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:

DEU (HOL) ANG - Smaller reference population due to a recent change in the definition of the trait.
DFS (HOL) Started a new system for handling genotypes. As consequence few bulls with genotypes have been deleted from the system
ESP (HOL) Base change
OFL - Extreme changes for some bulls detected due to their sires entering the reference population
HUN (HOL) New GEBV provided since 2022, in a transition period from previous service owner to the new Herd-Book Society.
NLD (HOL) SNP effects and DGTV are estimated with single step genomic system. GEBV are published from the pseudo-record system using DGV from the single step system
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 2023

Country	Date
BEL	20201201
CAN	20231201
DEU	20231205
DFS	20231107
ESP	20231115
FRA	20231206
GBR	20231110
ITA	20231107
NLD	20231201
HUN	20231117
POL	20231009
CZE	20231120

Table 2.

Number of bulls in reference population for	sta
BEL 1671.0	
CAN 726.0 40061.0	
DEU 727.0 9670.0 45543.0	

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DFS   649.0  5574.0 39409.0 40350.0
ESP   703.0  7011.0 40827.0 39606.0 41942.0
FRA   710.0  4040.0 34733.0 34465.0 34820.0 36460.0
GBR   684.0 33652.0 10463.0  6352.0  7822.0  4125.0 36103.0
ITA   721.0 34321.0  9270.0  5091.0  6479.0  3309.0 33582.0 35398.0
NLD   740.0  4117.0 36597.0 36278.0 36577.0 34238.0  4459.0  3475.0 38371.0
HUN   549.0  2235.0  8227.0  7827.0  8062.0  7283.0  2451.0  2215.0  7806.0  9032.0
POL   994.0  4866.0 33911.0 33899.0 34090.0 30343.0  5326.0  4362.0 31845.0  7626.0 35475.0
CZE   844.0  1928.0  2441.0  1866.0  2257.0  1693.0  1856.0  1872.0  1725.0  1426.0  2549.0  3812.0

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Number of bulls in reference population for        cwi
---------------------------------------------------------
CAN 40058.0
DEU  9672.0 44324.0
DFS  5575.0 38201.0 39134.0
ESP  7013.0 39614.0 38396.0 40715.0
FRA  4040.0 33540.0 33280.0 33625.0 35254.0
GBR 33649.0 10465.0  6353.0  7824.0  4125.0 36100.0
ITA 34318.0  9272.0  5092.0  6481.0  3309.0 33579.0 35395.0
NLD  4117.0 35404.0 35084.0 35384.0 33071.0  4459.0  3475.0 37176.0
HUN  2235.0  7691.0  7290.0  7524.0  6773.0  2451.0  2215.0  7268.0  8493.0
POL  4866.0 32756.0 32744.0 32935.0 29214.0  5326.0  4362.0 30697.0  7087.0 34316.0
CZE  1928.0  2438.0  1863.0  2254.0  1690.0  1856.0  1872.0  1723.0  1425.0  2546.0  3809.0

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Number of bulls in reference population for        bde
---------------------------------------------------------
CAN 40061.0
DEU  9670.0 44984.0
DFS  5574.0 38851.0 39788.0
ESP  7011.0 40269.0 39047.0 41382.0
FRA  4040.0 34201.0 33933.0 34288.0 35927.0
GBR 33652.0 10463.0  6352.0  7822.0  4125.0 36103.0
ITA 34321.0  9270.0  5091.0  6479.0  3309.0 33582.0 35398.0
NLD  4117.0 36038.0 35718.0 36017.0 33705.0  4459.0  3475.0 37810.0
HUN  2235.0  7715.0  7314.0  7548.0  6797.0  2451.0  2215.0  7292.0  8517.0
POL  4866.0 33398.0 33385.0 33575.0 29856.0  5326.0  4362.0 31330.0  7111.0 34959.0
CZE  1928.0  2440.0  1865.0  2256.0  1692.0  1856.0  1872.0  1724.0  1425.0  2548.0  3811.0

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Number of bulls in reference population for        ang
---------------------------------------------------------
BEL  1579.0
CAN   720.0 39130.0
DEU   684.0  9214.0 31807.0
DFS   614.0  5131.0 26601.0 27503.0
ESP   667.0  6564.0 27991.0 26824.0 29077.0
FRA   677.0  3623.0 23062.0 22847.0 23143.0 24768.0
GBR   660.0 33225.0  9894.0  5793.0  7260.0  3592.0 35182.0
ITA   715.0 33814.0  8961.0  4790.0  6175.0  3027.0 33236.0 34850.0
NLD   680.0  3673.0 23850.0 23597.0 23848.0 22638.0  3833.0  3176.0 25158.0
HUN   512.0  2209.0  5030.0  4642.0  4861.0  4181.0  2345.0  2195.0  4465.0  5523.0
POL   957.0  4424.0 21124.0 21189.0 21351.0 18751.0  4769.0  4061.0 19166.0  4427.0 22668.0
CZE   824.0  1913.0  2363.0  1797.0  2186.0  1627.0  1845.0  1858.0  1655.0  1382.0  2475.0  3717.0

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Number of bulls in reference population for        ran
---------------------------------------------------------
CAN 40060.0
DEU  9669.0 45446.0
DFS  5573.0 39312.0 40253.0
ESP  7010.0 40735.0 39514.0 41850.0
FRA  4040.0 34638.0 34370.0 34730.0 36365.0
GBR 33651.0 10462.0  6351.0  7821.0  4125.0 36102.0
ITA 34320.0  9269.0  5090.0  6478.0  3309.0 33581.0 35397.0
NLD  4116.0 36501.0 36182.0 36486.0 34143.0  4458.0  3474.0 38275.0
HUN  2235.0  8227.0  7827.0  8062.0  7283.0  2451.0  2215.0  7806.0  9032.0
POL  4866.0 33908.0 33896.0 34087.0 30340.0  5326.0  4362.0 31842.0  7626.0 35472.0
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CZE  1928.0  2441.0  1866.0  2257.0  1693.0  1856.0  1872.0  1725.0  1426.0  2549.0  3812.0

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Number of bulls in reference population for        rwi
-----------------------------------------------------
CAN 39238.0
DEU  9669.0 45487.0
DFS  5573.0 39353.0 40294.0
ESP  7010.0 40772.0 39551.0 41887.0
FRA  4040.0 34678.0 34410.0 34766.0 36405.0
GBR 33651.0 10462.0  6351.0  7821.0  4125.0 36102.0
ITA 34320.0  9269.0  5090.0  6478.0  3309.0 33581.0 35397.0
NLD  4116.0 36541.0 36222.0 36522.0 34183.0  4458.0  3474.0 38315.0
HUN  2235.0  8218.0  7818.0  8053.0  7274.0  2451.0  2215.0  7797.0  9023.0
POL  4866.0 33901.0 33889.0 34080.0 30333.0  5326.0  4362.0 31835.0  7617.0 35465.0
CZE  1928.0  2441.0  1866.0  2257.0  1693.0  1856.0  1872.0  1725.0  1426.0  2549.0  3812.0

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Number of bulls in reference population for        rls
-----------------------------------------------------
CAN 40061.0
DEU  9670.0 45544.0
DFS  5574.0 39410.0 40351.0
ESP  7011.0 40828.0 39607.0 41943.0
FRA  4040.0 34734.0 34466.0 34821.0 36461.0
GBR 33652.0 10463.0  6352.0  7822.0  4125.0 36103.0
ITA 34321.0  9270.0  5091.0  6479.0  3309.0 33582.0 35398.0
NLD  4117.0 36598.0 36279.0 36578.0 34239.0  4459.0  3475.0 38372.0
HUN  2235.0  8227.0  7827.0  8062.0  7283.0  2451.0  2215.0  7806.0  9032.0
POL  4866.0 33911.0 33899.0 34090.0 30343.0  5326.0  4362.0 31845.0  7626.0 35475.0
CZE  1928.0  2441.0  1866.0  2257.0  1693.0  1856.0  1872.0  1725.0  1426.0  2549.0  3812.0

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Number of bulls in reference population for        rlr
-----------------------------------------------------
CAN 39132.0
DEU  9664.0 43433.0
DFS  5567.0 37328.0 38259.0
ESP  7004.0 38732.0 37521.0 39827.0
FRA  4032.0 32661.0 32417.0 32753.0 34322.0
GBR 32816.0 10455.0  6343.0  7813.0  4115.0 34957.0
ITA 33487.0  9264.0  5084.0  6472.0  3301.0 32749.0 34563.0
NLD  4106.0 34541.0 34221.0 34519.0 32220.0  4369.0  3466.0 35867.0
HUN  2230.0  7334.0  6933.0  7167.0  6427.0  2370.0  2212.0  6772.0  7867.0
POL  4857.0 31892.0 31878.0 32068.0 28359.0  5315.0  4353.0 29837.0  6731.0 33399.0
CZE  1927.0  2428.0  1853.0  2244.0  1681.0  1854.0  1871.0  1713.0  1418.0  2487.0  3721.0

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Number of bulls in reference population for        fan
-----------------------------------------------------
CAN 40027.0
DEU  9671.0 43385.0
DFS  5573.0 37515.0 38438.0
ESP  7011.0 38934.0 37714.0 40041.0
FRA  4038.0 32904.0 32636.0 32990.0 34625.0
GBR 33626.0 10464.0  6351.0  7822.0  4123.0 35774.0
ITA 34292.0  9271.0  5090.0  6479.0  3307.0 33557.0 35368.0
NLD  4113.0 34712.0 34393.0 34692.0 32418.0  4378.0  3473.0 36036.0
HUN  2232.0  7538.0  7139.0  7372.0  6631.0  2373.0  2214.0  6976.0  8072.0
POL  4864.0 32077.0 32064.0 32254.0 28574.0  5324.0  4360.0 30017.0  6937.0 33635.0
CZE  1927.0  2439.0  1864.0  2255.0  1691.0  1856.0  1871.0  1723.0  1424.0  2547.0  3809.0

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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 40062.0
DEU  9671.0 44723.0
DFS  5575.0 38600.0 39535.0
ESP  7013.0 40013.0 38794.0 41120.0
FRA  4040.0 33943.0 33680.0 34028.0 35665.0
GBR 33653.0 10461.0  6353.0  7823.0  4125.0 36101.0
ITA 34322.0  9270.0  5092.0  6480.0  3309.0 33582.0 35398.0
NLD  4117.0 35798.0 35478.0 35776.0 33465.0  4459.0  3475.0 37570.0
HUN  2235.0  7693.0  7292.0  7526.0  6775.0  2451.0  2215.0  7270.0  8495.0
POL  4866.0 33107.0 33095.0 33284.0 29566.0  5325.0  4361.0 31045.0  7089.0 34668.0
CZE  1928.0  2440.0  1865.0  2256.0  1692.0  1856.0  1872.0  1724.0  1425.0  2548.0  3811.0

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Number of bulls in reference population for        ruh
-----------------------------------------------------
CAN 40059.0
DEU  9669.0 44408.0
DFS  5574.0 38295.0 39208.0
ESP  7011.0 39697.0 38468.0 40778.0
FRA  4040.0 33636.0 33383.0 33722.0 35359.0
GBR 33650.0 10459.0  6352.0  7821.0  4125.0 36096.0
ITA 34319.0  9268.0  5091.0  6478.0  3309.0 33579.0 35395.0
NLD  4117.0 35475.0 35169.0 35454.0 33148.0  4459.0  3475.0 37246.0
HUN  2235.0  7704.0  7303.0  7537.0  6786.0  2451.0  2215.0  7281.0  8506.0
POL  4866.0 33243.0 33231.0 33420.0 29702.0  5325.0  4361.0 31180.0  7103.0 34804.0
CZE  1928.0  2440.0  1865.0  2256.0  1692.0  1856.0  1872.0  1724.0  1425.0  2548.0  3811.0

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Number of bulls in reference population for        ruw
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Number of bulls in reference population for        usu
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BEL  1671.0
CAN   726.0 40064.0
DEU   727.0  9672.0 45543.0
DFS   649.0  5576.0 39412.0 40353.0
ESP   703.0  7014.0 40830.0 39609.0 41945.0
FRA   710.0  4040.0 34733.0 34465.0 34820.0 36460.0
GBR   684.0 33655.0 10463.0  6355.0  7825.0  4125.0 36104.0
ITA   721.0 34324.0  9272.0  5094.0  6482.0  3309.0 33585.0 35401.0
NLD   740.0  4117.0 36597.0 36278.0 36577.0 34238.0  4459.0  3475.0 38371.0
HUN   549.0  2235.0  8227.0  7827.0  8062.0  7283.0  2451.0  2215.0  7806.0  9032.0
POL   994.0  4866.0 33909.0 33898.0 34088.0 30342.0  5325.0  4361.0 31844.0  7626.0 35473.0
CZE   844.0  1928.0  2441.0  1866.0  2257.0  1693.0  1856.0  1872.0  1725.0  1426.0  2549.0  3812.0

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Number of bulls in reference population for        ude
-----------------------------------------------------
CAN 40056.0
DEU  9671.0 45550.0
DFS  5574.0 39411.0 40352.0
ESP  7011.0 40829.0 39606.0 41942.0
FRA  4040.0 34733.0 34464.0 34820.0 36460.0
GBR 33651.0 10466.0  6354.0  7824.0  4125.0 35804.0
ITA 34321.0  9275.0  5093.0  6481.0  3309.0 33587.0 35404.0
NLD  4114.0 36601.0 36279.0 36578.0 34238.0  4383.0  3478.0 37934.0
HUN  2233.0  8228.0  7827.0  8062.0  7283.0  2375.0  2216.0  7667.0  8766.0
POL  4867.0 33911.0 33899.0 34090.0 30343.0  5326.0  4362.0 31846.0  7627.0 35475.0
CZE  1929.0  2441.0  1866.0  2257.0  1693.0  1857.0  1873.0  1725.0  1426.0  2549.0  3813.0

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Number of bulls in reference population for        ftp
-----------------------------------------------------
CAN 40066.0
DEU  9673.0 45507.0
DFS  5575.0 39367.0 40308.0
ESP  7012.0 40786.0 39563.0 41901.0
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FRA  4040.0 34687.0 34418.0 34775.0 36414.0
GBR 33656.0 10468.0  6355.0  7825.0  4125.0 36112.0
ITA 34326.0  9277.0  5094.0  6482.0  3309.0 33591.0 35409.0
NLD  4118.0 36557.0 36235.0 36536.0 34192.0  4464.0  3480.0 38333.0
HUN  2236.0  8228.0  7827.0  8062.0  7282.0  2453.0  2217.0  7806.0  9033.0
POL  4867.0 33910.0 33898.0 34089.0 30342.0  5326.0  4362.0 31845.0  7626.0 35474.0
CZE  1929.0  2441.0  1866.0  2257.0  1693.0  1857.0  1873.0  1725.0  1426.0  2549.0  3813.0

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Number of bulls in reference population for        ftl
------------------------------------------------------------
BEL  1642.0
CAN   724.0 40045.0
DEU   727.0  9670.0 45538.0
DFS   649.0  5574.0 39407.0 40348.0
ESP   703.0  7011.0 40824.0 39604.0 41937.0
FRA   710.0  4040.0 34732.0 34464.0 34819.0 36459.0
GBR   669.0 33649.0 10460.0  6352.0  7821.0  4125.0 35861.0
ITA   720.0 34318.0  9269.0  5091.0  6478.0  3309.0 33579.0 35394.0
NLD   720.0  4115.0 36595.0 36276.0 36574.0 34237.0  4384.0  3474.0 37952.0
HUN   531.0  2233.0  8226.0  7826.0  8061.0  7283.0  2397.0  2214.0  7679.0  8828.0
POL   994.0  4866.0 33909.0 33898.0 34088.0 30342.0  5325.0  4361.0 31844.0  7626.0 35473.0
CZE   844.0  1928.0  2441.0  1866.0  2257.0  1693.0  1856.0  1872.0  1725.0  1426.0  2549.0  3812.0

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Number of bulls in reference population for        rtp
------------------------------------------------------------
CAN 36965.0
DEU  9667.0 43244.0
DFS  5569.0 37126.0 37979.0
ESP  7006.0 38524.0 37243.0 39554.0
FRA  4034.0 32507.0 32205.0 32541.0 34179.0
GBR 31820.0 10462.0  6349.0  7819.0  4119.0 34268.0
ITA 32320.0  9272.0  5089.0  6477.0  3304.0 31763.0 33399.0
NLD  4094.0 34299.0 33943.0 34223.0 31963.0  4440.0  3456.0 35872.0
POL  4860.0 32423.0 32354.0 32547.0 28853.0  5319.0  4356.0 30307.0 33858.0
CZE  1924.0  2425.0  1851.0  2241.0  1678.0  1852.0  1868.0  1709.0  2474.0  3728.0

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Number of bulls in reference population for        ocs
------------------------------------------------------------
AUS  3060.0
CAN  1233.0 39974.0
DEU   918.0  9622.0 44783.0
ESP   841.0  6990.0 40134.0 41228.0
FRA   747.0  4036.0 34059.0 34141.0 35768.0
GBR  1285.0 33581.0 10409.0  7800.0  4123.0 36018.0
ITA  1172.0 34251.0  9217.0  6459.0  3306.0 33501.0 35314.0
NLD   808.0  4110.0 35946.0 35930.0 33594.0  4449.0  3464.0 37711.0
HUN   764.0  2231.0  8225.0  8062.0  7284.0  2446.0  2210.0  7807.0  9028.0
POL   692.0  4859.0 33257.0 33434.0 29690.0  5322.0  4358.0 31202.0  7627.0 34815.0
CZE   414.0  1928.0  2439.0  2255.0  1691.0  1856.0  1872.0  1724.0  1426.0  2547.0  3810.0

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Number of bulls in reference population for        ous
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CAN 40011.0
DEU  9630.0 45448.0
DFS  5568.0 39393.0 40328.0
ESP  6993.0 40792.0 39594.0 41899.0
FRA  4038.0 34721.0 34460.0 34805.0 36442.0
GBR 33613.0 10413.0  6345.0  7801.0  4124.0 36043.0
ITA 34283.0  9223.0  5085.0  6460.0  3307.0 33533.0 35346.0
NLD  4111.0 36580.0 36277.0 36564.0 34228.0  4450.0  3465.0 38349.0
HUN  2231.0  8225.0  7828.0  8062.0  7284.0  2446.0  2210.0  7807.0  9028.0
POL  4861.0 33897.0 33895.0 34073.0 30331.0  5322.0  4358.0 31834.0  7627.0 35457.0
CZE  1928.0  2441.0  1866.0  2257.0  1693.0  1856.0  1872.0  1725.0  1426.0  2549.0  3812.0

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Number of bulls in reference population for ofl

CAN	39860.0									
DEU	9633.0	44811.0								
DFS	5568.0	38761.0	39693.0							
ESP	6994.0	40156.0	38961.0	41249.0						
FRA	4038.0	34080.0	33827.0	34162.0	35789.0					
GBR	33487.0	10419.0	6345.0	7803.0	4124.0	35617.0				
ITA	34158.0	9227.0	5085.0	6462.0	3307.0	33410.0	35222.0			
NLD	4109.0	35966.0	35662.0	35949.0	33614.0	4371.0	3465.0	37269.0		
HUN	2228.0	8223.0	7826.0	8060.0	7283.0	2368.0	2209.0	7666.0	8759.0	
POL	4861.0	33278.0	33276.0	33456.0	29711.0	5323.0	4359.0	31223.0	7626.0	34837.0
CZE	1928.0	2439.0	1864.0	2255.0	1691.0	1856.0	1872.0	1724.0	1426.0	2547.0	3810.0

Number of bulls in reference population for loc

CAN	34616.0									
DEU	9574.0	40689.0								
DFS	5522.0	34884.0	35684.0							
ESP	6945.0	36308.0	35029.0	37290.0						
FRA	3996.0	30417.0	30088.0	30455.0	32021.0					
GBR	31706.0	10364.0	6304.0	7759.0	4094.0	33810.0				
ITA	32146.0	9171.0	5048.0	6423.0	3278.0	31638.0	33183.0			
NLD	4072.0	32300.0	31919.0	32240.0	30002.0	4340.0	3438.0	33497.0		
CZE	1918.0	2404.0	1832.0	2223.0	1660.0	1848.0	1861.0	1692.0	3684.0	
HUN	2222.0	6509.0	6116.0	6341.0	5630.0	2359.0	2204.0	5947.0	1397.0	7029.0
POL	4816.0	29456.0	29354.0	29581.0	26014.0	5283.0	4320.0	27519.0	2435.0	5907.0	30785.0

Number of bulls in reference population for bcs

DEU	37255.0									
FRA	27257.0	28701.0								
GBR	10203.0	4058.0	32423.0							
ITA	9096.0	3265.0	30105.0	31827.0						
NLD	28934.0	26761.0	4377.0	3419.0	30578.0					
CZE	2397.0	1655.0	1837.0	1854.0	1689.0	3559.0				
CAN	9464.0	3947.0	30181.0	30836.0	4011.0	1909.0	34793.0			
ESP	32887.0	27290.0	7575.0	6351.0	28848.0	2216.0	6839.0	33801.0		
HUN	7302.0	6406.0	2437.0	2201.0	6877.0	1412.0	2222.0	7139.0	8088.0	
POL	28125.0	24797.0	5145.0	4263.0	26187.0	2363.0	4713.0	28217.0	6711.0	29400.0