INTRODUCTION

The latest genomic test international evaluation for conformation traits took place as scheduled at the Interbull Centre. Data from twenty-four (24) countries were included in this evaluation.

International genetic evaluations for conformation traits of bulls were computed from:
AUS BEL CAN CHE CZE DEU DFS ESP EST FRA GBR HUN IRL ITA JPN KOR NLD NZL POL PRT SVN USA ZAF LVA
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, POL, HUN, CZE
bde: , CAN, DEU, ESP, FRA, , DFS, GBR, ITA, NLD, POL, HUN, CZE
cwi: , CAN, DEU, ESP, FRA, , DFS, GBR, ITA, NLD, POL, HUN, CZE
fan: , 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: , CAN, DEU, ESP, FRA, , DFS, GBR, ITA, NLD, POL, HUN, CZE
fua: , CAN, DEU, ESP, FRA, , DFS, GBR, ITA, NLD, POL, HUN, CZE
loc: , CAN, DEU, ESP, FRA, , DFS, GBR, ITA, NLD, POL, HUN, CZE
ocs: , CAN, DEU, ESP, FRA, AUS, , GBR, ITA, NLD, POL, HUN, CZE
ofl: , CAN, DEU, ESP, FRA, , DFS, GBR, ITA, NLD, POL, HUN, CZE
ous: , CAN, DEU, ESP, FRA, , DFS, GBR, ITA, NLD, POL, HUN, CZE
ran: , CAN, DEU, ESP, FRA, , DFS, GBR, ITA, NLD, POL, HUN, CZE
rlr: , CAN, DEU, ESP, FRA, , DFS, GBR, ITA, NLD, POL, HUN, CZE
rls: , CAN, DEU, ESP, FRA, , DFS, GBR, ITA, NLD, POL, HUN, CZE
rtp: , CAN, DEU, ESP, FRA, , DFS, GBR, ITA, NLD, POL, , CZE
ruh: , CAN, DEU, ESP, FRA, , DFS, GBR, ITA, NLD, POL, HUN, CZE
rwi: , 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: , 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:

AUS (HOL) ous: update of genotypes
FRA (HOL) Proofs and reliability calculated with the single step methodology (HSSGBLUP) developped by INRAE. A new software for the count of daughters and herds has also been developped by Geneval. Principles stayed the same than before but pedigree corrections have been made. Other information concerning publication can have been changed
ESP (HOL) Change in genetic base for ran and fua in line with changes in MACE
GBR (HOL) Updates in genotypes and data update

INTERBULL CHANGES COMPARED TO THE DECEMBER ROUTINE RUN

No changes in Interbull procedures

DATA AND METHOD OF ANALYSIS

Thirteen 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 thirteen 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 test 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 2022

Country	Date
BEL	20201201
CAN	20221201
DEU	20221206
DFS	20221101
ESP	20221115
FRA	20221206
GBR	20221109
ITA	20221111
NLD	20221201
HUN	20211122
POL	20221109
CZE	20221121

Table 2.

Number of bulls in reference population for sta

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-----------------------------------------------------
BEL  1670.0
CAN   723.0 39091.0
DEU   726.0  8688.0 44118.0
DFS   634.0  5348.0 38512.0 39475.0
ESP   701.0  6409.0 39832.0 38698.0 40942.0
FRA   710.0  4032.0 34725.0 34197.0 34810.0 36452.0
GBR   682.0 32864.0  9237.0  5833.0  6981.0  4121.0 35014.0
ITA   717.0 33624.0  8171.0  4808.0  5878.0  3300.0 32829.0 34622.0
NLD   740.0  4107.0 36575.0 35940.0 36565.0 34236.0  4450.0  3465.0 38367.0
HUN   549.0  2223.0  8205.0  7665.0  8051.0  7283.0  2439.0  2204.0  7807.0  9024.0
POL   994.0  4776.0 33513.0 33222.0 33860.0 30337.0  5166.0  4210.0 31844.0  7627.0 35251.0
CZE   842.0  1770.0  2258.0  1811.0  2111.0  1671.0  1717.0  1711.0  1710.0  1399.0  2501.0  3632.0

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Number of bulls in reference population for        cwi
-----------------------------------------------------
CAN 39086.0
DEU  8688.0 42897.0
DFS  5349.0 37302.0 38258.0
ESP  6410.0 38617.0 37487.0 39714.0
FRA  4032.0 33531.0 33010.0 33614.0 35245.0
GBR 32859.0  9238.0  5835.0  6983.0  4121.0 35010.0
ITA 33619.0  8172.0  4810.0  5880.0  3300.0 32825.0 34618.0
NLD  4107.0 35381.0 34744.0 35371.0 33068.0  4450.0  3465.0 37171.0
HUN  2223.0  7668.0  7126.0  7512.0  6772.0  2439.0  2204.0  7268.0  8484.0
POL  4776.0 32357.0 32065.0 32704.0 29207.0  5166.0  4210.0 30695.0  7087.0 34091.0
CZE  1770.0  2255.0  1808.0  2108.0  1668.0  1717.0  1711.0  1708.0  1398.0  2498.0  3629.0

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Number of bulls in reference population for        bde
-----------------------------------------------------
CAN 39091.0
DEU  8688.0 43559.0
DFS  5348.0 37953.0 38912.0
ESP  6409.0 39274.0 38138.0 40382.0
FRA  4032.0 34193.0 33664.0 34278.0 35919.0
GBR 32864.0  9237.0  5833.0  6981.0  4121.0 35014.0
ITA 33624.0  8171.0  4808.0  5878.0  3300.0 32829.0 34622.0
NLD  4107.0 36016.0 35379.0 36005.0 33703.0  4450.0  3465.0 37806.0
HUN  2223.0  7693.0  7151.0  7537.0  6797.0  2439.0  2204.0  7293.0  8509.0
POL  4776.0 33000.0 32707.0 33345.0 29850.0  5166.0  4210.0 31329.0  7112.0 34735.0
CZE  1770.0  2257.0  1810.0  2110.0  1670.0  1717.0  1711.0  1709.0  1398.0  2500.0  3631.0

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Number of bulls in reference population for        ang
-----------------------------------------------------
BEL  1618.0
CAN   720.0 38646.0
DEU   716.0  8683.0 40328.0
DFS   627.0  5344.0 34756.0 35709.0
ESP   691.0  6405.0 36049.0 34938.0 37137.0
FRA   700.0  4025.0 31037.0 30538.0 31118.0 32747.0
GBR   662.0 32847.0  9230.0  5827.0  6975.0  4112.0 34698.0
ITA   715.0 33424.0  8165.0  4803.0  5873.0  3292.0 32810.0 34416.0
NLD   707.0  4097.0 32832.0 32218.0 32821.0 30576.0  4360.0  3456.0 34166.0
HUN   517.0  2213.0  5136.0  4616.0  4974.0  4294.0  2353.0  2195.0  4590.0  5643.0
POL   983.0  4769.0 29810.0 29539.0 30151.0 26715.0  5156.0  4200.0 28149.0  4552.0 31534.0
CZE   833.0  1766.0  2218.0  1777.0  2071.0  1633.0  1713.0  1704.0  1671.0  1361.0  2458.0  3582.0

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Number of bulls in reference population for        ran
-----------------------------------------------------
CAN 39090.0
DEU  8687.0 44021.0
DFS  5347.0 38415.0 39378.0
ESP  6408.0 39740.0 38606.0 40850.0
FRA  4032.0 34630.0 34102.0 34720.0 36357.0
GBR 32863.0  9236.0  5832.0  6980.0  4121.0 35013.0
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ITA 33623.0  8170.0  4807.0  5877.0  3300.0 32828.0 34621.0
NLD  4106.0 36479.0 35844.0 36474.0 34141.0  4449.0  3464.0 38271.0
HUN  2223.0  8205.0  7665.0  8051.0  7283.0  2439.0  2204.0  7807.0  9024.0
POL  4776.0 33510.0 33219.0 33857.0 30334.0  5166.0  4210.0 31841.0  7627.0 35248.0
CZE  1770.0  2258.0  1811.0  2111.0  1671.0  1717.0  1711.0  1710.0  1399.0  2501.0  3632.0

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Number of bulls in reference population for        rwi
-----------------------------------------------------
CAN 38268.0
DEU  8687.0 44062.0
DFS  5347.0 38456.0 39419.0
ESP  6408.0 39777.0 38643.0 40887.0
FRA  4032.0 34670.0 34142.0 34756.0 36397.0
GBR 32863.0  9236.0  5832.0  6980.0  4121.0 35013.0
ITA 33623.0  8170.0  4807.0  5877.0  3300.0 32828.0 34621.0
NLD  4106.0 36519.0 35884.0 36510.0 34181.0  4449.0  3464.0 38311.0
HUN  2223.0  8196.0  7656.0  8042.0  7274.0  2439.0  2204.0  7798.0  9015.0
POL  4776.0 33503.0 33212.0 33850.0 30327.0  5166.0  4210.0 31834.0  7618.0 35241.0
CZE  1770.0  2258.0  1811.0  2111.0  1671.0  1717.0  1711.0  1710.0  1399.0  2501.0  3632.0

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Number of bulls in reference population for        rls
-----------------------------------------------------
CAN 39091.0
DEU  8688.0 44119.0
DFS  5348.0 38513.0 39476.0
ESP  6409.0 39833.0 38699.0 40943.0
FRA  4032.0 34726.0 34198.0 34811.0 36453.0
GBR 32864.0  9237.0  5833.0  6981.0  4121.0 35014.0
ITA 33624.0  8171.0  4808.0  5878.0  3300.0 32829.0 34622.0
NLD  4107.0 36576.0 35941.0 36566.0 34237.0  4450.0  3465.0 38368.0
HUN  2223.0  8205.0  7665.0  8051.0  7283.0  2439.0  2204.0  7807.0  9024.0
POL  4776.0 33513.0 33222.0 33860.0 30337.0  5166.0  4210.0 31844.0  7627.0 35251.0
CZE  1770.0  2258.0  1811.0  2111.0  1671.0  1717.0  1711.0  1710.0  1399.0  2501.0  3632.0

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Number of bulls in reference population for        rlr
-----------------------------------------------------
CAN 38166.0
DEU  8683.0 42009.0
DFS  5342.0 36431.0 37385.0
ESP  6404.0 37738.0 36614.0 38831.0
FRA  4024.0 32652.0 32148.0 32742.0 34313.0
GBR 32031.0  9231.0  5826.0  6975.0  4111.0 33885.0
ITA 32792.0  8167.0  4803.0  5874.0  3292.0 31999.0 33790.0
NLD  4096.0 34518.0 33882.0 34507.0 32217.0  4359.0  3456.0 35861.0
HUN  2218.0  7311.0  6770.0  7155.0  6426.0  2359.0  2201.0  6771.0  7858.0
POL  4768.0 31494.0 31201.0 31838.0 28352.0  5156.0  4202.0 29835.0  6731.0 33175.0
CZE  1769.0  2245.0  1798.0  2098.0  1659.0  1715.0  1710.0  1698.0  1391.0  2439.0  3541.0

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Number of bulls in reference population for        fan
-----------------------------------------------------
CAN 39063.0
DEU  8688.0 41962.0
DFS  5349.0 36623.0 37569.0
ESP  6410.0 37942.0 36812.0 39047.0
FRA  4032.0 32901.0 32374.0 32985.0 34622.0
GBR 32840.0  9237.0  5834.0  6982.0  4121.0 34700.0
ITA 33599.0  8171.0  4809.0  5879.0  3300.0 32806.0 34596.0
NLD  4104.0 34694.0 34061.0 34686.0 32421.0  4369.0  3464.0 36035.0
HUN  2220.0  7515.0  6975.0  7360.0  6630.0  2362.0  2203.0  6975.0  8063.0
POL  4776.0 31684.0 31393.0 32029.0 28573.0  5166.0  4210.0 30021.0  6937.0 33416.0
CZE  1769.0  2256.0  1809.0  2109.0  1669.0  1717.0  1710.0  1708.0  1397.0  2499.0  3629.0

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Number of bulls in reference population for        hde
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Number of bulls in reference population for fua

CAN 39091.0
DEU 8688.0 43299.0
DFS 5349.0 37700.0 38658.0
ESP 6410.0 39016.0 37884.0 40119.0
FRA 4032.0 33934.0 33410.0 34017.0 35656.0
GBR 32864.0 9237.0 5834.0 6982.0 4121.0 35014.0
ITA 33624.0 8171.0 4809.0 5879.0 3300.0 32829.0 34622.0
NLD 4107.0 35775.0 35138.0 35763.0 33462.0 4450.0 3465.0 37565.0
HUN 2223.0 7670.0 7128.0 7514.0 6774.0 2439.0 2204.0 7270.0 8486.0
POL 4776.0 32709.0 32416.0 33054.0 29559.0 5166.0 4210.0 31043.0 7089.0 34444.0
CZE 1770.0 2257.0 1810.0 2110.0 1670.0 1717.0 1711.0 1709.0 1398.0 2500.0 3631.0

Number of bulls in reference population for ruh

CAN 39090.0
DEU 8688.0 42987.0
DFS 5348.0 37382.0 38312.0
ESP 6409.0 38703.0 37539.0 39779.0
FRA 4032.0 33628.0 33099.0 33712.0 35351.0
GBR 32863.0 9237.0 5833.0 6981.0 4121.0 35011.0
ITA 33623.0 8171.0 4808.0 5878.0 3300.0 32828.0 34621.0
NLD 4107.0 35453.0 34815.0 35442.0 33146.0 4450.0 3465.0 37242.0
HUN 2223.0 7682.0 7140.0 7526.0 6786.0 2439.0 2204.0 7282.0 8498.0
POL 4776.0 32846.0 32553.0 33191.0 29696.0 5166.0 4210.0 31179.0 7104.0 34581.0
CZE 1770.0 2257.0 1810.0 2110.0 1670.0 1717.0 1711.0 1709.0 1398.0 2500.0 3631.0

Number of bulls in reference population for ruw

Number of bulls in reference population for usu

BEL 1670.0
CAN   723.0 39094.0
DEU   726.0 8690.0 44119.0
DFS   634.0 5350.0 38512.0 39476.0
ESP   701.0 6412.0 39833.0 38699.0 40944.0
FRA   710.0 4032.0 34724.0 34196.0 34809.0 36451.0
GBR   682.0 32867.0 9239.0 5835.0 6984.0 4121.0 35017.0
ITA   717.0 33627.0 8173.0 4810.0 5881.0 3300.0 32832.0 34625.0
NLD   740.0 4107.0 36574.0 35939.0 36564.0 34235.0 4450.0 3465.0 38366.0
HUN   549.0 2223.0 8204.0 7664.0 8050.0 7282.0 2439.0 2204.0 7806.0 9023.0
POL   994.0 4776.0 33511.0 33220.0 33858.0 30335.0 5166.0 4210.0 31842.0 7626.0 35249.0
CZE   842.0 1770.0 2258.0 1811.0 2111.0 1671.0 1717.0 1711.0 1710.0 1399.0 2501.0 3632.0

Number of bulls in reference population for ude

CAN 39084.0
DEU 8687.0 44115.0
DFS 5347.0 38509.0 39472.0
ESP 6408.0 39829.0 38695.0 40939.0
FRA 4032.0 34724.0 34196.0 34809.0 36451.0
GBR 32860.0 9236.0 5832.0 6980.0 4121.0 34720.0
ITA 33620.0 8170.0 4807.0 5877.0 3300.0 32826.0 34618.0
NLD 4103.0 36572.0 35937.0 36562.0 34235.0 4368.0 3463.0 37920.0
HUN 2220.0 8204.0 7664.0 8050.0 7283.0 2362.0 2203.0 7666.0 8756.0
POL 4776.0 33512.0 33221.0 33859.0 30336.0 5166.0 4210.0 31843.0 7627.0 35250.0
CZE 1770.0 2258.0 1811.0 2111.0 1671.0 1717.0 1711.0 1710.0 1399.0 2501.0 3632.0

Number of bulls in reference population for ftp

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CAN 39094.0
DEU  8691.0 44075.0
DFS  5349.0 38467.0 39430.0
ESP  6411.0 39789.0 38654.0 40899.0
FRA  4032.0 34678.0 34150.0 34764.0 36405.0
GBR 32867.0  9241.0  5835.0  6984.0  4121.0 35018.0
ITA 33627.0  8175.0  4810.0  5881.0  3300.0 32833.0 34626.0
NLD  4107.0 36528.0 35893.0 36519.0 34189.0  4450.0  3465.0 38320.0
HUN  2223.0  8204.0  7664.0  8050.0  7282.0  2439.0  2204.0  7806.0  9023.0
POL  4777.0 33512.0 33221.0 33859.0 30335.0  5167.0  4211.0 31842.0  7626.0 35250.0
CZE  1770.0  2258.0  1811.0  2111.0  1671.0  1717.0  1711.0  1710.0  1399.0  2501.0  3632.0

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Number of bulls in reference population for        ftl
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BEL  1641.0
CAN   721.0 39078.0
DEU   726.0  8691.0 44120.0
DFS   634.0  5349.0 38512.0 39475.0
ESP   701.0  6411.0 39833.0 38698.0 40943.0
FRA   710.0  4032.0 34724.0 34196.0 34809.0 36451.0
GBR   667.0 32864.0  9241.0  5835.0  6984.0  4121.0 34779.0
ITA   716.0 33624.0  8175.0  4810.0  5881.0  3300.0 32831.0 34623.0
NLD   720.0  4105.0 36573.0 35938.0 36563.0 34235.0  4374.0  3464.0 37948.0
HUN   531.0  2221.0  8204.0  7664.0  8050.0  7283.0  2386.0  2203.0  7680.0  8820.0
POL   994.0  4777.0 33513.0 33222.0 33860.0 30336.0  5167.0  4211.0 31843.0  7627.0 35251.0
CZE   842.0  1770.0  2258.0  1811.0  2111.0  1671.0  1717.0  1711.0  1710.0  1399.0  2501.0  3632.0

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Number of bulls in reference population for        rtp
--------------------------------------------------------
CAN 35992.0
DEU  8684.0 41810.0
DFS  5343.0 36207.0 37078.0
ESP  6405.0 37525.0 36311.0 38551.0
FRA  4026.0 32497.0 31919.0 32529.0 34169.0
GBR 31032.0  9234.0  5829.0  6978.0  4115.0 33175.0
ITA 31622.0  8169.0  4805.0  5876.0  3295.0 31006.0 32617.0
NLD  4083.0 34269.0 33583.0 34205.0 31959.0  4426.0  3441.0 35858.0
POL  4770.0 32024.0 31675.0 32316.0 28845.0  5160.0  4205.0 30303.0 33633.0
CZE  1765.0  2242.0  1796.0  2095.0  1656.0  1712.0  1706.0  1694.0  2426.0  3547.0

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Number of bulls in reference population for        ocs
--------------------------------------------------------
AUS  2900.0
CAN  1075.0 39016.0
DEU   787.0  8652.0 43372.0
ESP   749.0  6394.0 39146.0 40235.0
FRA   718.0  4028.0 34050.0 34130.0 35759.0
GBR  1172.0 32805.0  9195.0  6967.0  4119.0 34943.0
ITA  1016.0 33564.0  8128.0  5862.0  3297.0 32759.0 34549.0
NLD   767.0  4100.0 35923.0 35917.0 33591.0  4439.0  3454.0 37706.0
HUN   701.0  2219.0  8202.0  8050.0  7283.0  2434.0  2199.0  7807.0  9019.0
POL   657.0  4768.0 32857.0 33202.0 29683.0  5161.0  4205.0 31200.0  7627.0 34589.0
CZE   375.0  1770.0  2256.0  2109.0  1669.0  1717.0  1711.0  1709.0  1399.0  2499.0  3630.0

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Number of bulls in reference population for        ous
--------------------------------------------------------
CAN 39051.0
DEU  8658.0 44038.0
DFS  5343.0 38501.0 39459.0
ESP  6397.0 39805.0 38690.0 40907.0
FRA  4030.0 34712.0 34191.0 34794.0 36433.0
GBR 32835.0  9200.0  5829.0  6969.0  4120.0 34968.0
ITA 33594.0  8133.0  4803.0  5864.0  3298.0 32789.0 34579.0
NLD  4101.0 36557.0 35939.0 36551.0 34225.0  4440.0  3455.0 38344.0
HUN  2219.0  8202.0  7664.0  8050.0  7283.0  2434.0  2199.0  7807.0  9019.0
```

POL 4771.0 33499.0 33219.0 33843.0 30324.0 5163.0 4207.0 31832.0 7627.0 35233.0
CZE 1770.0 2258.0 1811.0 2111.0 1671.0 1717.0 1711.0 1710.0 1399.0 2501.0 3632.0

Number of bulls in reference population for ofl

CAN 38900.0
DEU 8659.0 43396.0
DFS 5343.0 37869.0 38824.0
ESP 6397.0 39167.0 38057.0 40257.0
FRA 4030.0 34071.0 33558.0 34151.0 35780.0
GBR 32707.0 9201.0 5829.0 6969.0 4120.0 34550.0
ITA 33467.0 8134.0 4803.0 5864.0 3298.0 32663.0 34452.0
NLD 4099.0 35943.0 35324.0 35937.0 33611.0 4360.0 3455.0 37263.0
HUN 2216.0 8200.0 7662.0 8048.0 7282.0 2357.0 2198.0 7665.0 8750.0
POL 4771.0 32879.0 32600.0 33225.0 29704.0 5163.0 4207.0 31221.0 7626.0 34612.0
CZE 1770.0 2256.0 1809.0 2109.0 1669.0 1717.0 1711.0 1709.0 1399.0 2499.0 3630.0

Number of bulls in reference population for loc

CAN 33542.0
DEU 8602.0 39284.0
DFS 5296.0 34010.0 34827.0
ESP 6349.0 35329.0 34137.0 36299.0
FRA 3987.0 30405.0 29823.0 30441.0 32009.0
GBR 30766.0 9147.0 5791.0 6927.0 4088.0 32579.0
ITA 31342.0 8076.0 4761.0 5818.0 3268.0 30736.0 32212.0
NLD 4061.0 32273.0 31584.0 32223.0 29997.0 4326.0 3424.0 33486.0
CZE 1759.0 2219.0 1777.0 2075.0 1638.0 1707.0 1698.0 1676.0 3502.0
HUN 2208.0 6484.0 5954.0 6328.0 5629.0 2346.0 2191.0 5946.0 1369.0 7018.0
POL 4724.0 29055.0 28675.0 29340.0 26004.0 5121.0 4163.0 27514.0 2387.0 5907.0 30550.0

Number of bulls in reference population for bcs

DEU 35903.0
FRA 27245.0 28689.0
GBR 9035.0 4051.0 31221.0
ITA 8026.0 3254.0 29203.0 30872.0
NLD 28906.0 26754.0 4364.0 3407.0 30568.0
CZE 2217.0 1635.0 1699.0 1692.0 1675.0 3381.0
CAN 8494.0 3937.0 29231.0 30021.0 4000.0 1751.0 33709.0
ESP 31960.0 27276.0 6791.0 5765.0 28830.0 2073.0 6243.0 32875.0
HUN 7275.0 6403.0 2422.0 2187.0 6874.0 1384.0 2208.0 7123.0 8075.0
POL 27763.0 24787.0 4989.0 4109.0 26182.0 2318.0 4619.0 27991.0 6708.0 29179.0