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:

DFS (HOL) ang - Decrease in reliability due to a number of foreign bulls failing to meet requirements.
AUS (HOL) ocs - Some changes due to genotype update, added information for some bulls and/or new information on relatives.
ITA (HOL) Decrease in reliability due to changes in bull population
DEU (HOL) Some bulls affected by changed or added information in relatives
ESP (HOL) Changed the reference genome and the imputing process, new check on genotypes and Interbull Method for gebv reliability. (GEBV test OK)
GBR (HOL) Some animals affected by change in genomic information

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 August 2023

Country	Date
BEL	20201201
CAN	20230801
DEU	20230808
DFS	20230808
ESP	20230710
FRA	20230809
GBR	20230710
ITA	20230704
NLD	20230801
HUN	20230721
POL	20230630
CZE	20230724

Table 2.

Number of bulls in reference population for	sta
BEL	1671.0
CAN	726.0 39599.0

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DEU   727.0  9375.0 45109.0
DFS   625.0  5214.0 38615.0 39570.0
ESP   702.0  6631.0 40414.0 38648.0 41317.0
FRA   710.0  4038.0 34731.0 34150.0 34813.0 36458.0
GBR   684.0 33208.0 10086.0  5821.0  7312.0  4121.0 35545.0
ITA   718.0 33596.0  8682.0  4520.0  5960.0  3302.0 32756.0 34606.0
NLD   740.0  4115.0 36593.0 35906.0 36569.0 34236.0  4455.0  3468.0 38368.0
HUN   549.0  2234.0  8226.0  7656.0  8056.0  7283.0  2449.0  2213.0  7806.0  9032.0
POL   994.0  4864.0 33870.0 33415.0 34076.0 30341.0  5319.0  4256.0 31843.0  7626.0 35472.0
CZE   843.0  1848.0  2362.0  1748.0  2175.0  1684.0  1769.0  1766.0  1715.0  1412.0  2533.0  3721.0

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Number of bulls in reference population for        cwi
---------------------------------------------------------
CAN 39596.0
DEU  9377.0 43889.0
DFS  5215.0 37405.0 38352.0
ESP  6633.0 39200.0 37436.0 40089.0
FRA  4038.0 33538.0 32964.0 33618.0 35252.0
GBR 33205.0 10088.0  5822.0  7314.0  4121.0 35542.0
ITA 33593.0  8684.0  4521.0  5962.0  3302.0 32753.0 34603.0
NLD  4115.0 35400.0 34711.0 35376.0 33069.0  4455.0  3468.0 37173.0
HUN  2234.0  7690.0  7118.0  7518.0  6773.0  2449.0  2213.0  7268.0  8493.0
POL  4864.0 32714.0 32258.0 32920.0 29212.0  5319.0  4256.0 30695.0  7087.0 34312.0
CZE  1848.0  2359.0  1745.0  2172.0  1681.0  1769.0  1766.0  1713.0  1411.0  2530.0  3718.0

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Number of bulls in reference population for        bde
---------------------------------------------------------
CAN 39599.0
DEU  9375.0 44549.0
DFS  5214.0 38055.0 39006.0
ESP  6631.0 39855.0 38087.0 40756.0
FRA  4038.0 34199.0 33617.0 34281.0 35925.0
GBR 33208.0 10086.0  5821.0  7312.0  4121.0 35545.0
ITA 33596.0  8682.0  4520.0  5960.0  3302.0 32756.0 34606.0
NLD  4115.0 36034.0 35345.0 36009.0 33703.0  4455.0  3468.0 37807.0
HUN  2234.0  7714.0  7142.0  7542.0  6797.0  2449.0  2213.0  7292.0  8517.0
POL  4864.0 33356.0 32899.0 33560.0 29854.0  5319.0  4256.0 31328.0  7111.0 34955.0
CZE  1848.0  2361.0  1747.0  2174.0  1683.0  1769.0  1766.0  1714.0  1411.0  2532.0  3720.0

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Number of bulls in reference population for        ang
---------------------------------------------------------
BEL  1579.0
CAN   720.0 38665.0
DEU   684.0  8919.0 31373.0
DFS   596.0  4782.0 25900.0 26815.0
ESP   666.0  6184.0 27576.0 25983.0 28452.0
FRA   677.0  3620.0 23058.0 22641.0 23134.0 24764.0
GBR   660.0 32781.0  9515.0  5273.0  6748.0  3586.0 34629.0
ITA   712.0 33090.0  8372.0  4224.0  5655.0  3019.0 32409.0 34060.0
NLD   680.0  3670.0 23843.0 23329.0 23838.0 22634.0  3826.0  3168.0 25152.0
HUN   512.0  2208.0  5029.0  4493.0  4855.0  4181.0  2343.0  2193.0  4465.0  5523.0
POL   957.0  4421.0 21079.0 20792.0 21334.0 18747.0  4759.0  3954.0 19161.0  4427.0 22661.0
CZE   823.0  1833.0  2284.0  1690.0  2104.0  1618.0  1758.0  1753.0  1645.0  1368.0  2459.0  3626.0

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Number of bulls in reference population for        ran
---------------------------------------------------------
CAN 39598.0
DEU  9374.0 45011.0
DFS  5213.0 38517.0 39472.0
ESP  6630.0 40321.0 38555.0 41224.0
FRA  4038.0 34636.0 34055.0 34723.0 36363.0
GBR 33207.0 10085.0  5820.0  7311.0  4121.0 35544.0
ITA 33595.0  8681.0  4519.0  5959.0  3302.0 32755.0 34605.0
NLD  4114.0 36497.0 35810.0 36478.0 34141.0  4454.0  3467.0 38272.0
HUN  2234.0  8226.0  7656.0  8056.0  7283.0  2449.0  2213.0  7806.0  9032.0
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POL  4864.0 33866.0 33411.0 34072.0 30338.0  5319.0  4256.0 31840.0  7626.0 35468.0
CZE  1848.0  2362.0  1748.0  2175.0  1684.0  1769.0  1766.0  1715.0  1412.0  2533.0  3721.0

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Number of bulls in reference population for        rwi
------------------------------------------------------
CAN 38776.0
DEU  9374.0 45053.0
DFS  5213.0 38559.0 39514.0
ESP  6630.0 40359.0 38593.0 41262.0
FRA  4038.0 34676.0 34095.0 34759.0 36403.0
GBR 33207.0 10085.0  5820.0  7311.0  4121.0 35544.0
ITA 33595.0  8681.0  4519.0  5959.0  3302.0 32755.0 34605.0
NLD  4114.0 36537.0 35850.0 36514.0 34181.0  4454.0  3467.0 38312.0
HUN  2234.0  8217.0  7647.0  8047.0  7274.0  2449.0  2213.0  7797.0  9023.0
POL  4864.0 33860.0 33405.0 34066.0 30331.0  5319.0  4256.0 31833.0  7617.0 35462.0
CZE  1848.0  2362.0  1748.0  2175.0  1684.0  1769.0  1766.0  1715.0  1412.0  2533.0  3721.0

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Number of bulls in reference population for        rls
------------------------------------------------------
CAN 39599.0
DEU  9375.0 45109.0
DFS  5214.0 38615.0 39570.0
ESP  6631.0 40414.0 38648.0 41317.0
FRA  4038.0 34732.0 34151.0 34814.0 36459.0
GBR 33208.0 10086.0  5821.0  7312.0  4121.0 35545.0
ITA 33596.0  8682.0  4520.0  5960.0  3302.0 32756.0 34606.0
NLD  4115.0 36594.0 35907.0 36570.0 34237.0  4455.0  3468.0 38369.0
HUN  2234.0  8226.0  7656.0  8056.0  7283.0  2449.0  2213.0  7806.0  9032.0
POL  4864.0 33869.0 33414.0 34075.0 30341.0  5319.0  4256.0 31843.0  7626.0 35471.0
CZE  1848.0  2362.0  1748.0  2175.0  1684.0  1769.0  1766.0  1715.0  1412.0  2533.0  3721.0

------------------------------------------------------
Number of bulls in reference population for        rlr
------------------------------------------------------
CAN 38671.0
DEU  9370.0 42999.0
DFS  5207.0 36533.0 37478.0
ESP  6625.0 38319.0 36562.0 39204.0
FRA  4030.0 32659.0 32102.0 32746.0 34320.0
GBR 32374.0 10079.0  5812.0  7304.0  4111.0 34408.0
ITA 32763.0  8677.0  4513.0  5954.0  3294.0 31924.0 33772.0
NLD  4104.0 34537.0 33849.0 34512.0 32218.0  4365.0  3459.0 35864.0
HUN  2229.0  7333.0  6762.0  7161.0  6427.0  2368.0  2210.0  6772.0  7867.0
POL  4855.0 31850.0 31393.0 32053.0 28357.0  5308.0  4247.0 29835.0  6731.0 33395.0
CZE  1847.0  2349.0  1735.0  2162.0  1672.0  1767.0  1765.0  1703.0  1404.0  2471.0  3630.0

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Number of bulls in reference population for        fan
------------------------------------------------------
CAN 39565.0
DEU  9376.0 42953.0
DFS  5213.0 36724.0 37661.0
ESP  6631.0 38523.0 36759.0 39420.0
FRA  4036.0 32905.0 32325.0 32986.0 34626.0
GBR 33182.0 10087.0  5820.0  7312.0  4119.0 35223.0
ITA 33567.0  8683.0  4519.0  5960.0  3300.0 32731.0 34576.0
NLD  4111.0 34711.0 34025.0 34688.0 32419.0  4374.0  3466.0 36036.0
HUN  2231.0  7537.0  6967.0  7366.0  6631.0  2371.0  2212.0  6976.0  8072.0
POL  4862.0 32038.0 31583.0 32242.0 28575.0  5317.0  4254.0 30018.0  6937.0 33634.0
CZE  1847.0  2360.0  1746.0  2173.0  1682.0  1769.0  1765.0  1713.0  1410.0  2531.0  3718.0

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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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---------------------------------------------------------
CAN 39601.0
DEU  9377.0 44290.0
DFS  5215.0 37804.0 38753.0
ESP  6633.0 39599.0 37834.0 40494.0
FRA  4038.0 33941.0 33364.0 34021.0 35663.0
GBR 33210.0 10086.0  5822.0  7313.0  4121.0 35544.0
ITA 33598.0  8683.0  4521.0  5961.0  3302.0 32757.0 34607.0
NLD  4115.0 35794.0 35105.0 35768.0 33463.0  4455.0  3468.0 37567.0
HUN  2234.0  7692.0  7120.0  7520.0  6775.0  2449.0  2213.0  7270.0  8495.0
POL  4864.0 33065.0 32609.0 33269.0 29564.0  5318.0  4255.0 31043.0  7089.0 34664.0
CZE  1848.0  2361.0  1747.0  2174.0  1683.0  1769.0  1766.0  1714.0  1411.0  2532.0  3720.0

---------------------------------------------------------
Number of bulls in reference population for        ruh
---------------------------------------------------------
CAN 39599.0
DEU  9376.0 43976.0
DFS  5214.0 37499.0 38426.0
ESP  6632.0 39284.0 37508.0 40153.0
FRA  4038.0 33634.0 33067.0 33715.0 35357.0
GBR 33208.0 10085.0  5821.0  7312.0  4121.0 35540.0
ITA 33596.0  8682.0  4520.0  5960.0  3302.0 32755.0 34605.0
NLD  4115.0 35471.0 34796.0 35446.0 33146.0  4455.0  3468.0 37243.0
HUN  2234.0  7703.0  7131.0  7531.0  6786.0  2449.0  2213.0  7281.0  8506.0
POL  4864.0 33201.0 32745.0 33405.0 29700.0  5318.0  4255.0 31178.0  7103.0 34800.0
CZE  1848.0  2361.0  1747.0  2174.0  1683.0  1769.0  1766.0  1714.0  1411.0  2532.0  3720.0

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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  1671.0
CAN   726.0 39603.0
DEU   727.0  9378.0 45110.0
DFS   625.0  5216.0 38617.0 39572.0
ESP   702.0  6634.0 40416.0 38650.0 41319.0
FRA   710.0  4038.0 34731.0 34150.0 34813.0 36458.0
GBR   684.0 33212.0 10088.0  5824.0  7315.0  4121.0 35547.0
ITA   718.0 33600.0  8685.0  4523.0  5963.0  3302.0 32760.0 34610.0
NLD   740.0  4115.0 36593.0 35906.0 36569.0 34236.0  4455.0  3468.0 38368.0
HUN   549.0  2234.0  8226.0  7656.0  8056.0  7283.0  2449.0  2213.0  7806.0  9032.0
POL   994.0  4864.0 33867.0 33413.0 34073.0 30340.0  5318.0  4255.0 31842.0  7626.0 35469.0
CZE   843.0  1848.0  2362.0  1748.0  2175.0  1684.0  1769.0  1766.0  1715.0  1412.0  2533.0  3721.0

---------------------------------------------------------
Number of bulls in reference population for        ude
---------------------------------------------------------
CAN 39595.0
DEU  9377.0 45115.0
DFS  5214.0 38614.0 39569.0
ESP  6631.0 40415.0 38647.0 41318.0
FRA  4038.0 34731.0 34149.0 34813.0 36458.0
GBR 33208.0 10089.0  5821.0  7313.0  4121.0 35251.0
ITA 33597.0  8687.0  4520.0  5961.0  3302.0 32761.0 34612.0
NLD  4112.0 36596.0 35904.0 36570.0 34236.0  4378.0  3470.0 37931.0
HUN  2232.0  8227.0  7656.0  8056.0  7283.0  2373.0  2214.0  7667.0  8766.0
POL  4865.0 33870.0 33415.0 34076.0 30341.0  5319.0  4256.0 31844.0  7627.0 35472.0
CZE  1849.0  2362.0  1748.0  2175.0  1684.0  1770.0  1767.0  1715.0  1412.0  2533.0  3722.0

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Number of bulls in reference population for        ftp
---------------------------------------------------------
CAN 39606.0
DEU  9380.0 45072.0
DFS  5215.0 38569.0 39524.0
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ESP  6633.0 40372.0 38603.0 41275.0
FRA  4038.0 34685.0 34103.0 34768.0 36412.0
GBR 33214.0 10092.0  5822.0  7315.0  4121.0 35553.0
ITA 33603.0  8690.0  4521.0  5963.0  3302.0 32766.0 34618.0
NLD  4116.0 36552.0 35860.0 36527.0 34190.0  4459.0  3472.0 38330.0
HUN  2235.0  8227.0  7656.0  8056.0  7282.0  2451.0  2215.0  7806.0  9033.0
POL  4865.0 33868.0 33413.0 34074.0 30340.0  5319.0  4256.0 31843.0  7626.0 35470.0
CZE  1849.0  2362.0  1748.0  2175.0  1684.0  1770.0  1767.0  1715.0  1412.0  2533.0  3722.0

---------------------------------------------------------
Number of bulls in reference population for        ftl
---------------------------------------------------------
BEL  1642.0
CAN   724.0 39584.0
DEU   727.0  9376.0 45106.0
DFS   625.0  5214.0 38613.0 39568.0
ESP   702.0  6631.0 40411.0 38646.0 41314.0
FRA   710.0  4038.0 34730.0 34149.0 34812.0 36457.0
GBR   669.0 33206.0 10085.0  5821.0  7311.0  4121.0 35304.0
ITA   717.0 33594.0  8682.0  4520.0  5959.0  3302.0 32754.0 34603.0
NLD   720.0  4113.0 36591.0 35904.0 36567.0 34235.0  4380.0  3467.0 37949.0
HUN   531.0  2232.0  8225.0  7655.0  8055.0  7283.0  2395.0  2212.0  7679.0  8828.0
POL   994.0  4864.0 33868.0 33414.0 34074.0 30340.0  5318.0  4255.0 31842.0  7626.0 35470.0
CZE   843.0  1848.0  2362.0  1748.0  2175.0  1684.0  1769.0  1766.0  1715.0  1412.0  2533.0  3721.0

---------------------------------------------------------
Number of bulls in reference population for        rtp
---------------------------------------------------------
CAN 36503.0
DEU  9374.0 42809.0
DFS  5209.0 36330.0 37197.0
ESP  6627.0 38110.0 36285.0 38928.0
FRA  4032.0 32505.0 31892.0 32534.0 34177.0
GBR 31378.0 10086.0  5816.0  7309.0  4115.0 33709.0
ITA 31598.0  8685.0  4516.0  5958.0  3297.0 30938.0 32609.0
NLD  4092.0 34294.0 33570.0 34214.0 31961.0  4435.0  3448.0 35869.0
POL  4858.0 32381.0 31870.0 32532.0 28851.0  5312.0  4250.0 30305.0 33854.0
CZE  1844.0  2346.0  1734.0  2159.0  1669.0  1765.0  1762.0  1699.0  2458.0  3637.0

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Number of bulls in reference population for        ocs
---------------------------------------------------------
AUS  2900.0
CAN  1075.0 39514.0
DEU   788.0  9330.0 44353.0
ESP   749.0  6613.0 39725.0 40607.0
FRA   718.0  4034.0 34057.0 34134.0 35766.0
GBR  1128.0 33141.0 10038.0  7296.0  4119.0 35467.0
ITA  1016.0 33532.0  8635.0  5944.0  3299.0 32683.0 34529.0
NLD   767.0  4108.0 35942.0 35922.0 33592.0  4445.0  3457.0 37708.0
HUN   701.0  2230.0  8224.0  8056.0  7284.0  2444.0  2208.0  7807.0  9028.0
POL   657.0  4857.0 33216.0 33420.0 29688.0  5315.0  4252.0 31200.0  7627.0 34812.0
CZE   375.0  1848.0  2360.0  2173.0  1682.0  1769.0  1766.0  1714.0  1412.0  2531.0  3719.0

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Number of bulls in reference population for        ous
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CAN 39551.0
DEU  9338.0 45018.0
DFS  5212.0 38607.0 39556.0
ESP  6616.0 40382.0 38641.0 41277.0
FRA  4036.0 34719.0 34145.0 34798.0 36440.0
GBR 33173.0 10043.0  5820.0  7297.0  4120.0 35491.0
ITA 33564.0  8641.0  4518.0  5945.0  3300.0 32714.0 34560.0
NLD  4109.0 36576.0 35906.0 36556.0 34226.0  4446.0  3458.0 38346.0
HUN  2230.0  8224.0  7657.0  8056.0  7284.0  2444.0  2208.0  7807.0  9028.0
POL  4859.0 33855.0 33412.0 34058.0 30329.0  5315.0  4252.0 31832.0  7627.0 35453.0
CZE  1848.0  2362.0  1748.0  2175.0  1684.0  1769.0  1766.0  1715.0  1412.0  2533.0  3721.0
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Number of bulls in reference population for ofl

CAN	39398.0										
DEU	9339.0	44378.0									
DFS	5212.0	37975.0	38921.0								
ESP	6616.0	39745.0	38008.0	40628.0							
FRA	4036.0	34078.0	33512.0	34155.0	35787.0						
GBR	33045.0	10046.0	5820.0	7298.0	4120.0	35070.0					
ITA	33437.0	8643.0	4518.0	5946.0	3300.0	32589.0	34434.0				
NLD	4107.0	35962.0	35291.0	35942.0	33612.0	4367.0	3458.0	37266.0			
HUN	2227.0	8222.0	7655.0	8054.0	7283.0	2366.0	2207.0	7666.0	8759.0		
POL	4859.0	33236.0	32793.0	33441.0	29709.0	5316.0	4253.0	31221.0	7626.0	34833.0	
CZE	1848.0	2360.0	1746.0	2173.0	1682.0	1769.0	1766.0	1714.0	1412.0	2531.0	3719.0

Number of bulls in reference population for loc

CAN	34248.0										
DEU	9281.0	40257.0									
DFS	5167.0	34108.0	34918.0								
ESP	6571.0	35903.0	34088.0	36674.0							
FRA	3995.0	30416.0	29782.0	30449.0	32020.0						
GBR	31361.0	9990.0	5779.0	7257.0	4090.0	33358.0					
ITA	31524.0	8587.0	4481.0	5908.0	3271.0	30912.0	32400.0				
NLD	4071.0	32297.0	31557.0	32234.0	30002.0	4336.0	3431.0	33495.0			
CZE	1837.0	2324.0	1715.0	2141.0	1651.0	1760.0	1754.0	1682.0	3592.0		
HUN	2221.0	6509.0	5950.0	6336.0	5631.0	2357.0	2202.0	5948.0	1383.0	7030.0	
POL	4814.0	29410.0	28870.0	29559.0	26013.0	5274.0	4213.0	27518.0	2419.0	5908.0	30774.0

Number of bulls in reference population for bcs

DEU	36845.0										
FRA	27255.0	28699.0									
GBR	9846.0	4054.0	31992.0								
ITA	8533.0	3258.0	29386.0	31064.0							
NLD	28928.0	26757.0	4373.0	3413.0	30573.0						
CZE	2317.0	1646.0	1748.0	1747.0	1679.0	3466.0					
CAN	9173.0	3945.0	29829.0	30206.0	4009.0	1827.0	34419.0				
ESP	32503.0	27283.0	7116.0	5855.0	28838.0	2133.0	6466.0	33243.0			
HUN	7301.0	6406.0	2435.0	2199.0	6877.0	1398.0	2221.0	7133.0	8088.0		
POL	28088.0	24795.0	5138.0	4163.0	26185.0	2346.0	4711.0	28203.0	6711.0	29396.0	