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, CZE submitted GEBVs.

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

CHANGES IN NATIONAL PROCEDURES

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

ESP (HOL) Base change

HUN (HOL) Changes affecting GREL

CZE (HOL) First participation

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 August 2020

Country	Date
BEL	20190901
CAN	20200801
DEU	20200811
DFS	20200811
ESP	20200721
FRA	20200812
GBR	20200616
ITA	20200714
NLD	20200811
HUN	20200723
POL	20200630
CZE	20200723

Table 2.

Number of bulls in reference population for	sta										
BEL	3172.0										
CAN	1777.0	36767.0									
DEU	1329.0	5872.0	40223.0								
DFS	1110.0	3987.0	36257.0	37273.0							
ESP	1284.0	4569.0	37082.0	36536.0	38121.0						
FRA	1285.0	3930.0	34409.0	33960.0	34581.0	36271.0					
GBR	1361.0	30503.0	5955.0	4074.0	4671.0	3951.0	32443.0				
ITA	1660.0	30811.0	5149.0	3216.0	3745.0	3135.0	29522.0	31347.0			
NLD	1233.0	3940.0	35918.0	35563.0	36119.0	34085.0	4064.0	3143.0	37913.0		
HUN	792.0	1769.0	7412.0	7015.0	7317.0	6979.0	1795.0	1682.0	7238.0	7963.0	
POL	1736.0	4182.0	31877.0	31825.0	32251.0	30183.0	3917.0	3310.0	31454.0	7088.0	33854.0
CZE	1387.0	1388.0	1801.0	1515.0	1717.0	1631.0	1293.0	1204.0	1640.0	1185.0	2326.0	3161.0

Number of bulls in reference population for	cwi										
BEL	3172.0										
CAN	1777.0	36763.0									
DEU	1328.0	5874.0	39006.0								
DFS	1109.0	3989.0	35051.0	36059.0							
ESP	1283.0	4571.0	35870.0	35327.0	36895.0						
FRA	1284.0	3931.0	33219.0	32777.0	33388.0	35068.0					
GBR	1361.0	30499.0	5957.0	4076.0	4673.0	3952.0	32439.0				
ITA	1660.0	30810.0	5151.0	3218.0	3747.0	3136.0	29521.0	31346.0			
NLD	1232.0	3942.0	34729.0	34372.0	34929.0	32921.0	4066.0	3145.0	36722.0		
HUN	792.0	1770.0	6877.0	6478.0	6780.0	6470.0	1796.0	1683.0	6701.0	7425.0	
POL	1735.0	4183.0	30725.0	30672.0	31098.0	29057.0	3918.0	3311.0	30309.0	6550.0	32699.0
CZE	1386.0	1388.0	1798.0	1512.0	1714.0	1628.0	1293.0	1204.0	1638.0	1184.0	2323.0	3158.0

Number of bulls in reference population for	bde										
BEL	3157.0										
CAN	1777.0	36767.0									
DEU	1329.0	5872.0	39664.0								
DFS	1110.0	3987.0	35698.0	36710.0							
ESP	1284.0	4569.0	36524.0	35976.0	37561.0						
FRA	1285.0	3930.0	33877.0	33427.0	34049.0	35738.0					
GBR	1361.0	30503.0	5955.0	4074.0	4671.0	3951.0	32443.0				
ITA	1660.0	30811.0	5149.0	3216.0	3745.0	3135.0	29522.0	31347.0			
NLD	1233.0	3940.0	35359.0	35002.0	35559.0	33552.0	4064.0	3143.0	37352.0		
HUN	792.0	1769.0	6901.0	6502.0	6804.0	6494.0	1795.0	1682.0	6725.0	7449.0	
POL	1736.0	4182.0	31364.0	31310.0	31736.0	29696.0	3917.0	3310.0	30939.0	6574.0	33338.0
CZE	1387.0	1388.0	1800.0	1514.0	1716.0	1630.0	1293.0	1204.0	1639.0	1184.0	2325.0	3160.0

Number of bulls in reference population for	ang										
BEL	3103.0										
CAN	1774.0	36323.0									
DEU	1319.0	5868.0	36454.0								
DFS	1102.0	3983.0	32521.0	33527.0							
ESP	1274.0	4565.0	33320.0	32796.0	34337.0						
FRA	1275.0	3925.0	30725.0	30303.0	30893.0	32570.0					
GBR	1340.0	30486.0	5950.0	4069.0	4666.0	3945.0	31676.0				
ITA	1658.0	30619.0	5144.0	3211.0	3740.0	3129.0	29511.0	31149.0			
NLD	1200.0	3933.0	32180.0	31844.0	32380.0	30429.0	3977.0	3137.0	33706.0		
HUN	783.0	1764.0	4346.0	3967.0	4244.0	3992.0	1789.0	1676.0	4164.0	4852.0	
POL	1725.0	4177.0	28177.0	28143.0	28545.0	26565.0	3910.0	3302.0	27762.0	4015.0	30141.0
CZE	1378.0	1385.0	1761.0	1481.0	1677.0	1593.0	1292.0	1198.0	1601.0	1147.0	2283.0	3111.0

Number of bulls in reference population for ran

BEL	3173.0											
CAN	1777.0	36767.0										
DEU	1329.0	5872.0	40127.0									
DFS	1110.0	3987.0	36161.0	37177.0								
ESP	1284.0	4569.0	36991.0	36445.0	38030.0							
FRA	1285.0	3930.0	34314.0	33865.0	34491.0	36176.0						
GBR	1361.0	30503.0	5955.0	4074.0	4671.0	3951.0	32443.0					
ITA	1660.0	30811.0	5149.0	3216.0	3745.0	3135.0	29522.0	31347.0				
NLD	1233.0	3940.0	35823.0	35468.0	36029.0	33990.0	4064.0	3143.0	37818.0			
HUN	792.0	1769.0	7412.0	7015.0	7317.0	6979.0	1795.0	1682.0	7238.0	7963.0		
POL	1736.0	4182.0	31874.0	31822.0	32248.0	30180.0	3917.0	3310.0	31451.0	7088.0	33851.0	
CZE	1387.0	1388.0	1801.0	1515.0	1717.0	1631.0	1293.0	1204.0	1640.0	1185.0	2326.0	3161.0

Number of bulls in reference population for rwi

BEL	3157.0											
CAN	1777.0	35944.0										
DEU	1329.0	5872.0	40168.0									
DFS	1110.0	3987.0	36202.0	37218.0								
ESP	1284.0	4569.0	37028.0	36482.0	38067.0							
FRA	1285.0	3930.0	34354.0	33905.0	34527.0	36216.0						
GBR	1361.0	30502.0	5955.0	4074.0	4671.0	3951.0	32442.0					
ITA	1660.0	30811.0	5149.0	3216.0	3745.0	3135.0	29522.0	31347.0				
NLD	1233.0	3940.0	35863.0	35508.0	36065.0	34030.0	4064.0	3143.0	37858.0			
HUN	792.0	1769.0	7403.0	7006.0	7308.0	6970.0	1795.0	1682.0	7229.0	7954.0		
POL	1736.0	4182.0	31867.0	31815.0	32241.0	30173.0	3917.0	3310.0	31444.0	7079.0	33844.0	
CZE	1387.0	1388.0	1801.0	1515.0	1717.0	1631.0	1293.0	1204.0	1640.0	1185.0	2326.0	3161.0

Number of bulls in reference population for rls

BEL	3173.0											
CAN	1777.0	36768.0										
DEU	1329.0	5873.0	40225.0									
DFS	1110.0	3988.0	36259.0	37275.0								
ESP	1284.0	4570.0	37084.0	36538.0	38123.0							
FRA	1285.0	3930.0	34410.0	33961.0	34582.0	36272.0						
GBR	1361.0	30504.0	5956.0	4075.0	4672.0	3951.0	32444.0					
ITA	1660.0	30812.0	5150.0	3217.0	3746.0	3135.0	29523.0	31348.0				
NLD	1233.0	3941.0	35920.0	35565.0	36121.0	34086.0	4065.0	3144.0	37915.0			
HUN	792.0	1769.0	7412.0	7015.0	7317.0	6979.0	1795.0	1682.0	7238.0	7963.0		
POL	1736.0	4182.0	31877.0	31825.0	32251.0	30183.0	3917.0	3310.0	31454.0	7088.0	33854.0	
CZE	1387.0	1388.0	1801.0	1515.0	1717.0	1631.0	1293.0	1204.0	1640.0	1185.0	2326.0	3161.0

Number of bulls in reference population for rlr

BEL	3121.0											
CAN	1773.0	35836.0										
DEU	1323.0	5866.0	38115.0									
DFS	1104.0	3981.0	34179.0	35185.0								
ESP	1278.0	4563.0	34989.0	34453.0	36010.0							
FRA	1279.0	3923.0	32340.0	31915.0	32516.0	34136.0						
GBR	1338.0	29663.0	5947.0	4066.0	4663.0	3942.0	30852.0					
ITA	1658.0	29979.0	5143.0	3210.0	3739.0	3128.0	28689.0	30513.0				
NLD	1204.0	3931.0	33866.0	33510.0	34065.0	32070.0	3974.0	3136.0	35401.0			
HUN	789.0	1768.0	6521.0	6123.0	6424.0	6124.0	1793.0	1681.0	6345.0	7067.0		
POL	1730.0	4174.0	29859.0	29805.0	30229.0	28201.0	3907.0	3302.0	29447.0	6194.0	31780.0	
CZE	1380.0	1387.0	1788.0	1502.0	1704.0	1619.0	1291.0	1203.0	1628.0	1177.0	2264.0	3070.0

Number of bulls in reference population for fan

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BEL  3134.0
CAN  1774.0 36749.0
DEU  1329.0  5873.0 38072.0
DFS  1110.0  3988.0 34370.0 35368.0
ESP  1284.0  4570.0 35194.0 34651.0 36227.0
FRA  1285.0  3930.0 32586.0 32138.0 32757.0 34442.0
GBR  1341.0 30488.0  5956.0  4075.0  4672.0  3951.0 31685.0
ITA  1659.0 30799.0  5150.0  3217.0  3746.0  3135.0 29511.0 31335.0
NLD  1210.0  3938.0 34039.0 33686.0 34242.0 32271.0  3983.0  3143.0 35572.0
HUN   792.0  1769.0  6726.0  6328.0  6629.0  6328.0  1795.0  1682.0  6550.0  7273.0
POL  1736.0  4182.0 30048.0 29996.0 30420.0 28420.0  3917.0  3310.0 29631.0  6400.0 32019.0
CZE  1387.0  1387.0  1799.0  1513.0  1715.0  1629.0  1293.0  1203.0  1638.0  1183.0  2324.0  3158.0

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Number of bulls in reference population for        hde
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Number of bulls in reference population for        fua
--------------------------------------------------------
BEL  3173.0
CAN  1777.0 36768.0
DEU  1329.0  5874.0 39406.0
DFS  1110.0  3989.0 35447.0 36457.0
ESP  1284.0  4571.0 36268.0 35723.0 37299.0
FRA  1285.0  3931.0 33619.0 33174.0 33789.0 35476.0
GBR  1361.0 30504.0  5957.0  4076.0  4673.0  3952.0 32444.0
ITA  1660.0 30812.0  5151.0  3218.0  3747.0  3136.0 29523.0 31348.0
NLD  1233.0  3942.0 35120.0 34763.0 35319.0 33312.0  4066.0  3145.0 37113.0
HUN   792.0  1770.0  6879.0  6480.0  6782.0  6472.0  1796.0  1683.0  6703.0  7427.0
POL  1736.0  4183.0 31074.0 31020.0 31446.0 29406.0  3918.0  3311.0 30654.0  6552.0 33048.0
CZE  1387.0  1388.0  1800.0  1514.0  1716.0  1630.0  1293.0  1204.0  1639.0  1184.0  2325.0  3160.0

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Number of bulls in reference population for        ruh
--------------------------------------------------------
BEL  3173.0
CAN  1777.0 36767.0
DEU  1329.0  5873.0 39094.0
DFS  1110.0  3988.0 35129.0 36112.0
ESP  1284.0  4570.0 35955.0 35379.0 36960.0
FRA  1285.0  3930.0 33313.0 32863.0 33484.0 35171.0
GBR  1361.0 30503.0  5956.0  4075.0  4672.0  3951.0 32441.0
ITA  1660.0 30811.0  5150.0  3217.0  3746.0  3135.0 29522.0 31347.0
NLD  1233.0  3941.0 34798.0 34440.0 34998.0 32996.0  4065.0  3144.0 36790.0
HUN   792.0  1769.0  6891.0  6492.0  6794.0  6484.0  1795.0  1682.0  6715.0  7439.0
POL  1736.0  4182.0 31210.0 31156.0 31582.0 29542.0  3917.0  3310.0 30789.0  6566.0 33184.0
CZE  1387.0  1388.0  1800.0  1514.0  1716.0  1630.0  1293.0  1204.0  1639.0  1184.0  2325.0  3160.0

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Number of bulls in reference population for        ruw
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--------------------------------------------------------
Number of bulls in reference population for        usu
--------------------------------------------------------
BEL  3173.0
CAN  1777.0 36769.0
DEU  1329.0  5873.0 40223.0
DFS  1110.0  3988.0 36257.0 37273.0
ESP  1284.0  4570.0 37082.0 36536.0 38121.0
FRA  1285.0  3930.0 34408.0 33959.0 34580.0 36270.0
GBR  1361.0 30505.0  5956.0  4075.0  4672.0  3951.0 32445.0
ITA  1660.0 30813.0  5150.0  3217.0  3746.0  3135.0 29524.0 31349.0
NLD  1233.0  3941.0 35918.0 35563.0 36119.0 34084.0  4065.0  3144.0 37913.0
HUN   792.0  1769.0  7411.0  7014.0  7316.0  6978.0  1795.0  1682.0  7237.0  7962.0
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POL  1736.0  4182.0 31875.0 31823.0 32249.0 30181.0  3917.0  3310.0 31452.0  7087.0 33852.0
CZE  1387.0  1388.0  1801.0  1515.0  1717.0  1631.0  1293.0  1204.0  1640.0  1185.0  2326.0  3161.0

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Number of bulls in reference population for        ude
-----------------------------------------------------
BEL  3136.0
CAN  1774.0 36760.0
DEU  1329.0  5872.0 40221.0
DFS  1110.0  3987.0 36255.0 37271.0
ESP  1284.0  4569.0 37080.0 36534.0 38119.0
FRA  1285.0  3930.0 34408.0 33959.0 34580.0 36270.0
GBR  1341.0 30498.0  5955.0  4074.0  4671.0  3951.0 31695.0
ITA  1659.0 30810.0  5149.0  3216.0  3745.0  3135.0 29521.0 31346.0
NLD  1210.0  3937.0 35916.0 35561.0 36117.0 34084.0  3982.0  3142.0 37456.0
HUN   792.0  1769.0  7412.0  7015.0  7317.0  6979.0  1795.0  1682.0  7238.0  7963.0
POL  1736.0  4182.0 31875.0 31823.0 32249.0 30182.0  3917.0  3310.0 31452.0  7088.0 33852.0
CZE  1387.0  1388.0  1801.0  1515.0  1717.0  1631.0  1293.0  1204.0  1640.0  1185.0  2326.0  3161.0

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Number of bulls in reference population for        ftp
-----------------------------------------------------
BEL  3173.0
CAN  1777.0 36769.0
DEU  1329.0  5874.0 40178.0
DFS  1110.0  3989.0 36212.0 37228.0
ESP  1284.0  4571.0 37038.0 36492.0 38077.0
FRA  1285.0  3931.0 34363.0 33914.0 34536.0 36225.0
GBR  1361.0 30505.0  5957.0  4076.0  4673.0  3952.0 32445.0
ITA  1660.0 30813.0  5151.0  3218.0  3747.0  3136.0 29524.0 31349.0
NLD  1233.0  3942.0 35873.0 35518.0 36075.0 34039.0  4066.0  3145.0 37868.0
HUN   792.0  1770.0  7412.0  7015.0  7317.0  6979.0  1796.0  1683.0  7238.0  7963.0
POL  1736.0  4183.0 31876.0 31824.0 32250.0 30182.0  3918.0  3311.0 31453.0  7088.0 33853.0
CZE  1387.0  1388.0  1801.0  1515.0  1717.0  1631.0  1293.0  1204.0  1640.0  1185.0  2326.0  3161.0

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Number of bulls in reference population for        ftl
-----------------------------------------------------
BEL  3136.0
CAN  1774.0 36750.0
DEU  1329.0  5874.0 40224.0
DFS  1110.0  3988.0 36256.0 37272.0
ESP  1284.0  4571.0 37082.0 36535.0 38121.0
FRA  1285.0  3931.0 34409.0 33960.0 34581.0 36271.0
GBR  1341.0 30499.0  5957.0  4075.0  4672.0  3952.0 31697.0
ITA  1659.0 30812.0  5152.0  3217.0  3747.0  3136.0 29523.0 31349.0
NLD  1210.0  3938.0 35917.0 35562.0 36118.0 34085.0  3983.0  3143.0 37457.0
HUN   792.0  1770.0  7413.0  7016.0  7318.0  6980.0  1796.0  1683.0  7239.0  7964.0
POL  1736.0  4183.0 31876.0 31824.0 32250.0 30183.0  3918.0  3311.0 31453.0  7089.0 33853.0
CZE  1387.0  1388.0  1801.0  1515.0  1717.0  1631.0  1293.0  1204.0  1640.0  1185.0  2326.0  3161.0

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Number of bulls in reference population for        rtp
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BEL  3154.0
CAN  1777.0 33657.0
DEU  1327.0  5869.0 37914.0
DFS  1108.0  3983.0 33951.0 34874.0
ESP  1282.0  4566.0 34774.0 34147.0 35728.0
FRA  1283.0  3925.0 32180.0 31681.0 32299.0 33987.0
GBR  1359.0 28658.0  5952.0  4070.0  4667.0  3946.0 30592.0
ITA  1660.0 28959.0  5148.0  3213.0  3743.0  3131.0 27848.0 29492.0
NLD  1231.0  3918.0 33612.0 33206.0 33759.0 31807.0  4042.0  3121.0 35400.0
POL  1733.0  4176.0 30386.0 30276.0 30705.0 28690.0  3911.0  3305.0 29912.0 32234.0
CZE  1385.0  1383.0  1785.0  1500.0  1701.0  1616.0  1289.0  1199.0  1624.0  2251.0  3076.0
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Number of bulls in reference population for ocs

AUS 2902.0
BEL 438.0 3156.0
CAN 1071.0 1777.0 36737.0
DEU 775.0 1328.0 5870.0 39562.0
ESP 726.0 1283.0 4568.0 36425.0 37451.0
FRA 711.0 1284.0 3929.0 33749.0 33918.0 35596.0
GBR 1211.0 1361.0 30477.0 5954.0 4671.0 3951.0 32417.0
ITA 863.0 1660.0 30789.0 5148.0 3745.0 3135.0 29500.0 31325.0
NLD 766.0 1232.0 3941.0 35290.0 35490.0 33456.0 4065.0 3144.0 37280.0
HUN 593.0 792.0 1770.0 7413.0 7318.0 6980.0 1796.0 1683.0 7239.0 7964.0
POL 658.0 1735.0 4180.0 31237.0 31611.0 29544.0 3916.0 3309.0 30826.0 7089.0 33213.0
CZE 374.0 1386.0 1388.0 1799.0 1715.0 1629.0 1293.0 1204.0 1639.0 1185.0 2324.0 3159.0

Number of bulls in reference population for ous

BEL 3151.0
CAN 1777.0 36767.0
DEU 1329.0 5873.0 40222.0
DFS 1110.0 3988.0 36257.0 37273.0
ESP 1284.0 4570.0 37081.0 36536.0 38120.0
FRA 1285.0 3930.0 34407.0 33959.0 34579.0 36266.0
GBR 1360.0 30503.0 5956.0 4075.0 4672.0 3951.0 32438.0
ITA 1660.0 30811.0 5150.0 3217.0 3746.0 3135.0 29522.0 31347.0
NLD 1233.0 3941.0 35920.0 35565.0 36121.0 34086.0 4065.0 3144.0 37914.0
HUN 792.0 1769.0 7412.0 7015.0 7317.0 6979.0 1795.0 1682.0 7238.0 7963.0
POL 1736.0 4182.0 31875.0 31823.0 32249.0 30181.0 3917.0 3310.0 31454.0 7088.0 33852.0
CZE 1387.0 1388.0 1801.0 1515.0 1717.0 1631.0 1293.0 1204.0 1640.0 1185.0 2326.0 3161.0

Number of bulls in reference population for ofl

BEL 3114.0
CAN 1774.0 36617.0
DEU 1328.0 5873.0 39582.0
DFS 1109.0 3988.0 35628.0 36641.0
ESP 1283.0 4570.0 36445.0 35905.0 37472.0
FRA 1284.0 3930.0 33769.0 33329.0 33938.0 35616.0
GBR 1340.0 30375.0 5956.0 4075.0 4672.0 3951.0 31568.0
ITA 1659.0 30716.0 5150.0 3217.0 3746.0 3135.0 29427.0 31252.0
NLD 1209.0 3938.0 35308.0 34953.0 35509.0 33475.0 3983.0 3143.0 36823.0
HUN 792.0 1769.0 7411.0 7014.0 7316.0 6978.0 1795.0 1682.0 7237.0 7962.0
POL 1735.0 4182.0 31257.0 31206.0 31632.0 29564.0 3917.0 3310.0 30845.0 7087.0 33234.0
CZE 1386.0 1388.0 1799.0 1513.0 1715.0 1629.0 1293.0 1204.0 1639.0 1185.0 2324.0 3159.0

Number of bulls in reference population for loc

BEL 3091.0
CAN 1766.0 30811.0
DEU 1323.0 5792.0 33419.0
DFS 1104.0 3908.0 29725.0 30513.0
ESP 1278.0 4487.0 30676.0 30008.0 31510.0
FRA 1279.0 3853.0 28204.0 27630.0 28390.0 29799.0
GBR 1335.0 28101.0 5881.0 4006.0 4599.0 3889.0 29259.0
ITA 1650.0 28348.0 5092.0 3164.0 3689.0 3087.0 27371.0 28806.0
NLD 1203.0 3864.0 29817.0 29337.0 30043.0 27995.0 3918.0 3089.0 31157.0
CZE 1382.0 1378.0 1765.0 1482.0 1683.0 1598.0 1286.0 1193.0 1607.0 3033.0
HUN 788.0 1758.0 5685.0 5294.0 5585.0 5315.0 1781.0 1673.0 5509.0 1156.0 6224.0

Number of bulls in reference population for bcs

BEL	3008.0									
DEU	1312.0	29767.0								
FRA	1268.0	24696.0	26102.0							
GBR	1342.0	5841.0	3852.0	28456.0						
ITA	1649.0	5073.0	3068.0	25843.0	27538.0					
NLD	1214.0	26238.0	24517.0	3958.0	3067.0	28001.0				
CZE	1372.0	1764.0	1597.0	1277.0	1187.0	1607.0	2913.0			
CAN	1766.0	5725.0	3788.0	26599.0	27088.0	3792.0	1371.0	31094.0		
ESP	1265.0	27078.0	24907.0	4551.0	3666.0	26451.0	1683.0	4408.0	27837.0	
HUN	785.0	6479.0	6093.0	1779.0	1668.0	6303.0	1171.0	1754.0	6383.0	7019.0