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
DFS (HOL) Cahnge in status of bulls
FRA (HOL) Base change
ITA (HOL) Cut off one year of data and base change
DEU (HOL) Base change
BEL (HOL) Base change
ESP (HOL) Exclusion from national genomic evaluation of candidates and culled bulls older than 2 years old.
Reduction in reliability due to reduction of parent average’s reliability

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 routine 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 2021

Country	Date
BEL	20201201
CAN	20210401
DEU	20210407
DFS	20210302
ESP	20210319
FRA	20210407
GBR	20210309
ITA	20210311
NLD	20210401
HUN	20210317
POL	20210407
CZE	20210318

Table 2.

Number of bulls in reference population for sta

BEL 1715.0
CAN   748.0 37569.0
DEU   721.0 6717.0 41385.0
DFS   630.0 4438.0 37003.0 37948.0
ESP   694.0 4841.0 37731.0 37002.0 38529.0
FRA   709.0 3996.0 34617.0 34131.0 34671.0 36377.0
GBR   682.0 31321.0 6945.0 4657.0 5055.0 4081.0 33474.0
ITA   730.0 31249.0 5805.0 3537.0 3974.0 3187.0 30059.0 31748.0
NLD   742.0 4048.0 36264.0 35777.0 36273.0 34167.0 4299.0 3228.0 38163.0
HUN   498.0 1882.0 7619.0 7218.0 7473.0 7082.0 1941.0 1766.0 7379.0 8175.0
POL 1017.0 4395.0 32360.0 32229.0 32531.0 30292.0 4277.0 3420.0 31678.0 7235.0 34298.0
CZE   840.0 1515.0 1945.0 1623.0 1815.0 1653.0 1448.0 1304.0 1692.0 1233.0 2382.0 3324.0

Number of bulls in reference population for cwi

CAN 37564.0
DEU 6718.0 40168.0
DFS 4439.0 35796.0 36733.0
ESP 4842.0 36518.0 35792.0 37302.0
FRA 3996.0 33426.0 32947.0 33477.0 35173.0
GBR 31316.0 6947.0 4658.0 5056.0 4081.0 33470.0
ITA 31247.0 5807.0 3538.0 3975.0 3187.0 30058.0 31747.0
NLD 4049.0 35074.0 34585.0 35082.0 33002.0 4300.0 3229.0 36971.0
HUN 1882.0 7083.0 6680.0 6935.0 6572.0 1941.0 1766.0 6841.0 7636.0
POL 4395.0 31207.0 31075.0 31377.0 29165.0 4277.0 3420.0 30532.0 6696.0 33142.0
CZE 1515.0 1942.0 1620.0 1812.0 1650.0 1448.0 1304.0 1690.0 1232.0 2379.0 3321.0

Number of bulls in reference population for bde

CAN 37570.0
DEU 6718.0 40827.0
DFS 4439.0 36445.0 37386.0
ESP 4842.0 37174.0 36443.0 37970.0
FRA 3996.0 34085.0 33598.0 34139.0 35844.0
GBR 31322.0 6946.0 4658.0 5056.0 4081.0 33475.0
ITA 31250.0 5806.0 3538.0 3975.0 3187.0 30060.0 31749.0
NLD 4049.0 35706.0 35217.0 35714.0 33634.0 4300.0 3229.0 37603.0
HUN 1882.0 7108.0 6705.0 6960.0 6597.0 1941.0 1766.0 6866.0 7661.0
POL 4395.0 31847.0 31714.0 32016.0 29805.0 4277.0 3420.0 31163.0 6721.0 33782.0
CZE 1515.0 1944.0 1622.0 1814.0 1652.0 1448.0 1304.0 1691.0 1232.0 2381.0 3323.0

Number of bulls in reference population for ang

BEL 1647.0
CAN   745.0 37123.0
DEU   711.0 6711.0 37614.0
DFS   623.0 4432.0 33266.0 34201.0
ESP   684.0 4835.0 33966.0 33260.0 34742.0
FRA   699.0 3989.0 30931.0 30473.0 30980.0 32674.0
GBR   661.0 31302.0 6937.0 4649.0 5047.0 4072.0 32702.0
ITA   728.0 31055.0 5798.0 3530.0 3967.0 3179.0 30044.0 31548.0
NLD   709.0 4039.0 32524.0 32057.0 32531.0 30509.0 4209.0 3220.0 33954.0
HUN   489.0 1875.0 4551.0 4169.0 4397.0 4093.0 1932.0 1758.0 4303.0 5062.0
POL 1006.0 4388.0 28658.0 28546.0 28822.0 26672.0 4267.0 3410.0 27984.0 4160.0 30583.0
CZE   831.0 1511.0 1904.0 1588.0 1774.0 1614.0 1444.0 1297.0 1652.0 1194.0 2338.0 3273.0

Number of bulls in reference population for ran

CAN 37568.0
DEU 6716.0 41288.0
DFS 4437.0 36906.0 37851.0
ESP 4840.0 37639.0 36910.0 38437.0

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FRA  3996.0 34522.0 34036.0 34581.0 36282.0
GBR 31320.0  6944.0  4656.0  5054.0  4081.0 33473.0
ITA 31248.0  5804.0  3536.0  3973.0  3187.0 30058.0 31747.0
NLD  4048.0 36169.0 35682.0 36183.0 34072.0  4299.0  3228.0 38068.0
HUN  1882.0  7619.0  7218.0  7473.0  7082.0  1941.0  1766.0  7379.0  8175.0
POL  4395.0 32357.0 32226.0 32528.0 30289.0  4277.0  3420.0 31675.0  7235.0 34295.0
CZE  1515.0  1945.0  1623.0  1815.0  1653.0  1448.0  1304.0  1692.0  1233.0  2382.0  3324.0

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Number of bulls in reference population for        rwi
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CAN 36747.0
DEU  6717.0 41330.0
DFS  4438.0 36948.0 37893.0
ESP  4841.0 37677.0 36948.0 38475.0
FRA  3996.0 34562.0 34076.0 34617.0 36322.0
GBR 31321.0  6945.0  4657.0  5055.0  4081.0 33474.0
ITA 31249.0  5805.0  3537.0  3974.0  3187.0 30059.0 31748.0
NLD  4048.0 36209.0 35722.0 36219.0 34112.0  4299.0  3228.0 38108.0
HUN  1882.0  7610.0  7209.0  7464.0  7073.0  1941.0  1766.0  7370.0  8166.0
POL  4395.0 32350.0 32219.0 32521.0 30282.0  4277.0  3420.0 31668.0  7226.0 34288.0
CZE  1515.0  1945.0  1623.0  1815.0  1653.0  1448.0  1304.0  1692.0  1233.0  2382.0  3324.0

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Number of bulls in reference population for        rls
---------------------------------------------------------
CAN 37570.0
DEU  6718.0 41387.0
DFS  4439.0 37005.0 37950.0
ESP  4842.0 37733.0 37004.0 38531.0
FRA  3996.0 34618.0 34132.0 34672.0 36378.0
GBR 31322.0  6946.0  4658.0  5056.0  4081.0 33475.0
ITA 31250.0  5806.0  3538.0  3975.0  3187.0 30060.0 31749.0
NLD  4049.0 36266.0 35779.0 36275.0 34168.0  4300.0  3229.0 38165.0
HUN  1882.0  7619.0  7218.0  7473.0  7082.0  1941.0  1766.0  7379.0  8175.0
POL  4395.0 32360.0 32229.0 32531.0 30292.0  4277.0  3420.0 31678.0  7235.0 34298.0
CZE  1515.0  1945.0  1623.0  1815.0  1653.0  1448.0  1304.0  1692.0  1233.0  2382.0  3324.0

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Number of bulls in reference population for        rlr
---------------------------------------------------------
CAN 36642.0
DEU  6711.0 39278.0
DFS  4431.0 34924.0 35859.0
ESP  4835.0 35638.0 34918.0 36418.0
FRA  3988.0 32547.0 32085.0 32605.0 34241.0
GBR 30484.0  6938.0  4648.0  5047.0  4071.0 31886.0
ITA 30421.0  5800.0  3530.0  3968.0  3179.0 29231.0 30919.0
NLD  4038.0 34211.0 33723.0 34218.0 32151.0  4208.0  3220.0 35650.0
HUN  1880.0  6727.0  6325.0  6579.0  6226.0  1938.0  1764.0  6485.0  7278.0
POL  4386.0 30341.0 30208.0 30508.0 28309.0  4266.0  3411.0 29670.0  6340.0 32223.0
CZE  1514.0  1932.0  1610.0  1802.0  1641.0  1446.0  1303.0  1680.0  1225.0  2320.0  3233.0

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Number of bulls in reference population for        fan
---------------------------------------------------------
CAN 37547.0
DEU  6718.0 39231.0
DFS  4439.0 35116.0 36043.0
ESP  4842.0 35843.0 35117.0 36635.0
FRA  3996.0 32794.0 32309.0 32847.0 34548.0
GBR 31302.0  6946.0  4658.0  5056.0  4081.0 32711.0
ITA 31233.0  5806.0  3538.0  3975.0  3187.0 30044.0 31732.0
NLD  4046.0 34385.0 33900.0 34396.0 32353.0  4218.0  3228.0 35822.0
HUN  1882.0  6931.0  6530.0  6784.0  6430.0  1941.0  1766.0  6689.0  7483.0
POL  4395.0 30531.0 30400.0 30700.0 28529.0  4277.0  3420.0 29855.0  6546.0 32463.0
CZE  1514.0  1943.0  1621.0  1813.0  1651.0  1448.0  1303.0  1690.0  1231.0  2380.0  3321.0

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Number of bulls in reference population for hde

Number of bulls in reference population for fua

CAN 37569.0
DEU 6718.0 40568.0
DFS 4439.0 36192.0 37131.0
ESP 4842.0 36916.0 36188.0 37706.0
FRA 3996.0 33826.0 33344.0 33878.0 35581.0
GBR 31321.0 6947.0 4658.0 5056.0 4081.0 33475.0
ITA 31249.0 5807.0 3538.0 3975.0 3187.0 30060.0 31749.0
NLD 4049.0 35465.0 34976.0 35472.0 33393.0 4300.0 3229.0 37362.0
HUN 1882.0 7085.0 6682.0 6937.0 6574.0 1941.0 1766.0 6843.0 7638.0
POL 4395.0 31556.0 31423.0 31725.0 29514.0 4277.0 3420.0 30877.0 6698.0 33491.0
CZE 1515.0 1944.0 1622.0 1814.0 1652.0 1448.0 1304.0 1691.0 1232.0 2381.0 3323.0

Number of bulls in reference population for ruh

CAN 37569.0
DEU 6718.0 40255.0
DFS 4439.0 35874.0 36786.0
ESP 4842.0 36603.0 35844.0 37367.0
FRA 3996.0 33520.0 33033.0 33573.0 35276.0
GBR 31321.0 6946.0 4658.0 5056.0 4081.0 33472.0
ITA 31249.0 5806.0 3538.0 3975.0 3187.0 30059.0 31748.0
NLD 4049.0 35143.0 34653.0 35151.0 33077.0 4300.0 3229.0 37039.0
HUN 1882.0 7098.0 6695.0 6950.0 6587.0 1941.0 1766.0 6856.0 7651.0
POL 4395.0 31693.0 31560.0 31862.0 29651.0 4277.0 3420.0 31013.0 6713.0 33628.0
CZE 1515.0 1944.0 1622.0 1814.0 1652.0 1448.0 1304.0 1691.0 1232.0 2381.0 3323.0

Number of bulls in reference population for ruw

Number of bulls in reference population for usu

BEL 1716.0
CAN 748.0 37571.0
DEU 721.0 6718.0 41385.0
DFS 630.0 4439.0 37003.0 37948.0
ESP 694.0 4842.0 37731.0 37002.0 38529.0
FRA 709.0 3996.0 34616.0 34130.0 34670.0 36376.0
GBR 682.0 31323.0 6946.0 4658.0 5056.0 4081.0 33476.0
ITA 730.0 31251.0 5806.0 3538.0 3975.0 3187.0 30061.0 31750.0
NLD 742.0 4049.0 36264.0 35777.0 36273.0 34166.0 4300.0 3229.0 38163.0
HUN 498.0 1882.0 7618.0 7217.0 7472.0 7081.0 1941.0 1766.0 7378.0 8174.0
POL 1017.0 4395.0 32358.0 32227.0 32529.0 30290.0 4277.0 3420.0 31676.0 7234.0 34296.0
CZE 840.0 1515.0 1945.0 1623.0 1815.0 1653.0 1448.0 1304.0 1692.0 1233.0 2382.0 3324.0

Number of bulls in reference population for ude

CAN 37562.0
DEU 6717.0 41383.0
DFS 4438.0 37001.0 37946.0
ESP 4841.0 37729.0 37000.0 38527.0
FRA 3996.0 34616.0 34130.0 34670.0 36376.0
GBR 31316.0 6945.0 4657.0 5055.0 4081.0 32725.0
ITA 31248.0 5805.0 3537.0 3974.0 3187.0 30058.0 31747.0
NLD 4045.0 36262.0 35775.0 36271.0 34166.0 4217.0 3227.0 37706.0
HUN 1882.0 7619.0 7218.0 7473.0 7082.0 1941.0 1766.0 7379.0 8175.0
POL 4395.0 32358.0 32227.0 32529.0 30291.0 4277.0 3420.0 31676.0 7235.0 34296.0
CZE 1515.0 1945.0 1623.0 1815.0 1653.0 1448.0 1304.0 1692.0 1233.0 2382.0 3324.0

Number of bulls in reference population for ftp

CAN	37571.0										
DEU	6719.0	41341.0									
DFS	4439.0	36957.0	37902.0								
ESP	4843.0	37687.0	36957.0	38485.0							
FRA	3996.0	34570.0	34084.0	34625.0	36330.0						
GBR	31323.0	6948.0	4658.0	5057.0	4081.0	33477.0					
ITA	31251.0	5808.0	3538.0	3976.0	3187.0	30062.0	31751.0				
NLD	4049.0	36218.0	35731.0	36228.0	34120.0	4300.0	3229.0	38117.0			
HUN	1882.0	7618.0	7217.0	7472.0	7081.0	1941.0	1766.0	7378.0	8174.0		
POL	4395.0	32358.0	32227.0	32529.0	30290.0	4277.0	3420.0	31676.0	7234.0	34296.0	
CZE	1515.0	1945.0	1623.0	1815.0	1653.0	1448.0	1304.0	1692.0	1233.0	2382.0	3324.0

Number of bulls in reference population for ftl

BEL	1680.0										
CAN	745.0	37552.0									
DEU	721.0	6719.0	41386.0								
DFS	630.0	4438.0	37001.0	37946.0							
ESP	694.0	4843.0	37731.0	37000.0	38529.0						
FRA	709.0	3996.0	34616.0	34130.0	34670.0	36376.0					
GBR	662.0	31318.0	6948.0	4657.0	5057.0	4081.0	32728.0				
ITA	729.0	31250.0	5808.0	3537.0	3976.0	3187.0	30061.0	31750.0			
NLD	719.0	4045.0	36262.0	35775.0	36271.0	34166.0	4217.0	3227.0	37706.0		
HUN	498.0	1882.0	7619.0	7218.0	7473.0	7082.0	1941.0	1766.0	7379.0	8175.0	
POL	1017.0	4395.0	32358.0	32227.0	32529.0	30291.0	4277.0	3420.0	31676.0	7235.0	34296.0
CZE	840.0	1515.0	1945.0	1623.0	1815.0	1653.0	1448.0	1304.0	1692.0	1233.0	2382.0	3324.0

Number of bulls in reference population for rtp

CAN	34468.0										
DEU	6714.0	39078.0									
DFS	4433.0	34698.0	35550.0								
ESP	4838.0	35425.0	34614.0	36138.0							
FRA	3990.0	32389.0	31853.0	32390.0	34094.0						
GBR	29486.0	6943.0	4652.0	5052.0	4075.0	31632.0					
ITA	29405.0	5804.0	3533.0	3972.0	3182.0	28393.0	29901.0				
NLD	4025.0	33959.0	33421.0	33914.0	31890.0	4276.0	3205.0	35654.0			
POL	4388.0	30870.0	30681.0	30986.0	28800.0	4270.0	3414.0	30137.0	32679.0		
CZE	1510.0	1929.0	1608.0	1799.0	1638.0	1443.0	1299.0	1676.0	2307.0	3239.0	

Number of bulls in reference population for ocs

AUS	2900.0										
CAN	1074.0	37538.0									
DEU	781.0	6714.0	40724.0								
ESP	727.0	4839.0	37073.0	37858.0							
FRA	714.0	3994.0	33956.0	34007.0	35701.0						
GBR	1214.0	31294.0	6944.0	5054.0	4080.0	33448.0					
ITA	865.0	31226.0	5804.0	3973.0	3186.0	30037.0	31726.0				
NLD	767.0	4048.0	35635.0	35643.0	33537.0	4299.0	3228.0	37529.0			
HUN	601.0	1882.0	7619.0	7473.0	7082.0	1941.0	1766.0	7379.0	8175.0		
POL	659.0	4392.0	31719.0	31890.0	29652.0	4275.0	3418.0	31049.0	7235.0	33656.0	
CZE	374.0	1515.0	1943.0	1813.0	1651.0	1448.0	1304.0	1691.0	1233.0	2380.0	3322.0

Number of bulls in reference population for ous

CAN	37569.0										
DEU	6718.0	41384.0									
DFS	4439.0	37002.0	37947.0								
ESP	4842.0	37730.0	37001.0	38528.0							
FRA	3996.0	34615.0	34129.0	34669.0	36372.0						
GBR	31321.0	6946.0	4658.0	5056.0	4081.0	33469.0					
ITA	31249.0	5806.0	3538.0	3975.0	3187.0	30059.0	31748.0				

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NLD  4049.0 36266.0 35779.0 36275.0 34168.0  4300.0  3229.0 38164.0
HUN  1882.0  7619.0  7218.0  7473.0  7082.0  1941.0  1766.0  7379.0  8175.0
POL  4395.0 32358.0 32227.0 32529.0 30290.0  4277.0  3420.0 31678.0  7235.0 34296.0
CZE  1515.0  1945.0  1623.0  1815.0  1653.0  1448.0  1304.0  1692.0  1233.0  2382.0  3324.0

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Number of bulls in reference population for        ofl
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CAN 37417.0
DEU  6719.0 40745.0
DFS  4440.0 36374.0 37316.0
ESP  4843.0 37095.0 36371.0 37881.0
FRA  3996.0 33977.0 33499.0 34028.0 35722.0
GBR 31191.0  6947.0  4659.0  5057.0  4081.0 32595.0
ITA 31156.0  5807.0  3539.0  3976.0  3187.0 29966.0 31655.0
NLD  4046.0 35654.0 35167.0 35663.0 33557.0  4218.0  3228.0 37074.0
HUN  1882.0  7618.0  7217.0  7472.0  7081.0  1941.0  1766.0  7378.0  8174.0
POL  4396.0 31741.0 31611.0 31913.0 29673.0  4278.0  3421.0 31069.0  7234.0 33679.0
CZE  1515.0  1943.0  1621.0  1813.0  1651.0  1448.0  1304.0  1691.0  1233.0  2380.0  3322.0

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Number of bulls in reference population for        loc
--------------------------------------------------------
CAN 31714.0
DEU  6670.0 36653.0
DFS  4394.0 32520.0 33325.0
ESP  4797.0 33273.0 32476.0 33951.0
FRA  3951.0 30292.0 29744.0 30305.0 31933.0
GBR 29010.0  6897.0  4618.0  5017.0  4043.0 30382.0
ITA 28876.0  5773.0  3511.0  3945.0  3161.0 28000.0 29345.0
NLD  4009.0 31969.0 31409.0 31938.0 29925.0  4185.0  3202.0 33281.0
CZE  1505.0  1909.0  1590.0  1781.0  1620.0  1440.0  1293.0  1659.0  3196.0
HUN  1876.0  5905.0  5511.0  5754.0  5429.0  1933.0  1761.0  5663.0  1204.0  6452.0
POL  4219.0 27922.0 27692.0 28051.0 25951.0  4240.0  3271.0 27341.0  2268.0  5516.0 29493.0

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Number of bulls in reference population for        bcs
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DEU 33369.0
FRA 27147.0 28626.0
GBR  6837.0  4010.0 29563.0
ITA  5748.0  3148.0 26473.0 28075.0
NLD 28619.0 26698.0  4226.0  3184.0 30387.0
CZE  1905.0  1618.0  1431.0  1286.0  1658.0  3073.0
CAN  6589.0  3903.0 27491.0 27614.0  3949.0  1497.0 31980.0
ESP 29995.0 27152.0  4955.0  3921.0 28560.0  1779.0  4712.0 30632.0
HUN  6699.0  6207.0  1931.0  1756.0  6457.0  1219.0  1872.0  6553.0  7247.0
POL 26757.0 24749.0  4187.0  3314.0 26030.0  2199.0  4207.0 26839.0  6320.0 28320.0
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