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 genomic evaluation of conformation traits are as follows:

AUS (HOL) OUS:The change in SD is due to increase in observations for bulls born between 2015 to 2020.
ESP (HOL) Base change, in line with MACE
HUN (HOL) Provided new parameters. The software for the estimation of SNP solutions has been updated. New estimation of starting values for estimation of SNPs solutions and to calculate the ratio of residual to genetic variance. The changes triggered an increase in SD of all submitted traits.
NLD (HOL) Changes in trait OUS due to a change in formula to calculate the udder composite.

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 August 2022

Country	Date
BEL	20201201
CAN	20220801
DEU	20220809
DFS	20220809
ESP	20220711
FRA	20220810
GBR	20220704
ITA	20220712
NLD	20220801
HUN	20211122
POL	20220708
CZE	20220725

Table 2.

Number of bulls in reference population for	sta
BEL	1691.0

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CAN   723.0 38746.0
DEU   726.0  8291.0 43574.0
DFS   635.0  5230.0 38235.0 39230.0
ESP   701.0  6110.0 39356.0 38351.0 40468.0
FRA   710.0  4031.0 34720.0 34197.0 34808.0 36451.0
GBR   683.0 32623.0  8761.0  5635.0  6592.0  4124.0 35447.0
ITA   705.0 30924.0  6038.0  3741.0  4267.0  3202.0 29954.0 31472.0
NLD   742.0  4118.0 36576.0 35949.0 36568.0 34244.0  4455.0  3248.0 38412.0
HUN   549.0  2219.0  8146.0  7663.0  8033.0  7282.0  2454.0  1895.0  7811.0  9021.0
POL   994.0  4662.0 33255.0 32968.0 33584.0 30335.0  4967.0  3231.0 31864.0  7624.0 34975.0
CZE   842.0  1729.0  2191.0  1793.0  2063.0  1669.0  1674.0  1315.0  1729.0  1396.0  2486.0  3584.0

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Number of bulls in reference population for        cwi
---------------------------------------------------------
CAN 38741.0
DEU  8291.0 42352.0
DFS  5231.0 37024.0 38012.0
ESP  6111.0 38140.0 37139.0 39239.0
FRA  4031.0 33526.0 33010.0 33612.0 35244.0
GBR 32618.0  8761.0  5636.0  6593.0  4124.0 35442.0
ITA 30921.0  6038.0  3741.0  4267.0  3202.0 29951.0 31469.0
NLD  4118.0 35382.0 34753.0 35374.0 33076.0  4455.0  3248.0 37216.0
HUN  2219.0  7609.0  7124.0  7494.0  6771.0  2454.0  1895.0  7272.0  8481.0
POL  4662.0 32099.0 31811.0 32428.0 29205.0  4967.0  3231.0 30715.0  7084.0 33815.0
CZE  1729.0  2188.0  1790.0  2060.0  1666.0  1674.0  1315.0  1727.0  1395.0  2483.0  3581.0

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Number of bulls in reference population for        bde
---------------------------------------------------------
CAN 38746.0
DEU  8291.0 43015.0
DFS  5230.0 37676.0 38667.0
ESP  6110.0 38798.0 37791.0 39908.0
FRA  4031.0 34188.0 33664.0 34276.0 35918.0
GBR 32623.0  8761.0  5635.0  6592.0  4124.0 35447.0
ITA 30924.0  6038.0  3741.0  4267.0  3202.0 29954.0 31472.0
NLD  4118.0 36017.0 35388.0 36008.0 33711.0  4455.0  3248.0 37851.0
HUN  2219.0  7634.0  7149.0  7519.0  6796.0  2454.0  1895.0  7297.0  8506.0
POL  4662.0 32742.0 32453.0 33069.0 29848.0  4967.0  3231.0 31349.0  7109.0 34459.0
CZE  1729.0  2190.0  1792.0  2062.0  1668.0  1674.0  1315.0  1728.0  1395.0  2485.0  3583.0

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Number of bulls in reference population for        ang
---------------------------------------------------------
BEL  1623.0
CAN   720.0 38300.0
DEU   716.0  8285.0 39783.0
DFS   628.0  5226.0 34479.0 35465.0
ESP   691.0  6105.0 35572.0 34591.0 36662.0
FRA   700.0  4024.0 31032.0 30538.0 31116.0 32746.0
GBR   662.0 32604.0  8753.0  5629.0  6585.0  4115.0 34341.0
ITA   703.0 30728.0  6031.0  3735.0  4260.0  3194.0 29937.0 31270.0
NLD   709.0  4108.0 32833.0 32227.0 32824.0 30584.0  4359.0  3239.0 34200.0
HUN   517.0  2209.0  5077.0  4614.0  4956.0  4293.0  2351.0  1886.0  4591.0  5640.0
POL   983.0  4655.0 29552.0 29285.0 29875.0 26713.0  4957.0  3221.0 28169.0  4549.0 31258.0
CZE   833.0  1725.0  2151.0  1759.0  2023.0  1631.0  1670.0  1308.0  1690.0  1358.0  2443.0  3534.0

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Number of bulls in reference population for        ran
---------------------------------------------------------
CAN 38744.0
DEU  8289.0 43467.0
DFS  5228.0 38128.0 39112.0
ESP  6108.0 39254.0 38238.0 40352.0
FRA  4031.0 34625.0 34102.0 34718.0 36356.0
GBR 32622.0  8754.0  5626.0  6581.0  4124.0 35436.0
ITA 30923.0  6037.0  3740.0  4266.0  3202.0 29953.0 31471.0
NLD  4117.0 36479.0 35852.0 36476.0 34149.0  4453.0  3247.0 38315.0
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HUN  2219.0  8146.0  7663.0  8033.0  7282.0  2454.0  1895.0  7811.0  9021.0
POL  4661.0 33242.0 32951.0 33565.0 30332.0  4960.0  3231.0 31860.0  7624.0 34955.0
CZE  1729.0  2191.0  1793.0  2063.0  1669.0  1674.0  1315.0  1729.0  1396.0  2486.0  3584.0

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Number of bulls in reference population for        rwi
-----------------------------------------------------
CAN 37923.0
DEU  8290.0 43518.0
DFS  5229.0 38179.0 39174.0
ESP  6109.0 39301.0 38296.0 40413.0
FRA  4031.0 34665.0 34142.0 34754.0 36396.0
GBR 32622.0  8760.0  5634.0  6591.0  4124.0 35446.0
ITA 30923.0  6037.0  3740.0  4266.0  3202.0 29953.0 31471.0
NLD  4117.0 36520.0 35893.0 36513.0 34189.0  4454.0  3247.0 38356.0
HUN  2219.0  8137.0  7654.0  8024.0  7273.0  2454.0  1895.0  7802.0  9012.0
POL  4662.0 33245.0 32958.0 33574.0 30325.0  4967.0  3231.0 31854.0  7615.0 34965.0
CZE  1729.0  2191.0  1793.0  2063.0  1669.0  1674.0  1315.0  1729.0  1396.0  2486.0  3584.0

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Number of bulls in reference population for        rls
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CAN 38746.0
DEU  8291.0 43575.0
DFS  5230.0 38236.0 39231.0
ESP  6110.0 39357.0 38352.0 40469.0
FRA  4031.0 34721.0 34198.0 34809.0 36452.0
GBR 32623.0  8761.0  5635.0  6592.0  4124.0 35447.0
ITA 30924.0  6038.0  3741.0  4267.0  3202.0 29954.0 31472.0
NLD  4118.0 36577.0 35950.0 36569.0 34245.0  4455.0  3248.0 38413.0
HUN  2219.0  8146.0  7663.0  8033.0  7282.0  2454.0  1895.0  7811.0  9021.0
POL  4662.0 33255.0 32968.0 33584.0 30335.0  4967.0  3231.0 31864.0  7624.0 34975.0
CZE  1729.0  2191.0  1793.0  2063.0  1669.0  1674.0  1315.0  1729.0  1396.0  2486.0  3584.0

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Number of bulls in reference population for        rlr
-----------------------------------------------------
CAN 37819.0
DEU  8283.0 41462.0
DFS  5223.0 36153.0 37139.0
ESP  6103.0 37260.0 36266.0 38355.0
FRA  4023.0 32647.0 32148.0 32740.0 34312.0
GBR 31787.0  8752.0  5627.0  6584.0  4114.0 33526.0
ITA 30094.0  6031.0  3734.0  4260.0  3194.0 29124.0 30641.0
NLD  4107.0 34519.0 33891.0 34510.0 32225.0  4358.0  3239.0 35895.0
HUN  2214.0  7252.0  6768.0  7137.0  6425.0  2357.0  1892.0  6772.0  7855.0
POL  4653.0 31235.0 30946.0 31561.0 28350.0  4956.0  3222.0 29855.0  6728.0 32898.0
CZE  1728.0  2178.0  1780.0  2050.0  1657.0  1672.0  1314.0  1717.0  1388.0  2424.0  3493.0

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Number of bulls in reference population for        fan
-----------------------------------------------------
CAN 38718.0
DEU  8291.0 41418.0
DFS  5231.0 36346.0 37324.0
ESP  6111.0 37466.0 36465.0 38573.0
FRA  4031.0 32896.0 32374.0 32983.0 34621.0
GBR 32598.0  8761.0  5636.0  6593.0  4124.0 34344.0
ITA 30900.0  6038.0  3741.0  4267.0  3202.0 29931.0 31448.0
NLD  4115.0 34695.0 34070.0 34689.0 32429.0  4368.0  3247.0 36069.0
HUN  2216.0  7456.0  6973.0  7342.0  6629.0  2360.0  1894.0  6976.0  8060.0
POL  4662.0 31426.0 31139.0 31753.0 28571.0  4967.0  3231.0 30041.0  6934.0 33140.0
CZE  1728.0  2189.0  1791.0  2061.0  1667.0  1674.0  1314.0  1727.0  1394.0  2484.0  3581.0

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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	38745.0										
DEU	8290.0	42745.0									
DFS	5230.0	37413.0	38392.0								
ESP	6110.0	38530.0	37516.0	39621.0							
FRA	4031.0	33929.0	33410.0	34015.0	35655.0						
GBR	32623.0	8755.0	5628.0	6583.0	4124.0	35437.0					
ITA	30923.0	6038.0	3741.0	4267.0	3202.0	29953.0	31471.0				
NLD	4118.0	35775.0	35146.0	35765.0	33470.0	4454.0	3248.0	37609.0			
HUN	2219.0	7611.0	7126.0	7496.0	6773.0	2454.0	1895.0	7274.0	8483.0		
POL	4661.0	32441.0	32148.0	32762.0	29557.0	4960.0	3231.0	31062.0	7086.0	34151.0	
CZE	1729.0	2190.0	1792.0	2062.0	1668.0	1674.0	1315.0	1728.0	1395.0	2485.0	3583.0

Number of bulls in reference population for ruh

CAN	38745.0										
DEU	8291.0	42443.0									
DFS	5230.0	37105.0	38067.0								
ESP	6110.0	38227.0	37192.0	39305.0							
FRA	4031.0	33623.0	33099.0	33710.0	35350.0						
GBR	32622.0	8761.0	5635.0	6592.0	4124.0	35444.0					
ITA	30923.0	6038.0	3741.0	4267.0	3202.0	29953.0	31471.0				
NLD	4118.0	35454.0	34824.0	35445.0	33154.0	4455.0	3248.0	37287.0			
HUN	2219.0	7623.0	7138.0	7508.0	6785.0	2454.0	1895.0	7286.0	8495.0		
POL	4662.0	32588.0	32299.0	32915.0	29694.0	4967.0	3231.0	31199.0	7101.0	34305.0	
CZE	1729.0	2190.0	1792.0	2062.0	1668.0	1674.0	1315.0	1728.0	1395.0	2485.0	3583.0

Number of bulls in reference population for ruw

Number of bulls in reference population for usu

BEL	1692.0											
CAN	723.0	38748.0										
DEU	726.0	8292.0	43574.0									
DFS	635.0	5232.0	38235.0	39231.0								
ESP	701.0	6112.0	39356.0	38352.0	40469.0							
FRA	710.0	4031.0	34719.0	34196.0	34807.0	36450.0						
GBR	683.0	32625.0	8762.0	5637.0	6594.0	4124.0	35449.0					
ITA	705.0	30925.0	6039.0	3742.0	4268.0	3202.0	29955.0	31473.0				
NLD	742.0	4118.0	36575.0	35948.0	36567.0	34243.0	4455.0	3248.0	38411.0			
HUN	549.0	2219.0	8145.0	7662.0	8032.0	7281.0	2454.0	1895.0	7810.0	9020.0		
POL	994.0	4662.0	33253.0	32966.0	33582.0	30333.0	4967.0	3231.0	31862.0	7623.0	34973.0	
CZE	842.0	1729.0	2191.0	1793.0	2063.0	1669.0	1674.0	1315.0	1729.0	1396.0	2486.0	3584.0

Number of bulls in reference population for ude

CAN	38739.0										
DEU	8290.0	43571.0									
DFS	5229.0	38232.0	39227.0								
ESP	6109.0	39353.0	38348.0	40465.0							
FRA	4031.0	34719.0	34196.0	34807.0	36450.0						
GBR	32618.0	8760.0	5634.0	6591.0	4124.0	34364.0					
ITA	30922.0	6037.0	3740.0	4266.0	3202.0	29952.0	31470.0				
NLD	4114.0	36573.0	35946.0	36565.0	34243.0	4367.0	3246.0	37954.0			
HUN	2216.0	8145.0	7662.0	8032.0	7282.0	2360.0	1894.0	7667.0	8753.0		
POL	4662.0	33254.0	32967.0	33583.0	30334.0	4967.0	3231.0	31863.0	7624.0	34974.0	
CZE	1729.0	2191.0	1793.0	2063.0	1669.0	1674.0	1315.0	1729.0	1396.0	2486.0	3584.0

Number of bulls in reference population for ftp

CAN	38746.0	
DEU	8291.0	43528.0

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DFS  5230.0 38189.0 39184.0
ESP  6110.0 39311.0 38306.0 40423.0
FRA  4031.0 34673.0 34150.0 34762.0 36404.0
GBR 32623.0  8762.0  5636.0  6593.0  4124.0 35448.0
ITA 30924.0  6039.0  3742.0  4268.0  3202.0 29955.0 31473.0
NLD  4118.0 36529.0 35902.0 36522.0 34197.0  4455.0  3248.0 38365.0
HUN  2219.0  8145.0  7662.0  8032.0  7281.0  2454.0  1895.0  7810.0  9020.0
POL  4662.0 33253.0 32966.0 33582.0 30333.0  4967.0  3231.0 31862.0  7623.0 34973.0
CZE  1729.0  2191.0  1793.0  2063.0  1669.0  1674.0  1315.0  1729.0  1396.0  2486.0  3584.0

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Number of bulls in reference population for        ftl
---------------------------------------------------------
BEL  1663.0
CAN   721.0 38732.0
DEU   726.0  8293.0 43575.0
DFS   635.0  5230.0 38234.0 39229.0
ESP   701.0  6110.0 39355.0 38350.0 40467.0
FRA   710.0  4031.0 34719.0 34196.0 34807.0 36450.0
GBR   668.0 32621.0  8764.0  5636.0  6593.0  4124.0 34991.0
ITA   704.0 30924.0  6040.0  3742.0  4268.0  3202.0 29955.0 31473.0
NLD   722.0  4116.0 36574.0 35947.0 36566.0 34243.0  4375.0  3247.0 37987.0
HUN   531.0  2218.0  8146.0  7662.0  8032.0  7282.0  2390.0  1894.0  7683.0  8818.0
POL   994.0  4662.0 33254.0 32967.0 33583.0 30334.0  4967.0  3231.0 31863.0  7624.0 34974.0
CZE   842.0  1729.0  2191.0  1793.0  2063.0  1669.0  1674.0  1315.0  1729.0  1396.0  2486.0  3584.0

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Number of bulls in reference population for        rtp
---------------------------------------------------------
CAN 35646.0
DEU  8286.0 41265.0
DFS  5224.0 35929.0 36832.0
ESP  6104.0 37047.0 35963.0 38075.0
FRA  4025.0 32492.0 31919.0 32527.0 34168.0
GBR 30789.0  8757.0  5630.0  6587.0  4118.0 33606.0
ITA 29081.0  6034.0  3736.0  4262.0  3197.0 28289.0 29626.0
NLD  4094.0 34270.0 33592.0 34208.0 31967.0  4431.0  3224.0 35903.0
POL  4655.0 31765.0 31420.0 32039.0 28843.0  4960.0  3225.0 30323.0 33356.0
CZE  1724.0  2175.0  1778.0  2047.0  1654.0  1669.0  1310.0  1713.0  2411.0  3499.0

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Number of bulls in reference population for        ocs
---------------------------------------------------------
AUS  2900.0
CAN  1075.0 38675.0
DEU   785.0  8256.0 42832.0
ESP   749.0  6097.0 38672.0 39765.0
FRA   718.0  4027.0 34045.0 34128.0 35758.0
GBR  1222.0 32566.0  8721.0  6578.0  4122.0 35378.0
ITA   865.0 30881.0  6015.0  4259.0  3200.0 29908.0 31426.0
NLD   767.0  4111.0 35924.0 35920.0 33599.0  4444.0  3242.0 37751.0
HUN   701.0  2216.0  8144.0  8032.0  7282.0  2450.0  1893.0  7811.0  9017.0
POL   657.0  4656.0 32599.0 32928.0 29681.0  4962.0  3228.0 31220.0  7624.0 34315.0
CZE   375.0  1729.0  2189.0  2061.0  1667.0  1674.0  1315.0  1728.0  1396.0  2484.0  3582.0

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Number of bulls in reference population for        ous
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CAN 38709.0
DEU  8263.0 43499.0
DFS  5225.0 38224.0 39214.0
ESP  6100.0 39331.0 38343.0 40437.0
FRA  4029.0 34707.0 34191.0 34792.0 36432.0
GBR 32596.0  8727.0  5631.0  6580.0  4123.0 35403.0
ITA 30907.0  6021.0  3738.0  4261.0  3201.0 29934.0 31452.0
NLD  4112.0 36558.0 35948.0 36554.0 34233.0  4445.0  3243.0 38389.0
HUN  2216.0  8144.0  7662.0  8032.0  7282.0  2450.0  1893.0  7811.0  9017.0
POL  4659.0 33241.0 32965.0 33569.0 30322.0  4964.0  3230.0 31852.0  7624.0 34959.0
CZE  1729.0  2191.0  1793.0  2063.0  1669.0  1674.0  1315.0  1729.0  1396.0  2486.0  3584.0
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Number of bulls in reference population for ofl

CAN	38558.0										
DEU	8264.0	42857.0									
DFS	5225.0	37592.0	38579.0								
ESP	6100.0	38693.0	37710.0	39787.0							
FRA	4029.0	34066.0	33558.0	34149.0	35779.0						
GBR	32467.0	8728.0	5631.0	6580.0	4123.0	34196.0					
ITA	30814.0	6022.0	3738.0	4261.0	3201.0	29841.0	31359.0				
NLD	4110.0	35944.0	35333.0	35940.0	33619.0	4359.0	3243.0	37297.0			
HUN	2213.0	8142.0	7660.0	8030.0	7281.0	2356.0	1892.0	7666.0	8748.0		
POL	4659.0	32621.0	32346.0	32951.0	29702.0	4964.0	3230.0	31241.0	7623.0	34338.0	
CZE	1729.0	2189.0	1791.0	2061.0	1667.0	1674.0	1315.0	1728.0	1396.0	2484.0	3582.0

Number of bulls in reference population for loc

CAN	33204.0										
DEU	8210.0	38755.0									
DFS	5180.0	33738.0	34588.0								
ESP	6053.0	34860.0	33796.0	35835.0							
FRA	3984.0	30397.0	29820.0	30436.0	32005.0						
GBR	30489.0	8671.0	5592.0	6537.0	4086.0	32184.0					
ITA	28876.0	5990.0	3713.0	4235.0	3175.0	28082.0	29326.0				
NLD	4071.0	32273.0	31592.0	32226.0	30003.0	4325.0	3215.0	33520.0			
CZE	1720.0	2155.0	1760.0	2029.0	1636.0	1667.0	1305.0	1696.0	3457.0		
HUN	2206.0	6427.0	5953.0	6311.0	5628.0	2346.0	1887.0	5947.0	1367.0	7017.0	
POL	4614.0	28802.0	28428.0	29073.0	26001.0	4925.0	3199.0	27534.0	2372.0	5904.0	30284.0

Number of bulls in reference population for bcs

DEU	35388.0										
FRA	27240.0	28688.0									
GBR	8578.0	4051.0	31640.0								
ITA	5962.0	3163.0	26545.0	27980.0							
NLD	28907.0	26762.0	4368.0	3197.0	30612.0						
CZE	2151.0	1633.0	1656.0	1297.0	1694.0	3333.0					
CAN	8101.0	3936.0	28955.0	27533.0	4011.0	1711.0	33371.0				
ESP	31506.0	27274.0	6427.0	4209.0	28833.0	2025.0	5947.0	32440.0			
HUN	7218.0	6402.0	2438.0	1882.0	6878.0	1382.0	2206.0	7106.0	8074.0		
POL	27561.0	24785.0	4833.0	3179.0	26202.0	2302.0	4525.0	27786.0	6705.0	28974.0	