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.

CAN, DEU, ESP, FRA, AUS, DFS, GBR, ITA, NLD, POL, HUN, CZE submitted GEBVs.

ang: 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: 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: CAN, DEU, ESP, FRA, , DFS, GBR, ITA, NLD, POL, HUN, CZE
ude: CAN, DEU, ESP, FRA, , DFS, GBR, ITA, NLD, POL, HUN, CZE
usu: 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:

AUS (HOL) Change in status of some bulls for not being qualified to have the results published
Decrease in reliability due to pedigree updates
Some bulls with missing pedigree due to pedigree update or not having sire or dam
DFS (HOL) No longer participating in the bcs evaluation
FRA (HOL) Some bulls with missing pedigree due to pedigree update
Some bulls changed from official to unofficial because they have been blocked from publication by Holstein breed society
ITA (HOL) Some bulls missing pedigree due to the authority issue
NLD (HOL) Some bulls with type of proof 13, with unexpected type of proof, because of not being eligible for daughter testing breeding values.
ESP (HOL) Base change
Decrease in reliability for "ANG", due to the decrease in reliability of its pedigree index used for GEBV calculation
GBR (HOL) Some bulls with missing pedigree because they either younger than 10 months or they don’t have sireID or they have international IDs
Change in status of some bulls, due to the decrease in number of daughters
ocs and rtp: Some extreme deviation from the year mean for Friesian bulls in the UK and Ireland due to comparing Friesian and Holstein bulls
DEU (HOL) Introduction of single step evaluation
POL (HOL) Change in status of some bulls due to the increase in number of daughters
BEL (HOL) Participating with MACE data due to very old data and no more qualifying young bulls

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 August 2025

Country	Date
CAN	20250801
DEU	20250812
DFS	20250812
ESP	20250710
FRA	20250813
GBR	20250714

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ITA      20250707
NLD      20250813
HUN      20250725
POL      20250617
CZE      20250317
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Table 2.
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Number of bulls in reference population for        sta
------------------------------------------------------------
CAN 41506.0
DEU 11353.0 47765.0
DFS  6816.0 40936.0 41879.0
ESP 41340.0 47710.0 41857.0141155.0
FRA  5543.0 37513.0 36966.0 39290.0 39294.0
GBR 35151.0 12378.0  7794.0 37771.0  6047.0 37940.0
ITA 36140.0 11319.0  6718.0 37495.0  5075.0 35573.0 37637.0
NLD  4117.0 36607.0 36141.0 38368.0 34678.0  4463.0  3477.0 38371.0
HUN  2239.0  8243.0  7821.0  8987.0  7625.0  2457.0  2220.0  7806.0  9037.0
POL  4874.0 34005.0 33843.0 35592.0 32383.0  5371.0  4396.0 31842.0  7623.0 35597.0
CZE  2216.0  2719.0  2034.0  4135.0  1955.0  2177.0  2176.0  1729.0  1429.0  2558.0  4144.0

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Number of bulls in reference population for        cwi
------------------------------------------------------------
CAN 41504.0
DEU 11355.0 46548.0
DFS  6817.0 39799.0 40736.0
ESP 41338.0 46493.0 40714.0135890.0
FRA  5543.0 36321.0 35849.0 38084.0 38088.0
GBR 35149.0 12381.0  7796.0 37770.0  6047.0 37939.0
ITA 36138.0 11322.0  6720.0 37494.0  5075.0 35572.0 37636.0
NLD  4117.0 35415.0 35016.0 37174.0 33512.0  4463.0  3477.0 37177.0
HUN  2239.0  7706.0  7315.0  8448.0  7114.0  2457.0  2220.0  7267.0  8497.0
POL  4874.0 32851.0 32757.0 34435.0 31255.0  5371.0  4396.0 30695.0  7083.0 34439.0
CZE  2216.0  2716.0  2031.0  4132.0  1952.0  2177.0  2176.0  1727.0  1428.0  2555.0  4141.0

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Number of bulls in reference population for        bde
------------------------------------------------------------
CAN 41506.0
DEU 11353.0 47206.0
DFS  6816.0 40409.0 41348.0
ESP 41340.0 47151.0 41326.0139043.0
FRA  5543.0 36981.0 36461.0 38757.0 38761.0
GBR 35151.0 12378.0  7794.0 37771.0  6047.0 37940.0
ITA 36140.0 11319.0  6718.0 37495.0  5075.0 35573.0 37637.0
NLD  4117.0 36048.0 35612.0 37807.0 34145.0  4463.0  3477.0 37810.0
HUN  2239.0  7731.0  7339.0  8473.0  7139.0  2457.0  2220.0  7292.0  8522.0
POL  4874.0 33492.0 33360.0 35077.0 31896.0  5371.0  4396.0 31327.0  7108.0 35081.0
CZE  2216.0  2718.0  2033.0  4134.0  1954.0  2177.0  2176.0  1728.0  1428.0  2557.0  4143.0

------------------------------------------------------------
Number of bulls in reference population for        ang
------------------------------------------------------------
CAN 40551.0
DEU 10880.0 28383.0
DFS  6358.0 22628.0 23482.0
ESP 40386.0 28328.0 23460.0 97501.0
FRA  5107.0 20467.0 20091.0 22206.0 22210.0
GBR 34706.0 11792.0  7220.0 36812.0  5495.0 36981.0
ITA 35614.0 10998.0  6407.0 36928.0  4780.0 35208.0 37070.0
NLD  3659.0 18238.0 17962.0 19515.0 17704.0  3821.0  3169.0 19518.0
HUN  2212.0  4997.0  4644.0  5452.0  4478.0  2348.0  2199.0  4416.0  5479.0
POL  4422.0 20173.0 20180.0 21724.0 19709.0  4802.0  4090.0 18114.0  4412.0 21728.0
CZE  2201.0  2636.0  1960.0  4034.0  1882.0  2165.0  2162.0  1654.0  1381.0  2479.0  4043.0

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Number of bulls in reference population for ran

CAN	41503.0										
DEU	11351.0	47667.0									
DFS	6815.0	40839.0	41782.0								
ESP	41337.0	47612.0	41760.0	140884.0							
FRA	5542.0	37417.0	36871.0	39194.0	39198.0						
GBR	35148.0	12376.0	7793.0	37768.0	6046.0	37937.0					
ITA	36137.0	11317.0	6717.0	37492.0	5074.0	35570.0	37634.0				
NLD	4116.0	36511.0	36045.0	38272.0	34583.0	4462.0	3476.0	38275.0			
HUN	2239.0	8243.0	7821.0	8987.0	7625.0	2457.0	2220.0	7806.0	9037.0		
POL	4874.0	34002.0	33840.0	35589.0	32380.0	5371.0	4396.0	31839.0	7623.0	35594.0	
CZE	2216.0	2719.0	2034.0	4135.0	1955.0	2177.0	2176.0	1729.0	1429.0	2558.0	4144.0

Number of bulls in reference population for rwi

CAN	40681.0										
DEU	11351.0	47708.0									
DFS	6815.0	40883.0	41826.0								
ESP	40515.0	47653.0	41804.0	138829.0							
FRA	5542.0	37457.0	36914.0	39234.0	39238.0						
GBR	35148.0	12376.0	7793.0	37768.0	6046.0	37937.0					
ITA	36137.0	11317.0	6717.0	37492.0	5074.0	35570.0	37634.0				
NLD	4116.0	36551.0	36088.0	38312.0	34623.0	4462.0	3476.0	38315.0			
HUN	2239.0	8234.0	7815.0	8978.0	7616.0	2457.0	2220.0	7797.0	9028.0		
POL	4874.0	33995.0	33836.0	35582.0	32373.0	5371.0	4396.0	31832.0	7614.0	35587.0	
CZE	2216.0	2719.0	2034.0	4135.0	1955.0	2177.0	2176.0	1729.0	1429.0	2558.0	4144.0

Number of bulls in reference population for rls

CAN	41507.0										
DEU	11354.0	47767.0									
DFS	6816.0	40937.0	41880.0								
ESP	41341.0	47712.0	41858.0	141128.0							
FRA	5543.0	37514.0	36967.0	39291.0	39295.0						
GBR	35152.0	12379.0	7794.0	37772.0	6047.0	37941.0					
ITA	36141.0	11320.0	6718.0	37496.0	5075.0	35574.0	37638.0				
NLD	4117.0	36608.0	36142.0	38369.0	34679.0	4463.0	3477.0	38372.0			
HUN	2239.0	8243.0	7821.0	8987.0	7625.0	2457.0	2220.0	7806.0	9037.0		
POL	4874.0	34005.0	33843.0	35592.0	32383.0	5371.0	4396.0	31842.0	7623.0	35597.0	
CZE	2216.0	2719.0	2034.0	4135.0	1955.0	2177.0	2176.0	1729.0	1429.0	2558.0	4144.0

Number of bulls in reference population for rlr

CAN	40581.0										
DEU	11349.0	45654.0									
DFS	6809.0	38939.0	39874.0								
ESP	40415.0	45599.0	39852.0	121887.0							
FRA	5535.0	35437.0	34999.0	37144.0	37148.0						
GBR	34319.0	12372.0	7785.0	36616.0	6037.0	36784.0					
ITA	35310.0	11315.0	6711.0	36663.0	5067.0	34743.0	36805.0				
NLD	4107.0	34549.0	34168.0	35862.0	32656.0	4374.0	3469.0	35865.0			
HUN	2234.0	7348.0	6963.0	7822.0	6767.0	2376.0	2217.0	6770.0	7870.0		
POL	4865.0	31983.0	31906.0	33513.0	30396.0	5360.0	4387.0	29831.0	6726.0	33517.0	
CZE	2215.0	2706.0	2021.0	4043.0	1943.0	2175.0	2175.0	1717.0	1421.0	2495.0	4052.0

Number of bulls in reference population for fan

CAN	41472.0										
DEU	11354.0	45600.0									
DFS	6815.0	39101.0	40025.0								
ESP	41306.0	45545.0	40003.0	125554.0							
FRA	5541.0	35680.0	35191.0	37451.0	37455.0						
GBR	35125.0	12380.0	7794.0	37429.0	6045.0	37598.0					
ITA	36111.0	11321.0	6718.0	37465.0	5073.0	35548.0	37607.0				

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NLD  4113.0 34717.0 34313.0 36028.0 32854.0  4382.0  3475.0 36031.0
HUN  2236.0  7553.0  7167.0  8028.0  6972.0  2379.0  2219.0  6975.0  8076.0
POL  4872.0 32166.0 32065.0 33748.0 30610.0  5369.0  4394.0 30009.0  6933.0 33752.0
CZE  2215.0  2716.0  2032.0  4131.0  1953.0  2177.0  2175.0  1727.0  1427.0  2556.0  4140.0

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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 41507.0
DEU 11354.0 46949.0
DFS  6817.0 40190.0 41128.0
ESP 41341.0 46894.0 41106.0138008.0
FRA  5543.0 36723.0 36240.0 38494.0 38498.0
GBR 35152.0 12380.0  7796.0 37773.0  6047.0 37942.0
ITA 36141.0 11321.0  6720.0 37497.0  5075.0 35575.0 37639.0
NLD  4117.0 35808.0 35402.0 37567.0 33905.0  4463.0  3477.0 37570.0
HUN  2239.0  7708.0  7317.0  8450.0  7116.0  2457.0  2220.0  7269.0  8499.0
POL  4874.0 33202.0 33100.0 34787.0 31606.0  5371.0  4396.0 31042.0  7085.0 34791.0
CZE  2216.0  2718.0  2033.0  4134.0  1954.0  2177.0  2176.0  1728.0  1428.0  2557.0  4143.0

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Number of bulls in reference population for        ruh
------------------------------------------------------
CAN 41506.0
DEU 11354.0 46635.0
DFS  6817.0 39888.0 40804.0
ESP 41340.0 46580.0 40782.0136585.0
FRA  5543.0 36416.0 35945.0 38189.0 38193.0
GBR 35151.0 12379.0  7795.0 37769.0  6047.0 37938.0
ITA 36140.0 11320.0  6719.0 37495.0  5075.0 35573.0 37637.0
NLD  4117.0 35485.0 35096.0 37243.0 33588.0  4463.0  3477.0 37246.0
HUN  2239.0  7720.0  7328.0  8462.0  7128.0  2457.0  2220.0  7281.0  8511.0
POL  4874.0 33338.0 33229.0 34923.0 31742.0  5371.0  4396.0 31177.0  7100.0 34927.0
CZE  2216.0  2718.0  2033.0  4134.0  1954.0  2177.0  2176.0  1728.0  1428.0  2557.0  4143.0

------------------------------------------------------
Number of bulls in reference population for        ruw
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------------------------------------------------------
Number of bulls in reference population for        usu
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CAN 41510.0
DEU 11356.0 47770.0
DFS  6818.0 40940.0 41883.0
ESP 41344.0 47715.0 41861.0141104.0
FRA  5543.0 37514.0 36967.0 39291.0 39295.0
GBR 35155.0 12382.0  7797.0 37776.0  6047.0 37945.0
ITA 36144.0 11323.0  6721.0 37500.0  5075.0 35578.0 37642.0
NLD  4117.0 36608.0 36142.0 38369.0 34679.0  4463.0  3477.0 38372.0
HUN  2239.0  8243.0  7821.0  8987.0  7625.0  2457.0  2220.0  7806.0  9037.0
POL  4874.0 34005.0 33843.0 35592.0 32383.0  5371.0  4396.0 31842.0  7623.0 35597.0
CZE  2216.0  2719.0  2034.0  4135.0  1955.0  2177.0  2176.0  1729.0  1429.0  2558.0  4144.0

------------------------------------------------------
Number of bulls in reference population for        ude
------------------------------------------------------
CAN 41509.0
DEU 11361.0 47790.0
DFS  6817.0 40943.0 41885.0
ESP 41343.0 47735.0 41863.0134783.0
FRA  5544.0 37515.0 36967.0 39292.0 39296.0
GBR 35157.0 12397.0  7800.0 37474.0  6049.0 37644.0
ITA 36147.0 11337.0  6723.0 37513.0  5077.0 35591.0 37656.0
NLD  4116.0 36616.0 36145.0 37938.0 34680.0  4392.0  3483.0 37941.0
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HUN  2238.0  8246.0  7822.0  8723.0  7627.0  2383.0  2223.0  7668.0  8773.0
POL  4875.0 34010.0 33845.0 35597.0 32385.0  5375.0  4399.0 31846.0  7625.0 35602.0
CZE  2217.0  2719.0  2034.0  4136.0  1955.0  2178.0  2177.0  1729.0  1429.0  2558.0  4145.0

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Number of bulls in reference population for        ftp
----------------------------------------------------------
CAN 41518.0
DEU 11362.0 47746.0
DFS  6817.0 40898.0 41841.0
ESP 41352.0 47691.0 41819.0140941.0
FRA  5544.0 37469.0 36921.0 39246.0 39250.0
GBR 35161.0 12398.0  7800.0 37795.0  6049.0 37965.0
ITA 36151.0 11338.0  6723.0 37518.0  5077.0 35595.0 37661.0
NLD  4119.0 36571.0 36100.0 38336.0 34634.0  4472.0  3484.0 38339.0
HUN  2241.0  8246.0  7822.0  8990.0  7626.0  2461.0  2224.0  7807.0  9040.0
POL  4875.0 34009.0 33844.0 35596.0 32384.0  5375.0  4399.0 31845.0  7624.0 35601.0
CZE  2217.0  2719.0  2034.0  4136.0  1955.0  2178.0  2177.0  1729.0  1429.0  2558.0  4145.0

----------------------------------------------------------
Number of bulls in reference population for        ftl
----------------------------------------------------------
CAN 41491.0
DEU 11354.0 47764.0
DFS  6816.0 40934.0 41877.0
ESP 41325.0 47709.0 41855.0136162.0
FRA  5543.0 37512.0 36965.0 39289.0 39293.0
GBR 35149.0 12379.0  7794.0 37530.0  6047.0 37699.0
ITA 36138.0 11320.0  6718.0 37492.0  5075.0 35571.0 37634.0
NLD  4115.0 36605.0 36139.0 37949.0 34677.0  4388.0  3476.0 37952.0
HUN  2237.0  8242.0  7820.0  8783.0  7625.0  2403.0  2219.0  7679.0  8833.0
POL  4874.0 34004.0 33842.0 35591.0 32382.0  5371.0  4396.0 31841.0  7623.0 35596.0
CZE  2216.0  2719.0  2034.0  4135.0  1955.0  2177.0  2176.0  1729.0  1429.0  2558.0  4144.0

----------------------------------------------------------
Number of bulls in reference population for        rtp
----------------------------------------------------------
CAN 38400.0
DEU 11356.0 45480.0
DFS  6811.0 38731.0 39588.0
ESP 38235.0 45425.0 39566.0113629.0
FRA  5538.0 35286.0 34773.0 37009.0 37013.0
GBR 33308.0 12392.0  7794.0 35935.0  6043.0 36104.0
ITA 34129.0 11333.0  6718.0 35492.0  5072.0 33751.0 35635.0
NLD  4095.0 34310.0 33882.0 35873.0 32403.0  4448.0  3460.0 35876.0
POL  4868.0 32519.0 32362.0 33978.0 30893.0  5368.0  4393.0 30305.0 33982.0
CZE  2212.0  2703.0  2019.0  4051.0  1940.0  2173.0  2172.0  1713.0  2483.0  4060.0

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Number of bulls in reference population for        ocs
----------------------------------------------------------
AUS  3088.0
CAN  1237.0 41396.0
DEU   929.0 11291.0 46992.0
ESP  3086.0 41236.0 46937.0137711.0
FRA   794.0  5536.0 36839.0 38596.0 38600.0
GBR  1251.0 35066.0 12311.0 37674.0  6043.0 37841.0
ITA  1177.0 36051.0 11253.0 37396.0  5070.0 35479.0 37532.0
NLD   809.0  4109.0 35957.0 37709.0 34035.0  4452.0  3465.0 37712.0
HUN   767.0  2234.0  8240.0  8982.0  7626.0  2451.0  2214.0  7807.0  9032.0
POL   692.0  4863.0 33348.0 34929.0 31731.0  5362.0  4391.0 31201.0  7623.0 34934.0
CZE   415.0  2216.0  2717.0  4133.0  1953.0  2177.0  2176.0  1728.0  1429.0  2556.0  4142.0

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Number of bulls in reference population for        ous
----------------------------------------------------------
CAN 41435.0
DEU 11301.0 47661.0
DFS  6799.0 40912.0 41846.0
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ESP 41275.0 47606.0 41825.0139932.0
FRA  5538.0 37500.0 36960.0 39270.0 39274.0
GBR 35099.0 12320.0  7778.0 37703.0  6044.0 37869.0
ITA 36084.0 11262.0  6701.0 37429.0  5071.0 35512.0 37565.0
NLD  4111.0 36591.0 36141.0 38347.0 34668.0  4454.0  3467.0 38350.0
HUN  2234.0  8240.0  7821.0  8982.0  7626.0  2451.0  2214.0  7807.0  9032.0
POL  4865.0 33988.0 33837.0 35571.0 32371.0  5363.0  4392.0 31832.0  7623.0 35576.0
CZE  2216.0  2719.0  2034.0  4135.0  1955.0  2177.0  2176.0  1729.0  1429.0  2558.0  4144.0

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Number of bulls in reference population for        ofl
----------------------------------------------------------
CAN 41287.0
DEU 11305.0 47025.0
DFS  6799.0 40320.0 41252.0
ESP 41127.0 46970.0 41231.0128603.0
FRA  5538.0 36861.0 36368.0 38619.0 38623.0
GBR 34976.0 12326.0  7780.0 37265.0  6045.0 37431.0
ITA 35962.0 11268.0  6703.0 37308.0  5072.0 35392.0 37444.0
NLD  4109.0 35978.0 35563.0 37268.0 34055.0  4375.0  3467.0 37271.0
HUN  2231.0  8239.0  7820.0  8714.0  7625.0  2374.0  2214.0  7666.0  8764.0
POL  4865.0 33369.0 33255.0 34951.0 31752.0  5363.0  4392.0 31222.0  7622.0 34956.0
CZE  2216.0  2717.0  2032.0  4133.0  1953.0  2177.0  2176.0  1728.0  1429.0  2556.0  4142.0

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Number of bulls in reference population for        loc
----------------------------------------------------------
CAN 36397.0
DEU 11234.0 42864.0
DFS  6750.0 36501.0 37282.0
ESP 36242.0 42810.0 37261.0102719.0
FRA  5489.0 33085.0 32583.0 34720.0 34724.0
GBR 33607.0 12256.0  7733.0 35873.0  6004.0 36038.0
ITA 34315.0 11196.0  6656.0 35635.0  5030.0 34021.0 35768.0
NLD  4074.0 32307.0 31906.0 33493.0 30432.0  4345.0  3441.0 33496.0
CZE  2206.0  2683.0  2000.0  4008.0  1922.0  2169.0  2165.0  1696.0  4016.0
HUN  2225.0  6524.0  6161.0  6985.0  5973.0  2363.0  2208.0  5948.0  1400.0  7033.0
POL  4818.0 29516.0 29382.0 30849.0 27933.0  5320.0  4351.0 27513.0  2444.0  5903.0 30851.0

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Number of bulls in reference population for        bcs
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DEU 36443.0
FRA 27065.0 28553.0
GBR 12017.0  5851.0 34387.0
ITA 11024.0  4969.0 32190.0 34080.0
NLD 26047.0 24442.0  4375.0  3421.0 27680.0
CZE  2669.0  1914.0  2151.0  2151.0  1692.0  3883.0
CAN 11121.0  5394.0 31850.0 32768.0  4011.0  2196.0 36471.0
ESP 36388.0 28549.0 34222.0 33948.0 27677.0  3875.0 36312.0 98231.0
HUN  7278.0  6712.0  2439.0  2205.0  6837.0  1414.0  2225.0  8004.0  8052.0
POL 27903.0 26316.0  5206.0  4302.0 25847.0  2371.0  4721.0 29195.0  6702.0 29199.0
```