Illustration of the interest of Robust MACE

H. Benhajali, V. Palucci, S. Mattalia, H. Jorjani & V. Ducrocq
What is Robust MACE?

=MACE (Multiple Across Country Evaluation)

Country x Birth-Year effect instead of Country effect

Inspired from Ducrocq et al., 2003

Why?

- Despite the trend validation tests, some discrepancies caused by ΔG biases remain.
- Robust MACE can correct these discrepancies (Benhajali et al., 2013)
AIM OF STUDY

Test the robustness of the Robust Mace model by simulating a systematic $\Delta G$ bias for:

- One country
- Two countries (opposite directions)
DATA

- Data on Holstein breed from INTERBULL routine evaluation of:
  - December 2013:

- 14 countries:
  AUS CAN DEU DFS ESP FRA GBR IRL ITA JPN NLD NZL POL USA

- 1 trait: SCS

- Same within country sire variances and genetic correlations as in December 2013 routine evaluation.
METHODS

Bias

Bias = (0.5(BY\text{bull} - 1986) + 0.25(BY\text{sire} - 1986) + 0.25(BY\text{dam} - 1986)) \times \text{stdg} \times B

Different levels of bias: B = 0%, 2%, 4%, 10%, -2%, -4%, -10%

Example:

born in 1990

born in 1996

born in 2000

Bias = (0.5 \times 14 + 0.25 \times 4 + 0.25 \times 10) \times B \times \text{stdg} = 10.5 \times B \times \text{stdg}
Bias

Bias = \((0.5(BY_{\text{bull}} - 1986) + 0.25(BY_{\text{sire}} - 1986) + 0.25(BY_{\text{dam}} - 1986)) \times B \times \text{stdg}\)

Different levels of bias: \(B = 0\%, 2\%, 4\%, 10\%, -2\%, -4\%, -10\%\)

Systematic biases were simulated in only one country (FRA) or two countries (FRA and NLD):

1. FRA_+2
2. FRA_+4
3. FRA_+10

1. NLD_-2
2. NLD_-4
3. NLD_-10
METHODS

7 Data sets

1. Regular data for all the countries
2. Regular data for all the other countries + FRA_+2
3. Regular data for all the other countries + FRA_+4
4. Regular data for all the other countries + FRA_+10
5. Regular data for all the other countries + FRA_+2 + NLD_-2
6. Regular data for all the other countries + FRA_+4 + NLD_-4
7. Regular data for all the other countries + FRA_+10 + NLD_-10

14 runs

7 MACE
7 R_MACE
RESULTS

CASE N°1

☐ BIASES WERE CREATED FOR ONLY ONE COUNTRY: FRANCE
RESULTS

ΔG SCS: FRA BULLS

<table>
<thead>
<tr>
<th>Year</th>
<th>MACE</th>
<th>ROBUST MACE</th>
</tr>
</thead>
<tbody>
<tr>
<td>1986</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1991</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1996</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2001</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2006</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

- bias = 0% STD
- bias = 2% STD
- bias = 4% STD
- bias = 10% STD

FRA scale
Mendelian samplings estimates: FRA bulls
RESULTS

ΔG SCS: NLD BULLS

MACE

ROBUST MACE

NLD scale

bias = 0% STD
bias = 2% STD
bias = 4% STD
bias = 10% STD

www.idele.fr

Interbull meeting – May 20-21, 2014 – Berlin, Germany
RESULTS

Mendelian samplings estimates: NLD bulls

MACE

ROBUST MACE

bias= 0% STD
bias= 2% STD
bias= 4% STD
bias= 10% STD
RESULTS

CASE N°2

- BIASES WERE CREATED FOR TWO COUNTRIES:

FRANCE: +

NETHERLANDS: -
Results

Mendelian samplings estimates: FRA bulls
RESULTS

ΔG SCS: NLD BULLS

MACE

ROBUST MACE

Bias=0%

Bias=+2% FRA -2% NLD

Bias= +4% FRA -4% NLD

Bias=+10% FRA -10% NLD
RESULTS

Mendelian samplings estimates: NLD bulls

MACE

ROBUST MACE

Bias=0%
Bias=+2%FRA -2%NLD
Bias= +4%FRA-4%NLD
Bias=+10%FRA-10%NLD
**FULL SIBS**

- All bulls with Birth Year >1996
- Deviations from NLD

**RESULTS**

<table>
<thead>
<tr>
<th></th>
<th>MACE</th>
<th>RMACE</th>
</tr>
</thead>
<tbody>
<tr>
<td>0%</td>
<td>0.12</td>
<td>0.05</td>
</tr>
<tr>
<td>2% FRA</td>
<td>0.22</td>
<td>0.32</td>
</tr>
<tr>
<td>4% FRA</td>
<td>0.53</td>
<td>0.57</td>
</tr>
<tr>
<td>10% FRA</td>
<td>0.062</td>
<td>0.021</td>
</tr>
<tr>
<td>2% FRA &amp; -2%NLD</td>
<td>0.11</td>
<td>0.025</td>
</tr>
<tr>
<td>4% FRA &amp; -4%NLD</td>
<td></td>
<td></td>
</tr>
<tr>
<td>10% FRA &amp; -10% NLD</td>
<td></td>
<td>0.04</td>
</tr>
</tbody>
</table>
CONCLUSION

ROBUST MACE

- Easy to implement, does not need any new data
- Ability to detect (using fixed country-year solutions) and correct for the discrepancies on national genetic trends
- With more consistent $\Delta G$, it is expected to improve genetic correlations between countries (to be verified)
- Trend validation tests are still important
Thanks to