## 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 submitted GEBVs.

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

## CHANGES IN NATIONAL PROCEDURES

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

GBR HOL Change of organization - data now provided by SRUC. New method for computing reliabilities. Coding of bulls is slightly different as usual rule in UK was applied for other traits in terms of status of bull and type of proof

FRA HOL New base and Inclusion of FRR population in HOLFRA

BEL HOL Small modifications in the editing and preparation of the data used for the SS GBLUP

POL HOL Corrections made for some previously incorrect types of proofs.

AUS HOL New base

DEU HOL New base

## INTERBULL CHANGES COMPARED TO THE DECEMBER ROUTINE RUN

The Parameter-space approach (Sullivan, 2016) was used for this GMACE run:

- New residual correlations were derived to account for different heritability among country-traits
- Parameter space restrictions were used to bound GMACE results on the scale of each country
- The use of Predicted National Reliabilities (the MP.5 approach) is no longer used for the GMACE genetic evaluations. For reliability approximations, MP.5 is no longer used for reliabilities that have a defined parameter space, but MP.5 continues to be used to improve reliability predictions in countries where a bull does not have a national GEBV (i.e. where a parameter space is not defined)
- Information about bull controlling country (file 734) and genotyped animals (file 733) is now extracted directly from IDEA

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

## 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 minimizing the need to resort to conversions.

At the same time, all recipients of Interbull results are expected to honor 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 2017

| Country | Date |
|---|---|
| BEL | 20170401 |
| CAN | 20170401 |
| DEU | 20170404 |
| DFS | 20170306 |
| ESP | 20170307 |
| FRA | 20170405 |
| GBR | 20170304 |
| ITA | 20170306 |
| NLD | 20170401 |
| POL | 20170215 |

Table 2.

| Number of bulls in reference population for sta | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| BEL | 2568.0 | | | | | | | | |
| CAN | 1310.0 | 31923.0 | | | | | | | |
| DEU | 958.0 | 2385.0 | 34025.0 | | | | | | |
| DFS | 867.0 | 2203.0 | 31825.0 | 32982.0 | | | | | |
| ESP | 920.0 | 2239.0 | 32135.0 | 32251.0 | 33198.0 | | | | |
| FRA | 1013.0 | 2553.0 | 30686.0 | 30639.0 | 31076.0 | 32910.0 | | | |
| GBR | 845.0 | 25494.0 | 2145.0 | 1943.0 | 1978.0 | 2235.0 | 25890.0 | | |
| ITA | 1144.0 | 26083.0 | 1773.0 | 1506.0 | 1534.0 | 1799.0 | 24642.0 | 26397.0 | |
| NLD | 981.0 | 2511.0 | 32349.0 | 32239.0 | 32668.0 | 31160.0 | 2218.0 | 1780.0 | 34331.0 |
| POL | 1439.0 | 2627.0 | 27663.0 | 27764.0 | 28128.0 | 26880.0 | 1990.0 | 1844.0 | 28236.0 | 29805.0 |

| Number of bulls in reference population for cwi | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| BEL | 2568.0 | | | | | | | | |
| CAN | 1310.0 | 31919.0 | | | | | | | |
| DEU | 957.0 | 2385.0 | 32811.0 | | | | | | |
| DFS | 866.0 | 2203.0 | 30745.0 | 31895.0 | | | | | |
| ESP | 919.0 | 2239.0 | 30928.0 | 31171.0 | 31987.0 | | | | |
| FRA | 1012.0 | 2553.0 | 29499.0 | 29572.0 | 29894.0 | 31710.0 | | | |
| GBR | 845.0 | 25491.0 | 2145.0 | 1943.0 | 1978.0 | 2235.0 | 25887.0 | | |
| ITA | 1144.0 | 26081.0 | 1773.0 | 1506.0 | 1534.0 | 1799.0 | 24641.0 | 26395.0 | |
| NLD | 980.0 | 2511.0 | 31162.0 | 31175.0 | 31480.0 | 29999.0 | 2218.0 | 1780.0 | 33141.0 |
| POL | 1438.0 | 2627.0 | 26515.0 | 26739.0 | 26978.0 | 25758.0 | 1990.0 | 1844.0 | 27093.0 | 28654.0 |

| Number of bulls in reference population for bde | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| BEL | 2553.0 | | | | | | | | |
| CAN | 1310.0 | 31923.0 | | | | | | | |
| DEU | 958.0 | 2385.0 | 33467.0 | | | | | | |
| DFS | 867.0 | 2203.0 | 31381.0 | 32535.0 | | | | | |
| ESP | 920.0 | 2239.0 | 31578.0 | 31807.0 | 32639.0 | | | | |
| FRA | 1013.0 | 2553.0 | 30155.0 | 30210.0 | 30545.0 | 32378.0 | | | |
| GBR | 845.0 | 25494.0 | 2145.0 | 1943.0 | 1978.0 | 2235.0 | 25890.0 | | |
| ITA | 1144.0 | 26083.0 | 1773.0 | 1506.0 | 1534.0 | 1799.0 | 24642.0 | 26397.0 | |
| NLD | 981.0 | 2511.0 | 31791.0 | 31794.0 | 32109.0 | 30628.0 | 2218.0 | 1780.0 | 33770.0 |
| POL | 1439.0 | 2627.0 | 27151.0 | 27365.0 | 27614.0 | 26394.0 | 1990.0 | 1844.0 | 27721.0 | 29290.0 |

| Number of bulls in reference population for ang | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| BEL | 2525.0 | | | | | | | | |
| CAN | 1308.0 | 31483.0 | | | | | | | |
| DEU | 948.0 | 2380.0 | 30253.0 | | | | | | |
| DFS | 859.0 | 2199.0 | 28258.0 | 29406.0 | | | | | |
| ESP | 910.0 | 2234.0 | 28385.0 | 28696.0 | 29438.0 | | | | |
| FRA | 1003.0 | 2548.0 | 27011.0 | 27149.0 | 27405.0 | 29218.0 | | | |
| GBR | 842.0 | 25482.0 | 2139.0 | 1938.0 | 1972.0 | 2229.0 | 25868.0 | | |
| ITA | 1142.0 | 25907.0 | 1768.0 | 1502.0 | 1529.0 | 1794.0 | 24633.0 | 26219.0 | |
| NLD | 961.0 | 2504.0 | 28607.0 | 28689.0 | 28934.0 | 27512.0 | 2208.0 | 1774.0 | 30236.0 |
| POL | 1427.0 | 2622.0 | 23960.0 | 24253.0 | 24431.0 | 23270.0 | 1983.0 | 1837.0 | 24534.0 | 26087.0 |

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Number of bulls in reference population for        ran
-----------------------------------------------------
BEL  2569.0
CAN  1310.0 31923.0
DEU   958.0  2385.0 33929.0
DFS   867.0  2203.0 31729.0 32886.0
ESP   920.0  2239.0 32044.0 32160.0 33107.0
FRA  1013.0  2553.0 30591.0 30544.0 30986.0 32815.0
GBR   845.0 25494.0  2145.0  1943.0  1978.0  2235.0 25890.0
ITA  1144.0 26083.0  1773.0  1506.0  1534.0  1799.0 24642.0 26397.0
NLD   981.0  2511.0 32254.0 32144.0 32578.0 31065.0  2218.0  1780.0 34236.0
POL  1439.0  2627.0 27660.0 27761.0 28125.0 26877.0  1990.0  1844.0 28233.0 29802.0

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Number of bulls in reference population for        rwi
-----------------------------------------------------
BEL  2553.0
CAN  1310.0 31103.0
DEU   958.0  2385.0 33970.0
DFS   867.0  2203.0 31773.0 32930.0
ESP   920.0  2239.0 32081.0 32200.0 33144.0
FRA  1013.0  2553.0 30631.0 30587.0 31022.0 32855.0
GBR   845.0 25494.0  2145.0  1943.0  1978.0  2235.0 25890.0
ITA  1144.0 26083.0  1773.0  1506.0  1534.0  1799.0 24642.0 26397.0
NLD   981.0  2511.0 32294.0 32187.0 32614.0 31105.0  2218.0  1780.0 34276.0
POL  1439.0  2627.0 27653.0 27757.0 28118.0 26870.0  1990.0  1844.0 28226.0 29795.0

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Number of bulls in reference population for        rls
-----------------------------------------------------
BEL  2569.0
CAN  1310.0 31923.0
DEU   958.0  2385.0 34026.0
DFS   867.0  2203.0 31826.0 32983.0
ESP   920.0  2239.0 32136.0 32252.0 33199.0
FRA  1013.0  2553.0 30687.0 30640.0 31077.0 32911.0
GBR   845.0 25494.0  2145.0  1943.0  1978.0  2235.0 25890.0
ITA  1144.0 26083.0  1773.0  1506.0  1534.0  1799.0 24642.0 26397.0
NLD   981.0  2511.0 32350.0 32240.0 32669.0 31161.0  2218.0  1780.0 34332.0
POL  1439.0  2627.0 27663.0 27764.0 28128.0 26880.0  1990.0  1844.0 28236.0 29805.0

-----------------------------------------------------
Number of bulls in reference population for        rlr
-----------------------------------------------------
BEL  2543.0
CAN  1308.0 30992.0
DEU   952.0  2377.0 31924.0
DFS   861.0  2195.0 29913.0 31060.0
ESP   914.0  2231.0 30053.0 30336.0 31108.0
FRA  1007.0  2545.0 28622.0 28748.0 29026.0 30778.0
GBR   842.0 24665.0  2136.0  1934.0  1969.0  2226.0 25053.0
ITA  1143.0 25246.0  1765.0  1498.0  1526.0  1791.0 23818.0 25558.0
NLD   965.0  2501.0 30302.0 30351.0 30617.0 29147.0  2205.0  1771.0 31944.0
POL  1433.0  2619.0 25651.0 25911.0 26110.0 24901.0  1981.0  1836.0 26232.0 27739.0

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Number of bulls in reference population for fan

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| BEL | 2554.0 | | | | | | | | |
| CAN | 1308.0 | 31918.0 | | | | | | | |
| DEU | 957.0 | 2385.0 | 31834.0 | | | | | | |
| DFS | 867.0 | 2203.0 | 30050.0 | 31191.0 | | | | | |
| ESP | 919.0 | 2239.0 | 30216.0 | 30484.0 | 31275.0 | | | | |
| FRA | 1012.0 | 2553.0 | 28830.0 | 28921.0 | 29225.0 | 31048.0 | | | |
| GBR | 843.0 | 25491.0 | 2145.0 | 1943.0 | 1978.0 | 2235.0 | 25883.0 | | |
| ITA | 1143.0 | 26081.0 | 1773.0 | 1506.0 | 1534.0 | 1799.0 | 24641.0 | 26395.0 | |
| NLD | 970.0 | 2509.0 | 30434.0 | 30475.0 | 30760.0 | 29314.0 | 2214.0 | 1779.0 | 32075.0 |
| POL | 1438.0 | 2627.0 | 25800.0 | 26051.0 | 26269.0 | 25085.0 | 1990.0 | 1844.0 | 26378.0 | 27937.0 |

Number of bulls in reference population for fua

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| BEL | 2569.0 | | | | | | | | |
| CAN | 1310.0 | 31922.0 | | | | | | | |
| DEU | 958.0 | 2385.0 | 33208.0 | | | | | | |
| DFS | 867.0 | 2203.0 | 31137.0 | 32289.0 | | | | | |
| ESP | 920.0 | 2239.0 | 31321.0 | 31562.0 | 32380.0 | | | | |
| FRA | 1013.0 | 2553.0 | 29896.0 | 29965.0 | 30287.0 | 32115.0 | | | |
| GBR | 845.0 | 25494.0 | 2145.0 | 1943.0 | 1978.0 | 2235.0 | 25890.0 | | |
| ITA | 1144.0 | 26082.0 | 1773.0 | 1506.0 | 1534.0 | 1799.0 | 24642.0 | 26396.0 | |
| NLD | 981.0 | 2511.0 | 31550.0 | 31562.0 | 31867.0 | 30387.0 | 2218.0 | 1780.0 | 33529.0 |
| POL | 1439.0 | 2627.0 | 26860.0 | 27083.0 | 27323.0 | 26103.0 | 1990.0 | 1844.0 | 27435.0 | 28999.0 |

Number of bulls in reference population for ruh

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| BEL | 2569.0 | | | | | | | | |
| CAN | 1310.0 | 31922.0 | | | | | | | |
| DEU | 958.0 | 2385.0 | 32896.0 | | | | | | |
| DFS | 867.0 | 2203.0 | 30818.0 | 31943.0 | | | | | |
| ESP | 920.0 | 2239.0 | 31009.0 | 31216.0 | 32040.0 | | | | |
| FRA | 1013.0 | 2553.0 | 29591.0 | 29653.0 | 29981.0 | 31811.0 | | | |
| GBR | 845.0 | 25493.0 | 2145.0 | 1943.0 | 1978.0 | 2235.0 | 25889.0 | | |
| ITA | 1144.0 | 26083.0 | 1773.0 | 1506.0 | 1534.0 | 1799.0 | 24642.0 | 26397.0 | |
| NLD | 981.0 | 2511.0 | 31229.0 | 31238.0 | 31547.0 | 30072.0 | 2218.0 | 1780.0 | 33207.0 |
| POL | 1439.0 | 2627.0 | 26997.0 | 27214.0 | 27460.0 | 26240.0 | 1990.0 | 1844.0 | 27571.0 | 29136.0 |

Number of bulls in reference population for usu

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| BEL | 2569.0 | | | | | | | | |
| CAN | 1310.0 | 31923.0 | | | | | | | |
| DEU | 958.0 | 2385.0 | 34024.0 | | | | | | |
| DFS | 867.0 | 2203.0 | 31824.0 | 32981.0 | | | | | |
| ESP | 920.0 | 2239.0 | 32134.0 | 32250.0 | 33197.0 | | | | |
| FRA | 1013.0 | 2553.0 | 30685.0 | 30638.0 | 31075.0 | 32909.0 | | | |
| GBR | 845.0 | 25494.0 | 2145.0 | 1943.0 | 1978.0 | 2235.0 | 25890.0 | | |
| ITA | 1144.0 | 26083.0 | 1773.0 | 1506.0 | 1534.0 | 1799.0 | 24642.0 | 26397.0 | |
| NLD | 981.0 | 2511.0 | 32348.0 | 32238.0 | 32667.0 | 31159.0 | 2218.0 | 1780.0 | 34330.0 |
| POL | 1439.0 | 2627.0 | 27661.0 | 27762.0 | 28126.0 | 26878.0 | 1990.0 | 1844.0 | 28234.0 | 29803.0 |

Number of bulls in reference population for ude

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| BEL | 2557.0 | | | | | | | | |
| CAN | 1308.0 | 31919.0 | | | | | | | |
| DEU | 958.0 | 2385.0 | 34023.0 | | | | | | |
| DFS | 867.0 | 2203.0 | 31823.0 | 32980.0 | | | | | |
| ESP | 920.0 | 2239.0 | 32133.0 | 32249.0 | 33196.0 | | | | |
| FRA | 1013.0 | 2553.0 | 30685.0 | 30638.0 | 31075.0 | 32909.0 | | | |
| GBR | 843.0 | 25491.0 | 2145.0 | 1943.0 | 1978.0 | 2235.0 | 25883.0 | | |
| ITA | 1143.0 | 26082.0 | 1773.0 | 1506.0 | 1534.0 | 1799.0 | 24641.0 | 26396.0 | |
| NLD | 971.0 | 2509.0 | 32347.0 | 32237.0 | 32666.0 | 31159.0 | 2214.0 | 1779.0 | 33996.0 |
| POL | 1439.0 | 2627.0 | 27661.0 | 27762.0 | 28126.0 | 26879.0 | 1990.0 | 1844.0 | 28234.0 | 29803.0 |

Number of bulls in reference population for ftp

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| BEL | 2569.0 | | | | | | | | |
| CAN | 1310.0 | 31923.0 | | | | | | | |
| DEU | 958.0 | 2385.0 | 33978.0 | | | | | | |
| DFS | 867.0 | 2203.0 | 31778.0 | 32935.0 | | | | | |
| ESP | 920.0 | 2239.0 | 32089.0 | 32205.0 | 33152.0 | | | | |
| FRA | 1013.0 | 2553.0 | 30639.0 | 30592.0 | 31030.0 | 32863.0 | | | |
| GBR | 845.0 | 25494.0 | 2145.0 | 1943.0 | 1978.0 | 2235.0 | 25890.0 | | |
| ITA | 1144.0 | 26083.0 | 1773.0 | 1506.0 | 1534.0 | 1799.0 | 24642.0 | 26397.0 | |
| NLD | 981.0 | 2511.0 | 32302.0 | 32192.0 | 32622.0 | 31113.0 | 2218.0 | 1780.0 | 34284.0 |
| POL | 1439.0 | 2627.0 | 27661.0 | 27762.0 | 28126.0 | 26878.0 | 1990.0 | 1844.0 | 28234.0 | 29803.0 |

Number of bulls in reference population for ftl

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| BEL | 2557.0 | | | | | | | | |
| CAN | 1308.0 | 31907.0 | | | | | | | |
| DEU | 958.0 | 2385.0 | 34023.0 | | | | | | |
| DFS | 867.0 | 2203.0 | 31823.0 | 32980.0 | | | | | |
| ESP | 920.0 | 2239.0 | 32133.0 | 32249.0 | 33196.0 | | | | |
| FRA | 1013.0 | 2553.0 | 30685.0 | 30638.0 | 31075.0 | 32909.0 | | | |
| GBR | 843.0 | 25491.0 | 2145.0 | 1943.0 | 1978.0 | 2235.0 | 25883.0 | | |
| ITA | 1143.0 | 26082.0 | 1773.0 | 1506.0 | 1534.0 | 1799.0 | 24641.0 | 26396.0 | |
| NLD | 971.0 | 2509.0 | 32347.0 | 32237.0 | 32666.0 | 31159.0 | 2214.0 | 1779.0 | 33996.0 |
| POL | 1439.0 | 2627.0 | 27661.0 | 27762.0 | 28126.0 | 26879.0 | 1990.0 | 1844.0 | 28234.0 | 29803.0 |

Number of bulls in reference population for rtp

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| BEL | 2546.0 | | | | | | | | |
| CAN | 1310.0 | 28776.0 | | | | | | | |
| DEU | 956.0 | 2375.0 | 31645.0 | | | | | | |
| DFS | 865.0 | 2195.0 | 29700.0 | 30759.0 | | | | | |
| ESP | 918.0 | 2229.0 | 29802.0 | 30040.0 | 30772.0 | | | | |
| FRA | 1011.0 | 2541.0 | 28437.0 | 28526.0 | 28766.0 | 30542.0 | | | |
| GBR | 845.0 | 23630.0 | 2138.0 | 1937.0 | 1971.0 | 2228.0 | 24021.0 | | |
| ITA | 1144.0 | 24148.0 | 1767.0 | 1501.0 | 1528.0 | 1792.0 | 22876.0 | 24460.0 | |
| NLD | 979.0 | 2484.0 | 30014.0 | 30056.0 | 30275.0 | 28853.0 | 2193.0 | 1756.0 | 31780.0 |
| POL | 1436.0 | 2619.0 | 26143.0 | 26393.0 | 26555.0 | 25353.0 | 1983.0 | 1838.0 | 26662.0 | 28143.0 |

Number of bulls in reference population for ocs

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| AUS | 2603.0 | | | | | | | | | |
| BEL | 318.0 | 2552.0 | | | | | | | | |
| CAN | 787.0 | 1310.0 | 31906.0 | | | | | | | |
| DEU | 557.0 | 957.0 | 2385.0 | 33393.0 | | | | | | |
| ESP | 539.0 | 919.0 | 2239.0 | 31509.0 | 32569.0 | | | | | |
| FRA | 572.0 | 1012.0 | 2553.0 | 30054.0 | 30448.0 | 32264.0 | | | | |
| GBR | 801.0 | 845.0 | 25477.0 | 2145.0 | 1978.0 | 2235.0 | 25873.0 | | | |
| ITA | 578.0 | 1144.0 | 26068.0 | 1773.0 | 1534.0 | 1799.0 | 24627.0 | 26382.0 | | |
| NLD | 653.0 | 980.0 | 2511.0 | 31745.0 | 32064.0 | 30556.0 | 2218.0 | 1780.0 | 33723.0 | |
| POL | 522.0 | 1438.0 | 2627.0 | 27052.0 | 27516.0 | 26268.0 | 1990.0 | 1844.0 | 27634.0 | 29193.0 |

Number of bulls in reference population for ous

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| BEL | 2547.0 | | | | | | | | |
| CAN | 1310.0 | 31922.0 | | | | | | | |
| DEU | 958.0 | 2385.0 | 34025.0 | | | | | | |
| DFS | 867.0 | 2203.0 | 31825.0 | 32981.0 | | | | | |
| ESP | 920.0 | 2239.0 | 32135.0 | 32250.0 | 33197.0 | | | | |
| FRA | 1013.0 | 2553.0 | 30686.0 | 30638.0 | 31075.0 | 32908.0 | | | |
| GBR | 845.0 | 25493.0 | 2145.0 | 1943.0 | 1978.0 | 2235.0 | 25889.0 | | |
| ITA | 1144.0 | 26083.0 | 1773.0 | 1506.0 | 1534.0 | 1799.0 | 24642.0 | 26397.0 | |
| NLD | 981.0 | 2511.0 | 32350.0 | 32240.0 | 32669.0 | 31161.0 | 2218.0 | 1780.0 | 34331.0 |
| POL | 1439.0 | 2627.0 | 27662.0 | 27762.0 | 28126.0 | 26878.0 | 1990.0 | 1844.0 | 28236.0 | 29803.0 |

Number of bulls in reference population for ofl

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| BEL | 2534.0 | | | | | | | | |
| CAN | 1308.0 | 31773.0 | | | | | | | |
| DEU | 957.0 | 2385.0 | 33389.0 | | | | | | |
| DFS | 866.0 | 2203.0 | 31202.0 | 32355.0 | | | | | |
| ESP | 919.0 | 2239.0 | 31505.0 | 31627.0 | 32565.0 | | | | |
| FRA | 1012.0 | 2553.0 | 30051.0 | 30014.0 | 30445.0 | 32261.0 | | | |
| GBR | 843.0 | 25365.0 | 2145.0 | 1943.0 | 1978.0 | 2235.0 | 25757.0 | | |
| ITA | 1143.0 | 25977.0 | 1773.0 | 1506.0 | 1534.0 | 1799.0 | 24536.0 | 26291.0 | |
| NLD | 970.0 | 2509.0 | 31741.0 | 31634.0 | 32060.0 | 30553.0 | 2214.0 | 1779.0 | 33365.0 | |
| POL | 1438.0 | 2627.0 | 27048.0 | 27151.0 | 27512.0 | 26265.0 | 1990.0 | 1844.0 | 27630.0 | 29189.0 |

Number of bulls in reference population for loc

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| BEL | 2513.0 | | | | | | | | |
| CAN | 1302.0 | 25657.0 | | | | | | | |
| DEU | 952.0 | 2339.0 | 27596.0 | | | | | | |
| DFS | 862.0 | 2156.0 | 25945.0 | 26840.0 | | | | | |
| ESP | 914.0 | 2191.0 | 26157.0 | 26351.0 | 26986.0 | | | | |
| FRA | 1007.0 | 2502.0 | 24715.0 | 24744.0 | 25101.0 | 26581.0 | | | |
| GBR | 840.0 | 22792.0 | 2104.0 | 1899.0 | 1934.0 | 2190.0 | 23168.0 | | |
| ITA | 1135.0 | 23302.0 | 1749.0 | 1484.0 | 1512.0 | 1776.0 | 22186.0 | 23596.0 | |
| NLD | 964.0 | 2466.0 | 26313.0 | 26317.0 | 26644.0 | 25117.0 | 2175.0 | 1756.0 | 27741.0 | |

Number of bulls in reference population for bcs

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| BEL | 2400.0 | | | | | | |
| DEU | 945.0 | 24397.0 | | | | | |
| FRA | 998.0 | 21637.0 | 23274.0 | | | | |
| GBR | 838.0 | 2092.0 | 2179.0 | 21682.0 | | | |
| ITA | 1136.0 | 1738.0 | 1766.0 | 20693.0 | 22340.0 | | |
| NLD | 953.0 | 23165.0 | 22021.0 | 2158.0 | 1740.0 | 24545.0 | |
| CAN | 1302.0 | 2325.0 | 2489.0 | 21322.0 | 22058.0 | 2447.0 | 25997.0 |