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


AUS (HOL)     Drop in information due to pedigree verification
FRA (HOL)     Changes in information due to pedigree verification
DEU (HOL)         Base change
              For ang,lower correlation for birth year 2021,due to the short history of the data for this new trait
ESP (HOL)     For rlr and loc traits, correction of a bug caused unexpected changes in type of proof
GBR (HOL)     Change in bulls' status due to re-assiging codes to bulls as more information from daughters become more available




INTERBULL CHANGES COMPARED TO THE DECEMBER ROUTINE RUN
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No changes in Interbull procedures

DATA AND METHOD OF ANALYSIS
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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)
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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 2024

Country Date

BEL   20201201
CAN   20241201
DEU   20241203
DFS   20241105
ESP   20241119
FRA   20241204
GBR   20241111
ITA   20241101
NLD   20241201
HUN   20241115
POL   20241107
CZE   20241118
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Table 2.

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--------------------------------------------------------
Number of bulls in reference population for       sta
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BEL  1671.0
CAN   726.0 40590.0
DEU   727.0 10594.0 46869.0
DFS   651.0  6323.0 40225.0 41191.0
ESP   704.0  7410.0 41636.0 40020.0 42660.0
FRA   719.0  5519.0 37420.0 36836.0 37493.0 39217.0
GBR   683.0 34279.0 11569.0  7232.0  8354.0  6007.0 36955.0
ITA   721.0 35252.0 10549.0  6147.0  7234.0  5050.0 34621.0 36967.0
NLD   740.0  4103.0 36600.0 36125.0 36583.0 34676.0  4440.0  3477.0 38370.0
HUN   549.0  2235.0  8229.0  7780.0  8066.0  7624.0  2452.0  2220.0  7806.0  9035.0
POL   994.0  5367.0 34724.0 34691.0 34924.0 32687.0  6095.0  5171.0 31841.0  7622.0 36472.0
CZE   844.0  2100.0  2599.0  1951.0  2386.0  1949.0  2009.0  2058.0  1727.0  1426.0  2627.0  4015.0

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Number of bulls in reference population for       cwi
--------------------------------------------------------

CAN 40588.0
DEU 10597.0 45652.0
DFS  6324.0 39083.0 40043.0
ESP  7412.0 40424.0 38874.0 41424.0
FRA  5520.0 36228.0 35714.0 36298.0 38005.0
GBR 34277.0 11573.0  7234.0  8357.0  6008.0 36954.0
ITA 35251.0 10553.0  6149.0  7237.0  5051.0 34621.0 36967.0
NLD  4103.0 35407.0 34995.0 35390.0 33509.0  4440.0  3477.0 37175.0
HUN  2235.0  7692.0  7269.0  7527.0  7113.0  2452.0  2220.0  7267.0  8495.0
POL  5367.0 33569.0 33600.0 33769.0 31558.0  6095.0  5171.0 30693.0  7082.0 35313.0
CZE  2100.0  2596.0  1948.0  2383.0  1946.0  2009.0  2058.0  1725.0  1425.0  2624.0  4012.0

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Number of bulls in reference population for       bde
--------------------------------------------------------

CAN 40590.0
DEU 10594.0 46310.0
DFS  6323.0 39693.0 40655.0
ESP  7410.0 41078.0 39485.0 42098.0
FRA  5519.0 36888.0 36326.0 36961.0 38684.0
GBR 34279.0 11569.0  7232.0  8354.0  6007.0 36955.0
ITA 35252.0 10549.0  6147.0  7234.0  5050.0 34621.0 36967.0
NLD  4103.0 36041.0 35591.0 36023.0 34143.0  4440.0  3477.0 37809.0
HUN  2235.0  7717.0  7293.0  7552.0  7138.0  2452.0  2220.0  7292.0  8520.0
POL  5367.0 34211.0 34203.0 34409.0 32200.0  6095.0  5171.0 31326.0  7107.0 35956.0
CZE  2100.0  2598.0  1950.0  2385.0  1948.0  2009.0  2058.0  1726.0  1425.0  2626.0  4014.0

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Number of bulls in reference population for       ang
--------------------------------------------------------

BEL  1579.0
CAN   720.0 39648.0
DEU   684.0 10134.0 33128.0
DFS   616.0  5876.0 27508.0 28436.0
ESP   668.0  6959.0 28793.0 27300.0 29752.0
FRA   686.0  5094.0 25711.0 25267.0 25776.0 27479.0
GBR   659.0 33843.0 10996.0  6670.0  7789.0  5468.0 36012.0
ITA   715.0 34735.0 10235.0  5841.0  6925.0  4761.0 34265.0 36409.0
NLD   680.0  3655.0 23847.0 23533.0 23847.0 23041.0  3809.0  3174.0 25151.0
HUN   512.0  2208.0  5029.0  4638.0  4862.0  4519.0  2344.0  2199.0  4462.0  5523.0
POL   957.0  4920.0 21931.0 22069.0 22175.0 21060.0  5534.0  4865.0 19156.0  4420.0 23658.0
CZE   824.0  2085.0  2520.0  1881.0  2314.0  1880.0  1997.0  2044.0  1656.0  1382.0  2552.0  3919.0

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Number of bulls in reference population for       ran
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CAN 40589.0
DEU 10593.0 46772.0
DFS  6322.0 40128.0 41094.0
ESP  7409.0 41544.0 39928.0 42568.0
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FRA  5519.0 37325.0 36741.0 37403.0 39122.0
GBR 34278.0 11568.0  7231.0  8353.0  6007.0 36954.0
ITA 35251.0 10548.0  6146.0  7233.0  5050.0 34620.0 36966.0
NLD  4102.0 36504.0 36029.0 36492.0 34581.0  4439.0  3476.0 38274.0
HUN  2235.0  8229.0  7780.0  8066.0  7624.0  2452.0  2220.0  7806.0  9035.0
POL  5367.0 34721.0 34688.0 34921.0 32684.0  6095.0  5171.0 31838.0  7622.0 36469.0
CZE  2100.0  2599.0  1951.0  2386.0  1949.0  2009.0  2058.0  1727.0  1426.0  2627.0  4015.0


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Number of bulls in reference population for        rwi
--------------------------------------------------------

CAN 39767.0
DEU 10593.0 46813.0
DFS  6322.0 40172.0 41138.0
ESP  7409.0 41581.0 39968.0 42605.0
FRA  5519.0 37365.0 36784.0 37439.0 39162.0
GBR 34278.0 11568.0  7231.0  8353.0  6007.0 36954.0
ITA 35251.0 10548.0  6146.0  7233.0  5050.0 34620.0 36966.0
NLD  4102.0 36544.0 36072.0 36528.0 34621.0  4439.0  3476.0 38314.0
HUN  2235.0  8220.0  7774.0  8057.0  7615.0  2452.0  2220.0  7797.0  9026.0
POL  5367.0 34714.0 34684.0 34914.0 32677.0  6095.0  5171.0 31831.0  7613.0 36462.0
CZE  2100.0  2599.0  1951.0  2386.0  1949.0  2009.0  2058.0  1727.0  1426.0  2627.0  4015.0

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Number of bulls in reference population for        rls
--------------------------------------------------------

CAN 40591.0
DEU 10595.0 46871.0
DFS  6323.0 40226.0 41192.0
ESP  7411.0 41638.0 40021.0 42662.0
FRA  5520.0 37422.0 36837.0 37495.0 39219.0
GBR 34280.0 11570.0  7232.0  8355.0  6008.0 36956.0
ITA 35253.0 10550.0  6147.0  7235.0  5051.0 34622.0 36968.0
NLD  4103.0 36601.0 36126.0 36584.0 34677.0  4440.0  3477.0 38371.0
HUN  2235.0  8229.0  7780.0  8066.0  7624.0  2452.0  2220.0  7806.0  9035.0
POL  5367.0 34724.0 34691.0 34924.0 32687.0  6095.0  5171.0 31841.0  7622.0 36472.0
CZE  2100.0  2599.0  1951.0  2386.0  1949.0  2009.0  2058.0  1727.0  1426.0  2627.0  4015.0


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Number of bulls in reference population for        rlr
--------------------------------------------------------

CAN 39664.0
DEU 10590.0 44760.0
DFS  6316.0 38223.0 39182.0
ESP  7404.0 39541.0 38013.0 40533.0
FRA  5512.0 35347.0 34864.0 35423.0 37074.0
GBR 33447.0 11563.0  7223.0  8346.0  5998.0 35800.0
ITA 34422.0 10545.0  6140.0  7228.0  5043.0 33792.0 36135.0
NLD  4093.0 34544.0 34147.0 34524.0 32656.0  4350.0  3469.0 35866.0
HUN  2230.0  7334.0  6916.0  7169.0  6766.0  2370.0  2217.0  6770.0  7868.0
POL  5358.0 32704.0 32749.0 32901.0 30702.0  6085.0  5162.0 29832.0  6725.0 34394.0
CZE  2099.0  2586.0  1938.0  2373.0  1937.0  2008.0  2057.0  1715.0  1418.0  2564.0  3923.0

--------------------------------------------------------
Number of bulls in reference population for        fan
--------------------------------------------------------

CAN 40556.0
DEU 10596.0 44711.0
DFS  6322.0 38386.0 39334.0
ESP  7411.0 39740.0 38165.0 40738.0
FRA  5518.0 35591.0 35057.0 35661.0 37382.0
GBR 34253.0 11572.0  7232.0  8356.0  6006.0 36614.0
ITA 35223.0 10552.0  6147.0  7236.0  5049.0 34596.0 36937.0
NLD  4099.0 34713.0 34293.0 34695.0 32855.0  4358.0  3475.0 36033.0
HUN  2232.0  7539.0  7120.0  7375.0  6971.0  2373.0  2219.0  6975.0  8074.0
POL  5365.0 32888.0 32909.0 33083.0 30917.0  6093.0  5169.0 30011.0  6932.0 34630.0
CZE  2099.0  2597.0  1949.0  2384.0  1947.0  2009.0  2057.0  1725.0  1424.0  2625.0  4012.0


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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 40591.0
DEU 10595.0 46052.0
DFS  6324.0 39474.0 40435.0
ESP  7412.0 40823.0 39264.0 41834.0
FRA  5520.0 36631.0 36105.0 36701.0 38422.0
GBR 34280.0 11570.0  7234.0  8356.0  6008.0 36956.0
ITA 35253.0 10550.0  6149.0  7236.0  5051.0 34622.0 36968.0
NLD  4103.0 35801.0 35381.0 35782.0 33903.0  4440.0  3477.0 37569.0
HUN  2235.0  7694.0  7271.0  7529.0  7115.0  2452.0  2220.0  7269.0  8497.0
POL  5367.0 33920.0 33943.0 34118.0 31910.0  6094.0  5170.0 31041.0  7084.0 35665.0
CZE  2100.0  2598.0  1950.0  2385.0  1948.0  2009.0  2058.0  1726.0  1425.0  2626.0  4014.0

--------------------------------------------------------
Number of bulls in reference population for        ruh
--------------------------------------------------------
CAN 40589.0
DEU 10594.0 45737.0
DFS  6323.0 39159.0 40097.0
ESP  7411.0 40507.0 38928.0 41493.0
FRA  5520.0 36324.0 35798.0 36395.0 38117.0
GBR 34278.0 11568.0  7232.0  8354.0  6008.0 36951.0
ITA 35251.0 10548.0  6147.0  7234.0  5051.0 34619.0 36965.0
NLD  4103.0 35478.0 35063.0 35460.0 33586.0  4440.0  3477.0 37245.0
HUN  2235.0  7706.0  7282.0  7541.0  7127.0  2452.0  2220.0  7281.0  8509.0
POL  5367.0 34056.0 34071.0 34254.0 32046.0  6094.0  5170.0 31176.0  7099.0 35801.0
CZE  2100.0  2598.0  1950.0  2385.0  1948.0  2009.0  2058.0  1726.0  1425.0  2626.0  4014.0

--------------------------------------------------------
Number of bulls in reference population for        ruw
--------------------------------------------------------


--------------------------------------------------------
Number of bulls in reference population for        usu
--------------------------------------------------------
BEL  1671.0
CAN   726.0 40593.0
DEU   727.0 10596.0 46872.0
DFS   651.0  6325.0 40229.0 41195.0
ESP   704.0  7413.0 41640.0 40024.0 42664.0
FRA   719.0  5520.0 37422.0 36837.0 37495.0 39219.0
GBR   683.0 34282.0 11571.0  7235.0  8357.0  6008.0 36958.0
ITA   721.0 35255.0 10551.0  6150.0  7237.0  5051.0 34624.0 36970.0
NLD   740.0  4103.0 36601.0 36126.0 36584.0 34677.0  4440.0  3477.0 38371.0
HUN   549.0  2235.0  8229.0  7780.0  8066.0  7624.0  2452.0  2220.0  7806.0  9035.0
POL   994.0  5367.0 34723.0 34691.0 34923.0 32687.0  6094.0  5170.0 31841.0  7622.0 36471.0
CZE   844.0  2100.0  2599.0  1951.0  2386.0  1949.0  2009.0  2058.0  1727.0  1426.0  2627.0  4015.0

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Number of bulls in reference population for        ude
--------------------------------------------------------
CAN 40591.0
DEU 10600.0 46887.0
DFS  6325.0 40232.0 41198.0
ESP  7413.0 41645.0 40024.0 42667.0
FRA  5520.0 37423.0 36838.0 37496.0 39220.0
GBR 34284.0 11581.0  7238.0  8362.0  6010.0 36653.0
ITA 35258.0 10562.0  6153.0  7242.0  5053.0 34635.0 36981.0
NLD  4101.0 36608.0 36129.0 36588.0 34679.0  4367.0  3484.0 37937.0
HUN  2235.0  8233.0  7782.0  8067.0  7626.0  2378.0  2224.0  7668.0  8772.0
POL  5369.0 34729.0 34694.0 34927.0 32690.0  6099.0  5175.0 31845.0  7625.0 36477.0
CZE  2101.0  2600.0  1952.0  2387.0  1950.0  2012.0  2061.0  1728.0  1426.0  2628.0  4018.0

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Number of bulls in reference population for       ftp
---------------------------------------------------------
CAN 40601.0
DEU 10602.0 46844.0
DFS  6325.0 40187.0 41153.0
ESP  7414.0 41602.0 39980.0 42626.0
FRA  5521.0 37378.0 36792.0 37452.0 39175.0
GBR 34289.0 11583.0  7238.0  8363.0  6011.0 36974.0
ITA 35263.0 10564.0  6153.0  7243.0  5054.0 34640.0 36987.0
NLD  4104.0 36563.0 36084.0 36545.0 34633.0  4448.0  3485.0 38335.0
HUN  2238.0  8233.0  7782.0  8067.0  7625.0  2457.0  2225.0  7807.0  9039.0
POL  5369.0 34728.0 34693.0 34926.0 32689.0  6099.0  5175.0 31844.0  7624.0 36476.0
CZE  2101.0  2600.0  1952.0  2387.0  1950.0  2012.0  2061.0  1728.0  1426.0  2628.0  4018.0


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Number of bulls in reference population for       ftl
---------------------------------------------------------
BEL  1642.0
CAN   724.0 40574.0
DEU   727.0 10594.0 46866.0
DFS   651.0  6323.0 40223.0 41189.0
ESP   704.0  7410.0 41633.0 40018.0 42655.0
FRA   719.0  5519.0 37419.0 36835.0 37492.0 39216.0
GBR   668.0 34276.0 11568.0  7232.0  8353.0  6007.0 36712.0
ITA   720.0 35249.0 10548.0  6147.0  7233.0  5050.0 34617.0 36962.0
NLD   720.0  4101.0 36598.0 36123.0 36580.0 34675.0  4365.0  3476.0 37951.0
HUN   531.0  2233.0  8228.0  7779.0  8065.0  7624.0  2398.0  2219.0  7679.0  8831.0
POL   994.0  5367.0 34722.0 34690.0 34922.0 32686.0  6094.0  5170.0 31840.0  7622.0 36470.0
CZE   844.0  2100.0  2599.0  1951.0  2386.0  1949.0  2009.0  2058.0  1727.0  1426.0  2627.0  4015.0


---------------------------------------------------------
Number of bulls in reference population for       rtp
---------------------------------------------------------
CAN 37501.0
DEU 10596.0 44581.0
DFS  6319.0 38005.0 38884.0
ESP  7408.0 39340.0 37711.0 40270.0
FRA  5515.0 35198.0 34629.0 35218.0 36939.0
GBR 32455.0 11577.0  7232.0  8357.0  6005.0 35132.0
ITA 33259.0 10559.0  6148.0  7238.0  5049.0 32815.0 34979.0
NLD  4080.0 34305.0 33850.0 34232.0 32404.0  4424.0  3461.0 35874.0
POL  5362.0 33241.0 33210.0 33378.0 31200.0  6093.0  5169.0 30306.0 34860.0
CZE  2096.0  2584.0  1937.0  2371.0  1935.0  2008.0  2056.0  1712.0  2553.0  3933.0


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Number of bulls in reference population for       ocs
---------------------------------------------------------
AUS  3076.0
CAN  1235.0 40490.0
DEU   919.0 10535.0 46098.0
ESP   842.0  7385.0 40940.0 41936.0
FRA   793.0  5514.0 36746.0 36813.0 38518.0
GBR  1270.0 34198.0 11505.0  8328.0  6004.0 36860.0
ITA  1173.0 35172.0 10486.0  7211.0  5046.0 34532.0 36873.0
NLD   808.0  4095.0 35949.0 35937.0 34032.0  4429.0  3465.0 37710.0
HUN   764.0  2231.0  8227.0  8066.0  7625.0  2447.0  2215.0  7807.0  9031.0
POL   692.0  5357.0 34067.0 34265.0 32034.0  6087.0  5167.0 31199.0  7623.0 35809.0
CZE   413.0  2100.0  2597.0  2384.0  1947.0  2009.0  2058.0  1726.0  1426.0  2625.0  4013.0


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Number of bulls in reference population for       ous
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CAN 40529.0
DEU 10544.0 46766.0
DFS  6309.0 40202.0 41162.0
ESP  7388.0 41598.0 40004.0 42614.0
FRA  5516.0 37408.0 36831.0 37478.0 39199.0
GBR 34231.0 11512.0  7217.0  8329.0  6005.0 36888.0
ITA 35204.0 10493.0  6133.0  7212.0  5047.0 34564.0 36905.0
```

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NLD  4097.0 36584.0 36125.0 36571.0 34666.0  4431.0  3467.0 38349.0
HUN  2231.0  8227.0  7781.0  8066.0  7625.0  2447.0  2215.0  7807.0  9031.0
POL  5359.0 34707.0 34686.0 34904.0 32675.0  6087.0  5167.0 31831.0  7623.0 36451.0
CZE  2100.0  2599.0  1951.0  2386.0  1949.0  2009.0  2058.0  1727.0  1426.0  2627.0  4015.0
--------------------------------------------------------
Number of bulls in reference population for        ofl
--------------------------------------------------------
CAN 40379.0
DEU 10548.0 46128.0
DFS  6309.0 39608.0 40567.0
ESP  7389.0 40962.0 39410.0 41957.0
FRA  5516.0 36767.0 36238.0 36834.0 38539.0
GBR 34106.0 11517.0  7217.0  8331.0  6005.0 36448.0
ITA 35081.0 10498.0  6133.0  7214.0  5047.0 34442.0 36782.0
NLD  4095.0 35970.0 35547.0 35956.0 34052.0  4351.0  3467.0 37269.0
HUN  2228.0  8225.0  7779.0  8064.0  7624.0  2368.0  2214.0  7666.0  8762.0
POL  5359.0 34088.0 34104.0 34287.0 32055.0  6088.0  5168.0 31220.0  7622.0 35831.0
CZE  2100.0  2597.0  1949.0  2384.0  1947.0  2009.0  2058.0  1726.0  1426.0  2625.0  4013.0

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Number of bulls in reference population for        loc
--------------------------------------------------------
CAN 35399.0
DEU 10484.0 41996.0
DFS  6259.0 35811.0 36643.0
ESP  7341.0 37108.0 35538.0 37970.0
FRA  5467.0 33015.0 32489.0 33038.0 34679.0
GBR 32616.0 11456.0  7174.0  8287.0  5964.0 34934.0
ITA 33337.0 10435.0  6091.0  7173.0  5008.0 32958.0 34968.0
NLD  4060.0 32305.0 31889.0 32248.0 30434.0  4321.0  3441.0 33499.0
CZE  2091.0  2563.0  1917.0  2352.0  1916.0  2004.0  2048.0  1694.0  3888.0
HUN  2222.0  6512.0  6114.0  6346.0  5972.0  2359.0  2209.0  5948.0  1397.0  7033.0
POL  5312.0 30252.0 30256.0 30380.0 28271.0  6047.0  5127.0 27516.0  2513.0  5904.0 31759.0

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Number of bulls in reference population for        bcs
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DEU 38505.0
FRA 29712.0 31216.0
GBR 11258.0  5820.0 33361.0
ITA 10311.0  4949.0 31200.0 33399.0
NLD 28940.0 27177.0  4361.0  3425.0 30580.0
CZE  2553.0  1909.0  1990.0  2036.0  1691.0  3759.0
CAN 10376.0  5375.0 30915.0 31847.0  4000.0  2081.0 35522.0
ESP 33639.0 29728.0  8098.0  7061.0 28856.0  2344.0  7237.0 34459.0
HUN  7304.0  6747.0  2438.0  2206.0  6877.0  1412.0  2222.0  7143.0  8091.0
POL 28860.0 26915.0  5848.0  4988.0 26185.0  2438.0  5208.0 28958.0  6707.0 30289.0
```