858.0 37696.0
HUN 776.0 1702.0 7302.0 6940.0 7180.0 6927.0 1717.0 1525.0 7169.0 7850.0
POL 1732.0 4063.0 31605.0 31485.0 31832.0 30060.0 3780.0 3044.0 31259.0 7030.0 33616.0

Number of bulls in reference population for ofl

BEL 3111.0
CAN 1769.0 36206.0
DEU 1313.0 5412.0 38952.0
DFS 1097.0 3733.0 35300.0 36154.0
ESP 1243.0 4100.0 35911.0 35448.0 36721.0
FRA 1279.0 3856.0 33559.0 33119.0 33627.0 35485.0
GBR 1329.0 30011.0 5471.0 3776.0 4142.0 3874.0 31109.0
ITA 1625.0 29740.0 4307.0 2852.0 3132.0 2930.0 28424.0 30038.0
NLD 1208.0 3845.0 35045.0 34626.0 35102.0 33355.0 3865.0 2857.0 36606.0
HUN 776.0 1702.0 7301.0 6939.0 7179.0 6926.0 1717.0 1525.0 7168.0 7849.0
POL 1731.0 4063.0 30987.0 30868.0 31215.0 29443.0 3780.0 3044.0 30650.0 7029.0 32998.0

Number of bulls in reference population for loc

BEL 3088.0
CAN 1761.0 30364.0
DEU 1308.0 5342.0 32840.0
DFS 1092.0 3663.0 29433.0 30064.0
ESP 1238.0 4030.0 30195.0 29589.0 30818.0
FRA 1274.0 3784.0 28022.0 27444.0 28110.0 29685.0
GBR 1325.0 27698.0 5407.0 3716.0 4082.0 3816.0 28766.0
ITA 1616.0 27345.0 4259.0 2805.0 3085.0 2885.0 26333.0 27619.0
NLD 1202.0 3779.0 29577.0 29041.0 29670.0 27890.0 3809.0 2811.0 30961.0
HUN 772.0 1694.0 5583.0 5227.0 5457.0 5267.0 1707.0 1520.0 5447.0 6120.0

Number of bulls in reference population for bcs

BEL 3005.0
DEU 1297.0 29214.0
FRA 1263.0 24538.0 25993.0
GBR 1332.0 5374.0 3782.0 27884.0
ITA 1616.0 4245.0 2871.0 24830.0 26357.0
NLD 1213.0 26022.0 24418.0 3849.0 2791.0 27819.0
CAN 1760.0 5286.0 3719.0 26205.0 26094.0 3710.0 30657.0
ESP 1227.0 26630.0 24647.0 4048.0 3072.0 26114.0 3966.0 27195.0
HUN 770.0 6379.0 6047.0 1707.0 1517.0 6244.0 1692.0 6257.0 6920.0