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:

CAN (HOL) Base change, changes in the genomic reference population affecting the SNP estimates, when many MACE proofs are replaced by domestic EBV that include only local progeny of these international bulls (dropping out the USA progeny data).
FRA (HOL) Base change
AUS (HOL) OCS: influx of New Zealand genotypes, some with data and links to Australian pedigrees, and these have specifically affected GEBVs for NZL sires
DEU (HOL) Base change, ANG: The definition for this trait was changed since last year, its genomic reference population is much smaller than all the other conformation traits.
ITA (HOL): Base change, cut-off one year of data in line with MACE
POL (HOL): Changes in pedigrees and in the reference population
NLD (HOL): Base change
GBR (HOL): Updates in data and genotypes

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 April 2024

Country	Date
BEL	20201201
CAN	20240401
DEU	20240403
DFS	20240206
ESP	20240312
FRA	20240403
GBR	20240312
ITA	20240305
NLD	20240101
HUN	20231117
POL	20240307
CZE	20240318

Table 2.

Number of bulls in reference population for sta

BEL 1671.0
CAN 726.0 40147.0
DEU 727.0 9958.0 45971.0
DFS 651.0 6015.0 39757.0 40720.0
ESP 703.0 7039.0 41037.0 39511.0 41975.0
FRA 710.0 4040.0 34733.0 34289.0 34820.0 36460.0
GBR 683.0 33706.0 10834.0 6857.0 7878.0 4122.0 36266.0
ITA 721.0 34130.0 9413.0 5436.0 6490.0 3309.0 33381.0 35209.0
NLD 740.0 4118.0 36601.0 36096.0 36577.0 34238.0 4459.0 3476.0 38372.0
HUN 549.0 2235.0 8227.0 7770.0 8062.0 7283.0 2451.0 2215.0 7806.0 9032.0
POL 994.0 4866.0 33922.0 33708.0 34092.0 30343.0 5320.0 4364.0 31845.0 7626.0 35477.0
CZE 844.0 1932.0 2449.0 1878.0 2257.0 1693.0 1848.0 1872.0 1725.0 1426.0 2549.0 3812.0

Number of bulls in reference population for cwi

CAN 40144.0
DEU 9960.0 44751.0
DFS 6016.0 38617.0 39574.0
ESP 7041.0 39823.0 38371.0 40747.0
FRA 4040.0 33539.0 33170.0 33624.0 35253.0
GBR 33703.0 10836.0 6858.0 7880.0 4122.0 36263.0
ITA 34127.0 9415.0 5437.0 6492.0 3309.0 33378.0 35206.0
NLD 4118.0 35407.0 34969.0 35383.0 33070.0 4459.0 3476.0 37176.0
HUN 2235.0 7690.0 7263.0 7523.0 6772.0 2451.0 2215.0 7267.0 8492.0
POL 4866.0 32766.0 32620.0 32936.0 29213.0 5320.0 4364.0 30696.0 7086.0 34317.0
CZE 1932.0 2446.0 1875.0 2254.0 1690.0 1848.0 1872.0 1723.0 1425.0 2546.0 3809.0

Number of bulls in reference population for bde

CAN 40147.0
DEU 9958.0 45412.0
DFS 6015.0 39229.0 40188.0
ESP 7039.0 40479.0 38982.0 41415.0
FRA 4040.0 34201.0 33783.0 34288.0 35927.0
GBR 33706.0 10834.0 6857.0 7878.0 4122.0 36266.0
ITA 34130.0 9413.0 5436.0 6490.0 3309.0 33381.0 35209.0
NLD 4118.0 36042.0 35566.0 36017.0 33705.0 4459.0 3476.0 37811.0
HUN 2235.0 7715.0 7287.0 7548.0 6797.0 2451.0 2215.0 7292.0 8517.0
POL 4866.0 33409.0 33224.0 33577.0 29856.0 5320.0 4364.0 31330.0 7111.0 34961.0
CZE 1932.0 2448.0 1877.0 2256.0 1692.0 1848.0 1872.0 1724.0 1425.0 2548.0 3811.0

Number of bulls in reference population for ang

BEL 1579.0
CAN 720.0 39206.0
DEU 684.0 9497.0 32229.0
DFS 616.0 5568.0 27047.0 27973.0
ESP 667.0 6588.0 28196.0 26829.0 29105.0
FRA 677.0 3619.0 23056.0 22760.0 23137.0 24762.0
GBR 659.0 33269.0 10260.0 6294.0 7312.0 3585.0 35331.0
ITA 715.0 33613.0 9099.0 5131.0 6182.0 3023.0 33025.0 34652.0
NLD 680.0 3670.0 23849.0 23512.0 23843.0 22632.0 3829.0 3173.0 25154.0
HUN 512.0 2208.0 5028.0 4636.0 4859.0 4179.0 2344.0 2194.0 4463.0 5521.0
POL 957.0 4420.0 21130.0 21095.0 21348.0 18745.0 4759.0 4059.0 19161.0 4425.0 22665.0
CZE 824.0 1917.0 2371.0 1809.0 2186.0 1627.0 1837.0 1858.0 1655.0 1382.0 2475.0 3717.0

Number of bulls in reference population for ran

CAN 40146.0
DEU 9957.0 45874.0
DFS 6014.0 39660.0 40623.0
ESP 7038.0 40945.0 39419.0 41883.0
FRA 4040.0 34638.0 34194.0 34730.0 36365.0

```
GBR 33705.0 10833.0  6856.0  7877.0  4122.0 36265.0
ITA 34129.0  9412.0  5435.0  6489.0  3309.0 33380.0 35208.0
NLD  4117.0 36505.0 36000.0 36486.0 34143.0  4458.0  3475.0 38276.0
HUN  2235.0  8227.0  7770.0  8062.0  7283.0  2451.0  2215.0  7806.0  9032.0
POL  4866.0 33919.0 33705.0 34089.0 30340.0  5320.0  4364.0 31842.0  7626.0 35474.0
CZE  1932.0  2449.0  1878.0  2257.0  1693.0  1848.0  1872.0  1725.0  1426.0  2549.0  3812.0

--------------------------------------------------------
Number of bulls in reference population for        rwi
--------------------------------------------------------
CAN 39324.0
DEU  9957.0 45915.0
DFS  6014.0 39704.0 40667.0
ESP  7038.0 40982.0 39459.0 41920.0
FRA  4040.0 34678.0 34237.0 34766.0 36405.0
GBR 33705.0 10833.0  6856.0  7877.0  4122.0 36265.0
ITA 34129.0  9412.0  5435.0  6489.0  3309.0 33380.0 35208.0
NLD  4117.0 36545.0 36043.0 36522.0 34183.0  4458.0  3475.0 38316.0
HUN  2235.0  8218.0  7764.0  8053.0  7274.0  2451.0  2215.0  7797.0  9023.0
POL  4866.0 33912.0 33701.0 34082.0 30333.0  5320.0  4364.0 31835.0  7617.0 35467.0
CZE  1932.0  2449.0  1878.0  2257.0  1693.0  1848.0  1872.0  1725.0  1426.0  2549.0  3812.0

--------------------------------------------------------
Number of bulls in reference population for        rls
--------------------------------------------------------
CAN 40147.0
DEU  9958.0 45972.0
DFS  6015.0 39758.0 40721.0
ESP  7039.0 41038.0 39512.0 41976.0
FRA  4040.0 34734.0 34290.0 34821.0 36461.0
GBR 33706.0 10834.0  6857.0  7878.0  4122.0 36266.0
ITA 34130.0  9413.0  5436.0  6490.0  3309.0 33381.0 35209.0
NLD  4118.0 36602.0 36097.0 36578.0 34239.0  4459.0  3476.0 38373.0
HUN  2235.0  8227.0  7770.0  8062.0  7283.0  2451.0  2215.0  7806.0  9032.0
POL  4866.0 33922.0 33708.0 34092.0 30343.0  5320.0  4364.0 31845.0  7626.0 35477.0
CZE  1932.0  2449.0  1878.0  2257.0  1693.0  1848.0  1872.0  1725.0  1426.0  2549.0  3812.0

--------------------------------------------------------
Number of bulls in reference population for        rlr
--------------------------------------------------------
CAN 39220.0
DEU  9953.0 43861.0
DFS  6008.0 37760.0 38716.0
ESP  7032.0 38941.0 37513.0 39859.0
FRA  4032.0 32660.0 32322.0 32752.0 34321.0
GBR 32872.0 10827.0  6848.0  7869.0  4112.0 35118.0
ITA 33298.0  9408.0  5429.0  6483.0  3301.0 32550.0 34376.0
NLD  4108.0 34545.0 34123.0 34518.0 32219.0  4370.0  3468.0 35868.0
HUN  2230.0  7333.0  6911.0  7166.0  6426.0  2370.0  2212.0  6771.0  7866.0
POL  4857.0 31902.0 31771.0 32069.0 28358.0  5309.0  4355.0 29836.0  6730.0 33400.0
CZE  1931.0  2436.0  1865.0  2244.0  1681.0  1846.0  1871.0  1713.0  1418.0  2487.0  3721.0

--------------------------------------------------------
Number of bulls in reference population for        fan
--------------------------------------------------------
CAN 40112.0
DEU  9959.0 43813.0
DFS  6014.0 37923.0 38868.0
ESP  7039.0 39144.0 37679.0 40074.0
FRA  4038.0 32904.0 32515.0 32990.0 34625.0
GBR 33679.0 10835.0  6856.0  7878.0  4120.0 35932.0
ITA 34100.0  9414.0  5435.0  6490.0  3307.0 33355.0 35178.0
NLD  4114.0 34716.0 34270.0 34692.0 32418.0  4378.0  3474.0 36037.0
HUN  2232.0  7538.0  7115.0  7372.0  6631.0  2373.0  2214.0  6976.0  8072.0
POL  4864.0 32088.0 31932.0 32256.0 28574.0  5318.0  4362.0 30017.0  6937.0 33637.0
CZE  1931.0  2447.0  1876.0  2255.0  1691.0  1848.0  1871.0  1723.0  1424.0  2547.0  3809.0

--------------------------------------------------------
Number of bulls in reference population for        hde
```

Number of bulls in reference population for fua

CAN 40147.0
DEU 9958.0 45150.0
DFS 6015.0 39006.0 39964.0
ESP 7041.0 40222.0 38759.0 41152.0
FRA 4040.0 33942.0 33560.0 34027.0 35664.0
GBR 33706.0 10832.0 6857.0 7879.0 4122.0 36264.0
ITA 34130.0 9412.0 5436.0 6491.0 3309.0 33380.0 35208.0
NLD 4118.0 35801.0 35354.0 35775.0 33464.0 4459.0 3476.0 37570.0
HUN 2235.0 7692.0 7265.0 7525.0 6774.0 2451.0 2215.0 7269.0 8494.0
POL 4866.0 33117.0 32962.0 33285.0 29565.0 5319.0 4363.0 31044.0 7088.0 34669.0
CZE 1932.0 2448.0 1877.0 2256.0 1692.0 1848.0 1872.0 1724.0 1425.0 2548.0 3811.0

Number of bulls in reference population for ruh

CAN 40144.0
DEU 9956.0 44836.0
DFS 6014.0 38695.0 39630.0
ESP 7039.0 39907.0 38426.0 40811.0
FRA 4040.0 33636.0 33256.0 33722.0 35359.0
GBR 33703.0 10830.0 6856.0 7877.0 4122.0 36259.0
ITA 34127.0 9410.0 5435.0 6489.0 3309.0 33377.0 35205.0
NLD 4118.0 35479.0 35039.0 35454.0 33148.0 4459.0 3476.0 37247.0
HUN 2235.0 7704.0 7276.0 7537.0 6786.0 2451.0 2215.0 7281.0 8506.0
POL 4866.0 33254.0 33092.0 33422.0 29702.0 5319.0 4363.0 31180.0 7103.0 34806.0
CZE 1932.0 2448.0 1877.0 2256.0 1692.0 1848.0 1872.0 1724.0 1425.0 2548.0 3811.0

Number of bulls in reference population for ruw

Number of bulls in reference population for usu

BEL 1671.0
CAN   726.0 40149.0
DEU   727.0 9959.0 45971.0
DFS   651.0 6016.0 39759.0 40722.0
ESP   703.0 7042.0 41040.0 39514.0 41978.0
FRA   710.0 4040.0 34733.0 34289.0 34820.0 36460.0
GBR   683.0 33708.0 10834.0 6859.0 7881.0 4122.0 36267.0
ITA   721.0 34132.0 9414.0 5438.0 6493.0 3309.0 33383.0 35211.0
NLD   740.0 4118.0 36601.0 36096.0 36577.0 34238.0 4459.0 3476.0 38372.0
HUN   549.0 2235.0 8227.0 7770.0 8062.0 7283.0 2451.0 2215.0 7806.0 9032.0
POL   994.0 4866.0 33920.0 33707.0 34090.0 30342.0 5319.0 4363.0 31844.0 7626.0 35475.0
CZE   844.0 1932.0 2449.0 1878.0 2257.0 1693.0 1848.0 1872.0 1725.0 1426.0 2549.0 3812.0

Number of bulls in reference population for ude

CAN 40141.0
DEU 9958.0 45981.0
DFS 6014.0 39759.0 40722.0
ESP 7039.0 41040.0 39512.0 41976.0
FRA 4040.0 34733.0 34288.0 34820.0 36460.0
GBR 33704.0 10838.0 6858.0 7880.0 4122.0 35962.0
ITA 34129.0 9417.0 5437.0 6492.0 3309.0 33384.0 35212.0
NLD 4115.0 36605.0 36097.0 36578.0 34238.0 4383.0 3479.0 37935.0
HUN 2233.0 8228.0 7770.0 8062.0 7283.0 2375.0 2216.0 7667.0 8766.0
POL 4867.0 33922.0 33708.0 34092.0 30343.0 5320.0 4364.0 31846.0 7627.0 35477.0
CZE 1933.0 2449.0 1878.0 2257.0 1693.0 1849.0 1873.0 1725.0 1426.0 2549.0 3813.0

Number of bulls in reference population for ftp

```
-------------------------------------------------------
CAN 40151.0
DEU  9960.0 45938.0
DFS  6015.0 39715.0 40678.0
ESP  7040.0 40997.0 39469.0 41935.0
FRA  4040.0 34687.0 34242.0 34775.0 36414.0
GBR 33709.0 10840.0  6859.0  7881.0  4122.0 36274.0
ITA 34134.0  9419.0  5438.0  6493.0  3309.0 33388.0 35217.0
NLD  4119.0 36561.0 36053.0 36536.0 34192.0  4464.0  3481.0 38334.0
HUN  2236.0  8228.0  7770.0  8062.0  7282.0  2453.0  2217.0  7806.0  9033.0
POL  4867.0 33921.0 33707.0 34091.0 30342.0  5320.0  4364.0 31845.0  7626.0 35476.0
CZE  1933.0  2449.0  1878.0  2257.0  1693.0  1849.0  1873.0  1725.0  1426.0  2549.0  3813.0

-------------------------------------------------------
Number of bulls in reference population for        ftl
-------------------------------------------------------
BEL  1642.0
CAN   724.0 40130.0
DEU   727.0  9957.0 45966.0
DFS   651.0  6014.0 39754.0 40717.0
ESP   703.0  7039.0 41034.0 39509.0 41970.0
FRA   710.0  4040.0 34732.0 34288.0 34819.0 36459.0
GBR   668.0 33702.0 10831.0  6856.0  7877.0  4122.0 36022.0
ITA   720.0 34126.0  9411.0  5435.0  6489.0  3309.0 33377.0 35204.0
NLD   720.0  4116.0 36599.0 36094.0 36574.0 34237.0  4384.0  3475.0 37953.0
HUN   531.0  2233.0  8226.0  7769.0  8061.0  7283.0  2397.0  2214.0  7679.0  8828.0
POL   994.0  4866.0 33920.0 33707.0 34090.0 30342.0  5319.0  4363.0 31844.0  7626.0 35475.0
CZE   844.0  1932.0  2449.0  1878.0  2257.0  1693.0  1848.0  1872.0  1725.0  1426.0  2549.0  3812.0

-------------------------------------------------------
Number of bulls in reference population for        rtp
-------------------------------------------------------
CAN 37050.0
DEU  9954.0 43674.0
DFS  6009.0 37542.0 38418.0
ESP  7034.0 38734.0 37217.0 39587.0
FRA  4034.0 32506.0 32088.0 32540.0 34178.0
GBR 31873.0 10834.0  6853.0  7875.0  4116.0 34430.0
ITA 32128.0  9414.0  5433.0  6488.0  3304.0 31560.0 33207.0
NLD  4095.0 34302.0 33828.0 34222.0 31962.0  4440.0  3457.0 35872.0
POL  4860.0 32433.0 32231.0 32548.0 28852.0  5313.0  4358.0 30306.0 33859.0
CZE  1928.0  2433.0  1863.0  2241.0  1678.0  1844.0  1868.0  1709.0  2474.0  3728.0

-------------------------------------------------------
Number of bulls in reference population for        ocs
-------------------------------------------------------
AUS  3076.0
CAN  1235.0 40059.0
DEU   919.0  9910.0 45211.0
ESP   841.0  7019.0 40345.0 41262.0
FRA   747.0  4036.0 34059.0 34141.0 35768.0
GBR  1275.0 33635.0 10780.0  7857.0  4120.0 36181.0
ITA  1173.0 34060.0  9360.0  6471.0  3306.0 33300.0 35125.0
NLD   808.0  4110.0 35949.0 35930.0 33594.0  4448.0  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 33268.0 33436.0 29690.0  5316.0  4360.0 31202.0  7627.0 34817.0
CZE   414.0  1932.0  2447.0  2255.0  1691.0  1848.0  1872.0  1724.0  1426.0  2547.0  3810.0

-------------------------------------------------------
Number of bulls in reference population for        ous
-------------------------------------------------------
CAN 40097.0
DEU  9918.0 45877.0
DFS  6003.0 39735.0 40692.0
ESP  7022.0 41003.0 39497.0 41933.0
FRA  4038.0 34721.0 34284.0 34805.0 36442.0
GBR 33667.0 10785.0  6844.0  7858.0  4121.0 36207.0
ITA 34092.0  9366.0  5424.0  6472.0  3307.0 33332.0 35157.0
NLD  4112.0 36584.0 36095.0 36564.0 34228.0  4450.0  3466.0 38350.0
```

```
HUN  2231.0  8225.0  7771.0  8062.0  7284.0  2446.0  2210.0  7807.0  9028.0
POL  4861.0 33908.0 33704.0 34075.0 30331.0  5316.0  4360.0 31834.0  7627.0 35459.0
CZE  1932.0  2449.0  1878.0  2257.0  1693.0  1848.0  1872.0  1725.0  1426.0  2549.0  3812.0

------------------------------------------------------
Number of bulls in reference population for        ofl
------------------------------------------------------
CAN 39947.0
DEU  9922.0 45240.0
DFS  6004.0 39142.0 40098.0
ESP  7023.0 40367.0 38904.0 41283.0
FRA  4038.0 34080.0 33691.0 34162.0 35789.0
GBR 33542.0 10791.0  6845.0  7860.0  4121.0 35777.0
ITA 33968.0  9371.0  5425.0  6474.0  3307.0 33210.0 35034.0
NLD  4110.0 35970.0 35517.0 35949.0 33614.0  4371.0  3466.0 37270.0
HUN  2228.0  8223.0  7769.0  8060.0  7283.0  2368.0  2209.0  7666.0  8759.0
POL  4861.0 33289.0 33122.0 33458.0 29711.0  5317.0  4361.0 31223.0  7626.0 34839.0
CZE  1932.0  2447.0  1876.0  2255.0  1691.0  1848.0  1872.0  1724.0  1426.0  2547.0  3810.0

------------------------------------------------------
Number of bulls in reference population for        loc
------------------------------------------------------
CAN 34934.0
DEU  9863.0 41112.0
DFS  5958.0 35359.0 36188.0
ESP  6975.0 36516.0 35071.0 37324.0
FRA  3996.0 30418.0 30044.0 30456.0 32022.0
GBR 32006.0 10735.0  6802.0  7816.0  4091.0 34215.0
ITA 32189.0  9314.0  5386.0  6434.0  3278.0 31679.0 33229.0
NLD  4074.0 32306.0 31871.0 32241.0 30003.0  4341.0  3440.0 33500.0
CZE  1923.0  2413.0  1844.0  2223.0  1660.0  1841.0  1862.0  1692.0  3685.0
HUN  2222.0  6510.0  6108.0  6342.0  5631.0  2359.0  2204.0  5948.0  1397.0  7030.0
POL  4816.0 29468.0 29302.0 29584.0 26015.0  5276.0  4321.0 27520.0  2435.0  5908.0 30788.0

------------------------------------------------------
Number of bulls in reference population for        bcs
------------------------------------------------------
DEU 37657.0
FRA 27258.0 28702.0
GBR 10557.0  4056.0 32812.0
ITA  9240.0  3266.0 30135.0 31860.0
NLD 28940.0 26762.0  4378.0  3422.0 30581.0
CZE  2405.0  1655.0  1829.0  1854.0  1689.0  3559.0
CAN  9752.0  3948.0 30465.0 30868.0  4014.0  1913.0 35096.0
ESP 33078.0 27291.0  7637.0  6367.0 28850.0  2216.0  6872.0 33843.0
HUN  7302.0  6406.0  2437.0  2201.0  6877.0  1412.0  2222.0  7139.0  8088.0
POL 28140.0 24798.0  5143.0  4268.0 26189.0  2363.0  4716.0 28224.0  6711.0 29407.0
```