

Interbull Centre Activity Report



June 2019 – May 2020

INTERBULL CENTRE

ACTIVITY REPORT JUNE 2019 - MAY 2020¹

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The Interbull Centre is the operational unit of the ICAR permanent sub-committee Interbull.



The Interbull Centre holds the status of European Union Reference Centre (EURC) for Bovine Breeding.



The Interbull Centre is ISO 9001:2015 certified.



¹ As presented on the Interbull website in July 2020 (www.interbull.org/ib/itbcreports)

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inter  **genomics**

GEN  **EX**
International Genotype Exchange Platform



INTRODUCTION

The Interbull Centre is a section of the Department of Animal Breeding and Genetics (HGEN) of the Swedish University of Agricultural Sciences (SLU). The Interbull Centre is the operational unit for Interbull and Interbeef, a permanent subcommittee and a working group of the International Committee for Animal Recording (ICAR), respectively, and operates as the European Union Reference Centre for Zootechnics (Bovine Breeding).

This Report describes the activities at the Interbull Centre between 1 June 2019 and 31 May 2020.

Many thanks to all organisations and individuals contributing to the Interbull, Interbeef, GenoEx and EU Reference Centre successes, but especially to the Interbull Centre Team.

Toine Roozen,

Interbull Centre Director

1. PEOPLE

1.1. Interbull Centre Personnel

Interbull Centre staff are employed by the Department of Animal Breeding and Genetics (HGEN) of the Swedish University of Agricultural Sciences (SLU). There were no changes in the staff membership during the current reporting period. The team therefore still consists of the following members of staff:

- Toine Roozen (MSc, MBA) - Director

Genetic Data Analyst (*Genetics*):

- Haifa Benhajali (PhD) - R&D Coordinator; Service Owner GMACE
- Valentina Palucci (MSc) - Quality Manager; Service Owner MACE
- Joanna Sendeka (PhD) - Service Owner SNP services
- Simone Savoia (PhD) - Service Owner InterGenomics
- Alexis Michenet (PhD) - Service Owner Interbeef

Genetic Data Analyst (*IT*):

- Marcus Pedersén - Systems Administrator, IT Coordinator
- Carl Wasserman - Systems Developer
- Hans Persson - Programmer
- Jan-Erik Strömqvist - Programmer

In addition, the following SLU members of staff have part-time responsibilities at Interbull Centre:

- Louise Simann (BA) - Administrator
- Cano Merkan - IT Coordinator / Systems Analyst



Interbull Centre Team

1.2. Committee, Working Group and Task Force membership

Interbull Centre personnel is member of various Committees, Task Forces and Working groups. Details of these groups are included in Appendix 1.

1.3. Training, Courses, Meetings and Conferences

Staff was involved with the following courses, meetings and conferences. Due to the Covid-19 Pandemic most of the meetings that were scheduled during 2020 were attended via video conference.

Table 1.1: Provision of training during June 2019 – May 2020

Courses provided:	Location	Dates	Person
Seminar in International breeding evaluation during course in Cattle production	Uppsala, Sweden	12 November 2019	Valentina Palucci

Table 1.2: Attendance of events during June 2019 - May 2020

Event	Location	Dates 2019	Attendee
ICAR Annual Meeting (inc Interbeef WG and DNA WG)	Prague, Czech Republic	17-21 June 2019	Toine Roozen, Haifa Benhajali, Joanna Sendeck, Simone Savoia, Alexis Michenet
Interbull Annual Meeting	Cincinnati, USA	20-25 June 2019	Toine Roozen, Haifa Benhajali, Simone Savoia, Alexis Michenet, Valentina Palucci
Postgres London	London, UK	2-3 July, 2019	Carl Wasserman
EuroPython	Basel, Switzerland	10-12 July, 2019	Carl Wasserman
EAAP	Ghent	26-30 August 2019	Alexis Michenet
Course: Genomic analyses with emphasis on single-step (Misztal, Lourenco, Andonov)	Uppsala, Sweden	2-5 September 2019	Simone Savoia, Alexis Michenet
Eurogenetics meeting	Amsterdam, The Netherlands	24-25 October	Haifa Benhajali
Interbeef Meetings	Switzerland	4-6 November 2019	Haifa Benhajali, Simone Savoia, Alexis Michenet, Toine Roozen ⁺
AI Innovation Day, Nordics	Stockholm, Sweden	7 November 2019	Marcus Pedersén
Big Data Conference	Vilnius, Lithuania	26-28 November 2019	Haifa Benhajali
ISO External Audit	Uppsala	2 December 2019	Valentina Palucci, Toine Roozen, Joanna Sendeck
EU Reference Centre Directors Meeting	Brussels, Belgium	12 December 2019	Toine Roozen
“VikingGenetics @ SLU”	Uppsala	20 January 2020	Haifa Benhajali, Toine Roozen ^x
Scandinavian Quality Conference	Göteborg	20 January 2020	Valentina Palucci
Interbull Strategic Planning Workshop	Uppsala	23-24 January 2020	Toine Roozen, Valentina Palucci, Haifa Benhajali, Joanna Sendeck ^x , Alexis Michenet ^x , Simone Savoia ^x
Nordic Genomics Workshop	Video Conference	28 April 2020	Valentina Palucci, Haifa Benhajali, Joanna Sendeck, Alexis Michenet, Simone Savoia
Illumina Genome Workshop	Video Conference	12 May 2020	Alexis Michenet
ISO Internal surveillance Audit	Uppsala	20 and 27 May 2020	Valentina Palucci, Marcus Pedersén, Joanna Sendeck, Toine Roozen

+ : by video conference

X : part attendance

Table 1.3: Interbull Committee Meetings; June 2019 – May 2020

Event	Location	Dates	Attendee
Steering Committee	Cincinnati, Ohio	21 & 25 June 2019	Toine Roozen, Valentina Palucci
Steering Committee	Uppsala	24 January 2020	Toine Roozen, Valentina Palucci
Steering Committee	Conference calls	25 September 2019 20 November 2019 19 December 2019 12 February 2020 25 March 2020 7 May 2020	Toine Roozen, Valentina Palucci Haifa Benhajali: 20 Nov 2019 only
Technical Committee	Cincinnati, Ohio	21 & 23 June 2019	Haifa Benhajali, Valentina Palucci, Simone Savoia, Alexis Michenet, Toine Roozen*
Technical Committee	Conference calls	22 April 2020	Haifa Benhajali, Valentina Palucci, Simone Savoia, Alexis Michenet, Toine Roozen

Table 1.4: Working Group and Task Force Meetings by Conference call; June 2019 – May 2020

Group	Dates	Attendee
Genomic free EBV WG conference call	5 September 2019 1 November 2019	Haifa Benhajali
SNPMace WG	17 June 2019 23 September 2019 18 Nov 2019	Haifa Benhajali, Toine Roozen (Simone Savoia, Alexis Michenet attended the meeting on 17 June 2019)
Validation WG	25 February 2020	Valentina Palucci
ICAR DNA WG	21 October 2019 30 January 2020 29 April 2020	Joanna Sendeck
ICAR ID SC	26 September 2019 19 February 2020	Valentina Palucci
Interbeef operational WG	18 September 2019	Toine Roozen, Haifa Benhajali, Simone Savoia, Alexis Michenet
	13 February 2020	Alexis Michenet, Simone Savoia, Toine Roozen
Beef Phd Advisory Committee Meeting	24 September 2019	Alexis Michenet, Toine Roozen
	17 March 2020	Alexis Michenet, Toine Roozen
Interbeef Variance Component Estimation WG	17 February 2020	Alexis Michenet, Simone Savoia
EU Reference Centre WG	12 March 2020 24 April 2020 27 May 2020	Joanna Sendeck, Valentina Palucci, Toine Roozen
IgHOL WG	17 April 2020	Toine Roozen, Simone Savoia
	27 April 2020	Simone Savoia
	19 May 2020	Simone Savoia, Toine Roozen
Business Funding Models Task Force	23 October 2019 13 November 2019 21 November 2019 5 December 2019 29 April 2020	Toine Roozen
InterGenomics Management Group	24 April 2020	Toine Roozen, Haifa Benhajali
Post processing of MACE correlations WG	5 March 2020 8 May 2020	Valentina Palucci

1.4. Consultants and Suppliers

Through consultancy agreements with Lactanet Canada, the Irish Cattle Breeding Federation (ICBF) and the Czech Beef Breeders Association (CMBC), collaborations are in place with:

- **Dr Pete Sullivan** (Lactanet, Canada): works as a part time consultant (25%). In the current reporting period Pete's activities were mainly related to provide technical assistance for the GMACE methodology by fixing issues discovered with genomic reliabilities.
- **Dr Thierry Pabiou** (ICBF, Ireland): supplies international genetic parameters for Adjusted Weaning Weight (AWW) for Interbeef evaluations to the Interbull Centre.
- **Zdenka Vezela** (Czech Republic): supplies international genetic parameters for calving traits (birth weight, calving ease) for Interbeef evaluations to the Interbull Centre.

1.5. Visitors

We like to thank all our visitors for taking the time to visit us in Uppsala, which all contribute to productive collaboration.

- **Lena Gibson**, an auditor within Bureau Veritas Certification Sverige AB, visited the Interbull Centre on 2 December 2019 to carry out an ISO 9001 audit. The surveillance audit went successfully with total absence of non-conformities found and a praise from Lena about the strength and maturity of our Quality Management System considering the relative few years since it has been implemented.
- Four Swedish Highschool IT students, **Ludvig Vesterlund, Johannes Molin, Simon Folkesson and Anders Wengelin-Lind** worked with Marcus Pedersén for 3 days per week from 12 September 2019 until 7 February 2020. During this period, they had the opportunity to work with various system administration tasks and getting familiar with GNU/Linux operating systems.
- **Mohammed Abdallah Ahmed Sallam** is an 'Animal Science' MSc student at SLU. He started at the Interbull Centre in April 2019 his MSc project on comparing multi-trait to single-trait International genomic evaluations with the focus on InterGenomics (BSW and HOL, see §7.10). Mohammad was working under the supervision of Haifa Benhajali from Interbull Centre and Erling Strandberg from SLU. His project was completed in May 2020, and was one of only three projects that were selected to be presented with an oral presentation during the SLU Thesis Day live stream on 27 May 2020.
- **Dorian Garrick** (Massey University, New Zealand) visited the Interbull Centre on 19 and 20 November 2019 to get better acquainted with our services and team, with an emphasis on validations of evaluations (both beef and dairy) and New Zealand evaluations.
- On 22 January 2020 a meeting was held at the Interbull Centre between SLU's department of the Animal Breeding and Genetics (Prof. Lotta Rydhmer and Caroline Jansson), Interbull (**Matthew Shaffer** and Toine Roozen) and ICAR (**Jay Mattison** and **Martin Burke**).
- The Interbull Centre hosted the Interbull Strategic Planning Meeting (23 and 24 January 2020), and the Interbull Steering Committee meeting (24 January 2020).
- **Renzo Bonifazi** visited the Interbull Centre from 2-6 March 2020 to get advice from Simone and Alexis on performing imputation using InterGenomics workflow adapted for Limousin for his PhD project at Wageningen University.

2. GOVERNANCE

2.1. Interbull Terms of Reference and Rules of Procedures

The “*Terms of Reference for INTERBULL Sub-Committee*”, and the “*Rules of Procedures for INTERBULL Committees*” are available on: <http://interbull.org/ib/termsreference>.

2.2. Chair and Vice-Chair of the Interbull Steering Committee

Following a 20-year membership of the Interbull SC, of which 13 years as Chair, Reinhard Reents chaired his last Interbull Business Meeting on 22 June 2019. In line with last year’s announcement, he was succeeded by Matthew Shaffer (CEO of DataGene, Australia), becoming the 6th Chair of the Interbull Steering Committee. During the SC meeting of 21 June 2019, the Interbull SC elected Brian Van Doormaal (Chief Services Officer of Lactanet, Canada) as Vice-chair.



Left to right: Brian Van Doormaal (SC Vice-chair), Matthew Shaffer (SC Chair), Reinhard Reents (former SC Chair), Toine Roozen (Interbull Centre Director), Jay Mattison (ICAR President)

2.3. Steering Committee Membership

During the Interbull Business Meeting of 22 June 2019, the following three candidates were proposed as Interbull Steering committee members, and subsequently endorsed by the ICAR board:

- Gert Pedersen Aamand (Denmark; sitting SC member, representing the “Nordic Countries”; Norway, Denmark, Finland and Sweden); Gert is also continuing as the Chair of the Interbull Technical Committee;
- Urs Schnyder (Switzerland, new SC Member, representing the “German speaking countries”; Germany, Austria, Switzerland and Luxemburg);
- Gerben de Jong (The Netherlands, new SC Member, representing The Netherlands, UK and Ireland).

Marco Winters (Interbull member since 2015; 1 term) and Reinhard Reents (since 1999; 5 terms) did not renew their terms in the SC.

2.4. Codes of Practice

Together with the relevant communities, Interbull Centre staff have developed and maintained ‘Codes of Practice’ which guide the Interbull Centre and its Service Users in an efficient implementation and delivery of services.

Interbull Code of Practice

The Interbull Code of Practice (www.interbull.org/ib/codeofpractice) has been updated, on the basis of decisions by the Steering Committee, notably:

- **Chapter 5, Method of International evaluation:** clarified rules for inclusion of bulls with second country evaluation (type of genetic merit equal of 21).
- **Chapter 7: Data exchange and time of evaluation:** Updated rules for participation to a GMACE test evaluation.

Interbeef Code of Practice

Following a detailed review, the [Interbeef Code of Practice](#) was formally adopted during the Interbeef meeting in Switzerland. The Interbeef Code of Practice is also available through the ICAR website.

GenoEx-PSE Code of Practice

Updates to the GenoEx-PSE Code of Practice are being prepared. Until these are ratified and implemented, the original GenoEx-PSE Code of Practice (https://interbull.org/ib/pse_cop) will remain in place.

2.5. EU Reference Centre

As the European Union reference centre (EURC Zootechnics - Bovine Breeding), the Interbull Centre is responsible for the scientific and technical contribution to the harmonisation and improvement of the methods of performance testing and genetic evaluation of purebred breeding animals of the bovine species.

The GE and GENO forms provide a strong basis for developing and expanding this function. During the reporting period, the GE/GENO Forms have been updated with new information with 22 GE forms and 6 GENO forms from EU Member States.

Plans to create an improved system are under development in consultation with the EURC Working Group. The aim is for the information gathered in the database to be, as much as possible, standardised and grouped within pre-defined terms. Once completed, breed societies and third parties designated by breed societies (NGEC's) will, instead of giving descriptive answers to given questions, choose between standard options. Although this is a time intensive activity, it is expected to be most valuable in an effort to better compare and ultimately harmonise performance testing and genetic evaluation methodologies. The type of information to be collected includes:

- general information (country, breed etc)
- trait definition used (specifications, or e.g. ICAR standards)
- time periods for data collection and analysis
- processing and statistical procedures (levels for details)

In addition, the Interbull Centre has continued with its other activities related to its function as EURC, including the provision of genetic and genomic validation tests to National Genetic Evaluation Centres.

2.6. Interbull 2020-2023 Strategic Plan

A new, draft strategic plan has been developed during the reporting period and we are seeking feedback on this draft from our stakeholders during 2020. The **Draft Interbull 2020-2023 Strategic Plan** (available on www.interbull.org/ib/itbcreports) outlines the changes Interbull envisages during the next three to five years and has four key functions:

- a) Establishes Interbull's direction for the next three to five-year period
- b) Sets out goals and objectives in line with the vision and mission statements
- c) Seeks to consolidate the gains made under the previous Strategic Plans
- d) Identifies the areas for investment to strengthen capability and services.

Consultation and input into the strategic planning process included a review of previous Strategic Plans (2013-15 and 2016-18), an Online Survey of Interbull Stakeholders and a Strategic Planning Meeting (23-24 January 2020 in Uppsala). The review of the previous strategy and collation of new ideas contributed to identification of six goals within the Interbull 2020-2023 Strategic Plan. The six goals were considered equally important at the Strategic Planning Meeting.

GOALS



Meeting future data service needs



Defining a new traits pipeline



Providing international evaluations in the genomic era



Continuously improve core services



Strengthening governance



Driving branding and marketing

2.7. Business Funding Models

The Interbull Steering Committee appointed a Business Funding Models Task Force to review the current fee structure being applied to services offered by the Interbull Centre with the goal of assessing options and making recommendations for the future. As one of the first activities the Task Force assessed funding models to recognize the contribution made to the global system from countries with extensive data collection and/or a longer history of data recording at the national level. Such funding models may become realistic with the introduction of novel traits, such as an international evaluation of Clinical Mastitis as a tool for SNP training for countries with a national genomic evaluation for such trait in place.

3. SERVICES & OPERATIONS – Interbull Centre

Since the start of international evaluations in 1995, the service portfolio and output at the Interbull Centre has increased significantly; both through expansion of the international genetic evaluations to include new populations and new traits, and through the addition of new services.

During the current period Truncated MACE, and the exchange of information for genetic traits for the Holstein breed were put into service for dairy. In addition, “Country pilot evaluations” were performed for the first time for countries interested in joining Interbeef.

3.1. Global Reach

The Interbull Centre provides international genetic evaluation services for dairy and beef cattle in 35 countries from 5 continents; Europe: 26 countries; America’s: 4; Oceania and Asia 2 each; Africa: 1. The national genetic evaluation centres from Slovenia and Latvia joined the Interbeef services during the current reporting period. Both evaluations centres are also involved in Interbull (dairy) evaluations.

Figure 3.1: Interbull’s Global Reach (May 2020)



Dairy Evaluations:

Asia: Japan; South Korea.

Africa: South Africa.

America’s: Canada; Mexico; Uruguay, USA

Europe: Austria; Belgium; Croatia; Czech Republic; Denmark; Estonia; Finland; France; Germany; Hungary; Ireland; Israel; Italy; Latvia; Lithuania; Luxemburg; The Netherlands; Norway; Poland; Portugal; Slovak Republic; Slovenia; Spain; Sweden; Switzerland; United Kingdom.

Oceania: Australia; New Zealand.

Beef Evaluations:

Africa: South Africa

Europe: Czech Republic, Denmark, Finland, France, Germany, Ireland, Latvia, Slovenia, Sweden, Switzerland, United Kingdom

Oceania: Australia

GenoEx-PSE:

Europe: Germany, Italy, Slovenia, Ireland, Denmark, Norway, Poland

Asia: Japan

3.2. Quality Management

Interbull Centre is currently in the middle of its first re-certification period. The next surveillance audit will be scheduled during the autumn of 2020. All external audits to date have been concluded with total absence of non-conformities found. We are keen to keep these excellent results also for the next audits by periodical review of our procedures and by keeping high focus towards our customers' satisfaction. During the internal audits in May 2020, Management, IT and ICAR services were reviewed. No additional services have been included in our Quality Management System since last year's inclusion of GenoEx-PSE and ICAR's DNA Data Interpretations Accreditation. Instead we have focused on increasing the knowledge of the new members of the staff towards the services provided. This was a very fruitful process, resulting in new process owners for both Interbeef (Alexis Michenet) and InterGenomics (Simone Savoia).



4. SERVICE and OPERATIONS – International Dairy Breed Evaluations (Interbull)

4.1. Validation of National EBVs and GEBVs

Validation of national EBVs and GEBVs remains one of the top priorities towards reliable National/International genetic/genomic evaluations. The work of the Interbull Working Group on defining new validation procedures in the genomic area continues with the aim to provide new validation approaches for countries with national genomic evaluations in place. Such new methodologies will expand the portfolio of validation methods offered by Interbull currently consisting of five (5) different validation methods: four methods aimed at assessing the quality of conventional national evaluations, namely Method I, II, III and Mendelian Sampling Variance test and one assessing the quality of genomic national evaluations, GEBV test.

4.2. Truncated MACE (“TMACE”)

National genomic evaluations are increasingly dependent on Interbull MACE results due to the inclusion of foreign genotypes without national phenotypic information in the reference population. The only source of phenotypic information available for such animals are de-regressed MACE EBVs on the scale of interest. The latest MACE EBVs are used for regular estimation of SNP effects, but obtaining appropriate MACE de-regressed values for validation purposes is not a straightforward task.

In order to assist countries with improving the national genomic prediction and validation, Interbull introduced Truncated MACE as an additional service. Truncated MACE is performed annually in October. During the first Truncated MACE run in October 2019 the following populations participated: Japan (Holstein), Slovenia (Holstein, Brown Swiss and Simmental), and Switzerland (Holstein, Brown Swiss and Simmental).

4.3. MACE Evaluations

Interbull Centre test evaluation runs were performed in September-October 2019 and January-February 2020. Many changes in national and international evaluations have been introduced during this period, and are all described in the service reports published on the Interbull Centre website at http://www.interbull.org/ib/maceev_archive after each subsequent routine evaluation. Tables 4.1 and 4.2 show statistics on Interbull MACE evaluations.

Table 4.1: Size of the Interbull Centre operations for MACE

Multiple Across Country Evaluation (MACE)	Dec 2017	Dec 2018	Dec 2019
Countries	33	33	33
Evaluation breeds	6	6	6
Country-breed-trait combinations	1 901	1 937	1 930
Breed-trait evaluations	181	181	181
Animals in the pedigree database	29 450 570	34 643 754	36 094 659
Submitted national estimated breeding values	12 636 264	13 048 518	13 420 740
Qualified national estimated breeding values	6 880 265	7 171 732	7 332 267
Calculated international estimated breeding values	286 862 389	300 525 105	305 068 667
Distributed international estimated breeding values	107 380 799	111 976 925	112 896 290
Multiple Across Country Evaluation (MACE)	Sep 2017	Sep 2018	Sept 2019
Estimated across country genetic correlations	12 926	12 926	13 085
Validation tests (subject to natural fluctuations)	160	99	233

Table 4.2: Degree of Participation to MACE evaluations

	Prod (3)	Conf (up to 33)	Udder (2)	Long (1)	Calv (4)	Fert (5)	Work (2)	Tot (50)	2004r vs. 1904r
BSW	11	9	10	10	6	9	7	62	0
GUE	5	4	5	5	-	5	-	24	0
HOL	30	23	29	20	17	20	12	151	+1*
JER	12	10	9	9	-	9	6	55	0
RDC	15	10	14	12	7	11	7	76	0
SIM	12	-	12	5	-	-	-	29	-2*
Tot	85	56	79	61	30	54	32	397	
Change	-1	0	0	-1	0	0	+1		-1

* Routine international genetic evaluations for Brown Swiss, Guernsey, Holstein, Jersey, Red Dairy Cattle and Simmental were computed as scheduled in December 2019 and April 2020. The following changes in participation were observed:

- Production traits: SVK SIM is now participating in a joined evaluation with DEA and CZE
- Longevity: CZE SIM is no longer participating in this evaluation.
- Workability traits: JPN joined the evaluation for the first time with HOL data in April 2020.

4.4. International Genomic Evaluation of Young Bulls (GMACE)

International genomic evaluation of young bulls (GMACE) is to date conducted for the Holstein breed only, with 13 countries submitting national genomic breeding value estimates (GEBV) for up to 38 traits. Statistics on GMACE evaluations are presented in table 4.3.

GMACE test runs were performed as scheduled in September-October 2019 and January-February 2020. GMACE Routine Runs were performed in August and December 2019 and April 2020.

Table 4.3 - Size of the Interbull Centre operations for GMACE

Genomic Multiple Across Country Evaluation (GMACE)	Dec 2017	Dec 2018	Dec 2019
Countries	33	33	33
Evaluation breeds	1	1	1
Country-breed-trait combinations	368	374	376
Breed-trait evaluations	38	38	38
Animals in the pedigree database	29 450 570	34 643 754	36 094 659
Submitted national estimated breeding values	23 186 480	26 811 378	29 266 198
Qualified national estimated breeding values	16 888 048	19 234 402	19 527 768
Calculated international estimated breeding values	160 730 713	182 673 348	175 338 148
Distributed international estimated breeding values	488 685	458 789	427 365

4.5. Interbull genomic evaluation of the BSW populations (InterGenomics)

Interbull Centre conducts genomic evaluation of the BSW population on behalf of the countries with Brown Swiss dairy cattle (“InterGenomics”). Statistics on InterGenomics evaluations are presented in table 4.4. The process has been further streamlined by implementing a faster parallelization for two computationally time-consuming steps resulting in an overall improvement both in matter of time needed to run the operation as well as of better use of our infrastructure. The work on streamlining the process continued resulting in a better handling and checking of incoming data, introduction of a dedicated repository making easier and more accurate traceability of changes made to the programs.

**Table 4.4: Size of the Interbull Centre operations for InterGenomics**

InterGenomics (Genomic evaluation of BSW populations)	Dec 2017	Dec 2018	Dec 2019
Countries	8	8	8
Country-trait combinations	280	280	280
Unique submitted genotypes	32 344	37 913	44 625
Genotypes entering imputation & genomic evaluation	28 329	32 557	36 791
Distributed international genomic estimated breeding values	7 932 400	8 579 480	10 301 760

5. SERVICES and OPERATIONS – International Beef Evaluations (Interbeef)

Interbeef Routine evaluations are performed two times per year, in January and October. During the current reporting period, a **Test Run** was conducted in April 2020 during which 2 new countries participated:



- Slovenia (SVN): adjusted weaning weight (aww) and calving (birth weight + calving ease) for CHA and LIM
- Latvia (LVA): aww for CHA and LIM

The Technical Committee of the Interbeef ICAR Working Group first met in Uppsala in December 2012. Eric Venot (INRAE, France) has been the Chair of the Interbeef Technical Committee since then. Following a recent change of team at INRAE, Eric is no longer involved in Animal Genetics, and Romain Saintilan (GenEval, France) has taken over as Chair of the Interbeef Technical Committee.

In 2019, a new Interbeef service was introduced: the country pilot run. It gives the possibility to any country not yet member of Interbeef to try the service. A clone of IDEA database is dedicated to the run and the country can test all the functionalities of the service (international pedigree, data checking, international EBV), without being official.

Slovenia was the first country to test in October 2019 (aww for LIM and CHA), followed by Italy in April 2020 (aww for LIM).

The introduction of multiple countries in test runs and country pilot run was facilitated by use of the **performance database** (IDEA) in conjunction with improvement and automations in the workflow. In particular, the new process of uploading xml files allows uploading very big datasets (which are split in several files for the upload).

The distribution of Interbeef evaluations across breeds, traits and countries is reported in table 5.1.

Table 5.1: Distribution of evaluation across breeds, traits and countries

	AAN		HER		SIM			CHA			LIM			TOTAL
	aww	aww	aww	Bwt	Cae	aww	Bwt	cae	aww	bwt	cae			
AUS						✓			✓				2	
CZE	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓		11	
DEU	✓	✓	✓			✓			✓				5	
DFS	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓		11	
FRA						✓	✓	✓	✓	✓	✓		6	
IRL	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓		11	
ZAF						✓	✓						2	
CHE	✓	✓	✓			✓			✓				5	
GBR									✓	✓	✓		3	
SVN*						✓	✓	✓	✓	✓	✓		6	
LVA*						✓			✓				2	
TOTAL	5	5	5	3	3	10	6	5	10	6	6		65	

*country involved in April 2020 test run

Interbeef breeding values are estimated using MiX99 Software. Reliabilities are calculated using the MTEDC5 package. Variance components for adjusted weaning weight are estimated by ICBF using the DMU package, variance components for calving traits are estimated by CMBC using the BLUPF90 package.

Statistics on the Interbeef evaluations of the beef breeds Charolais, Limousin, Simmental, Hereford and Aberdeen Angus are presented in table 5.2.

Table 5.2: Size of the Interbull Centre operations for Interbeef

Interbeef	Jan 2018	Jan 2019	Jan 2020
Countries	7	9	9
Evaluation breeds	3	5	5
Country-breed-trait combinations	22	55	57
Animals in the pedigree database	29 965 798	35 109 302	36 502 945
Submitted phenotype records	8 234 838	40 734 117	42 548 308
International estimated breeding values*	63 215 818	257 156 657	266 458 024
Publishable international estimated breeding values *	1 407 786	6 805 936	7 429 550

* Direct + maternal EBVs are counted as one.

6. OTHER, NEW and IMPROVED SERVICES – Interbull Centre

6.1. GEBV test

Following a recommendation by the ITC, the GEBV test software was changed to set an upper limit for $b1(\text{slope})$ to 1.2 when applying the criterion $b1 \geq E(b1)$. The new version of the GEBV test software was provided to the countries in May 2019, and has during the current reporting period been used by 10 countries.

6.2. GenoEx-PSE

GenoEx-PSE (Parentage SNP Exchange) is the first service on Interbull Centre's International Genotype Exchange Platform. The main purpose of GenoEx-PSE is to provide a service for exchanging



standardised sets of SNPs for genotyped animals **to facilitate and streamline parentage analysis activities** carried out by organisations that are responsible and/or active in parentage integrity. One of the key benefits of joining GenoEx-PSE is that AI bull owners will have more accurate identity of daughters in countries importing semen. GenoEx-PSE is also expected to assist with the transition from the use of microsatellites to the use of SNP for parentage verification.

GenoEx-PSE is available for any cattle breed; both beef and dairy. By 31 May 2020, 61699 genotypes of 32 breeds have been uploaded by nine organisations from Germany, Italy, Slovenia, Ireland, Denmark, Norway, Poland and Japan.

Further details, including User Manual, Code of Practice and Service User Agreement are available on the GenoEx Website <https://GenoEx.org>.

6.3. Exchange of information on Genetic Traits

Exchange of genetic traits via the IDEA AnimInfo module continues. Information on genetic traits so far shared are based on the WHFF official list (www.whff.info/documentation/genetictraits.php#go1) and therefore at the moment limited for the Holstein breed, but AnimInfo has been set up in such a way that the service can be expanded to other breeds.

Countries that have signed up to this service are: Australia, The Netherlands, Germany, Belgium, Switzerland, Canada and United Kingdom. The shared data includes information on the following traits: Cholesterol Deficiency (66613 records); Polled (14053); Brachyspina (23455); Bovine Leukocyte Adhesion Deficiency (BLAD, 111357); Mule Foot (1564); Deficiency of Uridine Monophosphate Synthase (DUMPS, 22015); Complex Vertebral Malformation (CVM, 49579); Citrullinemia (1496); blood clotting disorder "Factor X1" (3).

As stated in the Interbull Code of Practice, Appendix X, handling of possible conflicting information is the responsibility of the national Genetic Evaluation Centres (NGECs) and, when applicable, of the third party providing such information. During the period covered by this report, participating NGECs have actively collaborated in order to resolve as many conflicting information as possible.

6.4. Improvements in Animal Identification

Correct identification of animals is critical to get the best national and international genetic evaluations. In the past years, an incorrect, and inconsistent use of country code 'USA' and '840' for animals born in the USA have created several animal ID duplicate cases, leading to suboptimal genetic evaluations. The introduction of the breed code 'BSM' for Simmental Beef inadvertently affected the genetic evaluation of both dairy and beef Simmental cattle in several countries.

In a continual effort to improve the service offered to its users, the following improvements in Animal Identification have been implemented by the Interbull Centre and the national genetic evaluation centres.

Country code for USA

From the December 2019 Routine Run onwards:

- The country code 'USA' has only been accepted for USA-born animals with a numerical part of International ID <3 billion.
- Country code '840' has been accepted only for USA-born animals with a numerical part of International ID >3 billion.

Breed code for Simmental

From the April 2020 Interbeef test evaluation onwards:

- The breed code 'BSM' has been banned from both IDEA pedigree and performance modules. Both beef and dairy Simmental cattle will be identified using breed code 'SIM'.
- For exchange of pedigree data with Interbull Centre via IDEA, each country has nominated one organisation as the authoritative organisation having the role to assure correctness of pedigree records.

Although some BSM animals are still present in the IDEA pedigree module, all pedigree related to SIM animals with performance data has been successfully changed into the corresponding SIM information. All new performance records received for the April 2020 Interbeef test evaluation have been successfully provided with the intended SIM breed code.

6.5. Support Services to ICAR

In addition to the genetic and genomic evaluations for dairy and beef, the Interbull Centre provides technical support to ICAR.

ICAR Accreditation of DNA Data Interpretation Centres

Since early 2018, when ICAR announced and officially released the Accreditation service for DNA Data Interpretation Centres it developed in the regular service. The accreditation is currently restricted to **Parentage Verification by SNP**, for which the Interbull Centre handles the technical component by distributing the test files, and checking the results. The test files are created by a programme, 'Cuckoo', that has been developed by CDN (now Lactanet), Canada.

As of 31 May 2020, twenty organisations have completed the test and are now recognised as **ICAR Accredited DNA Data Interpretation Centres** (see <http://tiny.cc/ICARDNAlist> for the full list). Five organisations were re-accredited, after the original, two-year term of their accreditation came to an end. Visit the ICAR website for further info: http://tiny.cc/ICARDNA_ACCR.



ICAR Certificate of Quality

The Interbull Centre supports ICAR with the provision of the ICAR Certificate of Quality. The Interbull Centre provides information on organisations that include genetics in their Certificate of Quality. This information relates to:

1. The organisations' participation in international evaluations (Conventional/Genomic/Dairy/Beef);
2. Whether validation tests were passed in recent years;
3. Genetic Correlations between the organisation in question and other countries;
4. GE, GENO and Beef Forms.

In the current reporting period, such reports were supplied for:

- France Génétique Elevage, France; 2019-06-05
- SEGES, Denmark; 2019-11-25

7. RESEARCH & DEVELOPMENT – Dairy

The following is a brief summary of research and development activities conducted at the Interbull Centre or with the involvement of the Interbull Centre staff since February 2018.

7.1. The “SNPMace” Working Group; International SNP Evaluations

SNPMACE Phase 1

The SNPMace Project officially started 7 May 2018 and ended November 2019. The aim from this project was to assess the feasibility of an international genomic evaluation without exchange of raw data. The study was conducted using BWS data from InterGenomics and breeding values estimated using the SNPMACE methodology were compared to those obtained from a multi-trait international genomic evaluation based on genotypes. Final results showed that combining the SNP solutions from several BSW populations gave the same result as combining the raw data. It means that the data on the training population of a country is analysed within country and then the SNP solutions combined across countries to give more accurate SNP solutions and hence more accurate genomic EBVs (Jightly et al., 2019).

Following a review of these results at the end of 2019, the Interbull SC decided to build on the positive results of this first phase of the SNPMace project and develop a service to calculate international SNP solutions using data from multiple countries. Therefore, a second agreement has been signed with Mike Goddard, Agriculture Victoria, Melbourne: SNPMace Phase 1a started 1 March 2020 and is planned to be completed by May 2021.

SNPMACE phase 1a

The aim from this extension of the project is mainly to fine-tune both the model and the software by addressing all the issues that were raised but not planned in phase 1 and cover the gap between the research analysis and the service implementation by testing the software in a service-like context. Interbull Centre together with Melbourne have already started investigating issues around including the mean in the SNPMACE model and adding a polygenic effect to the countries single-trait evaluations. Communications with the BSW community has also started to explore possibilities around a first set of service-like testing of the Software by BSW countries. This first set if successful will be followed by a wider data call to carry on a pilot run and a validation study as a final step before moving to a service.

7.2. The Genomic Pre-selection (“GPS”) and Future MACE Working Group

The Genomic Pre-selection simulation method developed by the WG as well as the potential impact of the bias on MACE (Benhajali et al., 2019) and the different possible approaches to increase MACE robustness to the GPS bias were presented (Sullivan et al., 2019) to both the ITC and the Interbull community in Cincinnati. Results showed that the current MACE system does only to a minor degree accommodate the GPS bias thus the need for changing the current model. After reviewing the different possible scenarios, the group decided to focus on the approach of introducing genetic groups in MACE to account for GPS effect. The group is currently working on remodelling MACE in order to implement the new genetic groups and investigating the possibility of adapting MIX99 software to the new model.

7.3. The Genomic Reliabilities (“GREL”) Working Group

Following the Interbull Technical Workshop in Dubrovnik where a special session was dedicated to present feedback from countries who had tested the Interbull standard method to calculate genomic reliabilities, it was decided to adjust the current formulas used to calculate the DGV reliabilities. One single formula is now used for all reference animals and it takes into consideration the data contribution for both bulls and cows. No change was suggested for candidates. This new formula was tested by Zengting Liu and approved by the WG. However, the effect of the change of cow reliabilities calculation on candidates still needs to be investigated.

7.4. The Genomic-free EBV Working Group

Many country members of Interbull have implemented or are working toward implementing a single step procedure in their routine evaluations. One issue that these countries are or will be facing is that the EBV produced by a single step evaluation includes genomic information and thus cannot be submitted as input for MACE. Some of these countries have requested Interbull to give some recommendations on how to produce genomic-free output that can be used in MACE without having to run the evaluation twice. To answer this request, the Interbull Technical Committee decided to create a dedicated Working Group in order to elaborate recommendations to the countries on this matter. Members of this group are Gert Pedersen Aamand, Gerben de Jong, Zengting Liu, Mike Goddard, Paul VanRaden, Esa Mäntysaari, Pete Sullivan, and Haifa Benhajali. The working group held two conference calls in September and November 2019 to discuss different proposals that were suggested by the members. Final recommendations were elaborated and submitted to ITC for approval.

7.5. GMACE Software Update

The GMACE computer software used by Interbull has been static since 2017, when parameter-space restrictions were first implemented (Sullivan, 2016). A recent review of GMACE results uncovered some rare cases of ill-defined parameter spaces, due to unexpected patterns of GMACE reliabilities. Following these findings, the GMACE software was modified. Two patches were installed, one to guarantee all estimates of the internal parameter fall within the expected range, and another to guarantee published GMACE reliabilities are always at least one point higher than corresponding reliabilities of parent average. Changes were implemented in the December 2019 GMACE run.

7.6. The Validation Working Group

Following a decision from the Interbull Technical Committee during the Dubrovnik meeting, a Validation Working Group was created to deal with the different validation issues both countries and ITBC are facing due to the new developments at the national level (genomic pre-selection, single step methods, etc). Members of the group are Esa Mäntysaari (Chair), Paul VanRaden, Zengting Liu, Pete Sullivan, Raphael Mrode and Valentina Palucci.

The current validation procedures are based on two main key elements 1) Forward validation based on cross validation (method I, III and GEBV test) and 2) Partitioning of data in order to analyse the different contribution to the EBV (method II and IV).

The WG had two conference calls in February and May 2020, and is preparing a new framework for validation as well as practical example of its applicability.

7.7. InterGenomics-Holstein (“IgHOL”)

In recent years we reported that, upon request from many of Interbull’s current customers from Holstein populations involved in MACE, the Interbull Centre started an investigation on how the InterGenomics model could be used by Interbull Centre to provide services required for genomic evaluation to these countries. Interbull Centre continued working on technical issues towards the implementation of InterGenomics-Holstein (IgHOL) as a Service. In December 2019 the results of the validation study performed on the second IgHOL research run data were presented to the Interbull Technical Committee (ITC). After reviewing the outcome of the study, the ITC recommended to proceed with an IgHOL pilot run and to include genotypes from a new IgHOL data call. Through this third call, issued in November 2019, genotypes were for the first time received from “non-IgHOL countries”, that have already implemented genomic evaluations, and were willing to contribute genotypes of their influential bulls to the IgHOL evaluation process.

The InterGenomics-Holstein pilot run was completed by Interbull Centre in March 2020. The ITC, supporting the work done, recommended to improve the reliability process before moving toward a test evaluation run, expected in September 2020.

Parallel to the technical aspects, the Interbull Steering Committee established, in January 2020, an IgHOL working group to address communication, governance, legal and financial matters for the implementation of IgHOL as a Service.

7.8. Post Processing of MACE Correlations Working Group

According to the current procedure, estimated correlations are required to fall within certain windows’ values. For milk production traits, for example, separate windows are maintained depending on the climate and whether or not countries predominantly have grazing system. Two countries with a similar climate and production system (grazing vs. non-grazing) are expected to be more correlated with each other than two countries with different climate or production system. If estimates are lower than the minimum window's value, they are set equal to the minimum window's value specified for that given group. In addition, estimates are regressed towards a mean correlation within groups, the regression depending on the number of common bulls.

Such windows values have been last reviewed during the 2015 Interbull Meeting with the ITC recommendation to periodically reviewing them with a period of 5 years. Following such recommendation, Interbull Centre has in January of this year (2020) re-activated the original working group, with the addition of few new members which we thank for their availability. The aim of the working group will be to review such values and present a proposal to the ITC for possible update with the aim to introduce them at the first possible test run (either September 2020 or January 2021 at the latest).

7.9. Clinical Mastitis and Other New Traits

A survey has been sent out last year to all Interbull Centre’s representatives in order to assess both the feasibility and relevance of potential new novel traits to add to the current MACE portfolio. Results from the survey have been shared during the last Interbull Meeting showing a high interest for udder health traits above other potential new traits.

In light of this result, and in response to the need of some countries to have a better reference population for their genomic evaluation for clinical mastitis, Interbull Centre, following the directives

of the Steering Committee and under the technical guidance of the Technical Committee, has explored the possibility to have a dedicated international evaluation for clinical mastitis (as in contrast to the current mastitis evaluation which also does include data from somatic cell scores as a predictor for mastitis for these countries not having a national evaluation for mastitis yet). It is envisioned that the current MACE mastitis evaluation would still be used for publication purposes while the new MACE clinical mastitis evaluation would be used for SNP training purpose only by countries with a national genomic evaluation for such trait in place.

ITC and Interbull Centre are currently working on defining the rules for inclusion of data in the new clinical mastitis evaluation while a task force from the Steering Committee is looking at possible new funding models to apply to it as an example of new funding models for future novel traits.

7.10. Comparison of single-trait to multi-trait international genomic evaluations for yield and fertility in BSW (InterGenomics BSW) and small HOL populations (InterGenomics HOL) (Master's thesis project)

The current official international genomic evaluation performed by Interbull Centre for BSW is based on a single trait model where genetic correlations are assumed to be equal to one between countries for all traits. The reason behind this decision was to avoid double counting of phenotypic information as MACE proofs are used as input for the genomic evaluation. For traits that are highly correlated, there is no much gain from the multi-trait over the single-trait evaluation. However, the loss in reliability can be important for traits with low correlations between countries. It was also a request from ITC to investigate the benefit from running a multi-trait evaluation for InterGenomics. This topic was suggested as a Masters thesis project at SLU. Results show very little gain from a multi-trait over a single-trait approach. These results are mainly explained by the importance of the MACE information coming from other countries than IG countries and used to feed the genomic evaluation. This information is even more important in case of IGHOL where big exporting countries are missing from InterGenomics.

8. RESEARCH & DEVELOPMENT – Beef

For Interbeef research projects that are not performed by Interbull Centre, data - including genotypes where appropriate - from participating organisations are sent to ITBC for renumbering of animal identification number, extraction of pedigree from IDEA and creation of the pedigree file needed in the project. All files are then sent to the research partner.



8.1. Carcass project

Some more tests on evaluation and combination of traits of interest (Carcass weight (cwe), Carcass conformation (cco) and Carcass fat (cfa)) were performed by ICBF (Ireland) and presented in last meeting in Prague. These research and development studies are based on the data call from 2018 with 4 countries (DFS, GBR, IRL and CHE) and 3 breeds (CHA, LIM and SIM). Results are promising but some questions still need to be addressed (single or multi-trait model, inclusion of aww) before a first test run.

8.2. Fertility project

The fertility project is led by vit (Germany) and focuses on number of calving (nca) and calving interval (cai) for CHA and LIM. Data editing from 6 countries was performed (DFS, DEU, GBR, IRL, FRA, CHE), and data call is still running for specific traits. The first tests on genetic parameter estimation were done. Some more tests are needed before production of first EBVs.

8.3. Validation of national and international models

There is currently no beef specific validation method that can be used either by countries to validate their national evaluation or by ITBC to validate the Interbeef evaluation. Although a range of validation methods have been developed and are routinely used in dairy, the beef evaluation system has its own specificities and challenges that make the dairy validation methods not optimum to use. This issue has been discussed in Prague (June 2019) and a working group will be suggested to work on developing a beef validation method that can satisfy the national and the Interbeef evaluation needs.

8.4. Variance component working group

The Interbeef WG decided to create a dedicated working group to take on board Renzo Bonifazi's work on genetic parameter estimation and define a set of recommendations to streamline, standardise and harmonise the process for parameter estimation across R&D and Service provision for Interbeef traits. It is becoming increasingly relevant in order to have better checking of parameters and give more flexibility to test runs.

8.5. International Genetic and Genomic Evaluations of Beef Cattle

In 2019, Renzo Bonifazi started the second part of his PhD project on International Genetic and Genomic Evaluations of Beef Cattle. This second part addresses: "Which genomic model is the most appropriate for beef cattle international evaluation and how much gain in terms of genomic reliability can be achieved through international cooperation?" Interbull Centre provided program and expertise to manage the genotypes from participating countries and imputation.

9. RESEARCH & DEVELOPMENT – Infrastructure & Data Exchange

The Interbull Centre has an efficient, effective, versatile, scalable, and powerful computing infrastructure. It consists of customer facing software services and databases for data exchange (IDEA, GenoEx), a cluster system with attached clustered file storage that is used for high-performance data analysis as well as tools for system monitoring, operational system management, backups, communication and project management. Software costs have been reduced to a minimum by use of well-vetted open source components, the performance and ease of maintenance of the system has been honed by years of experience doing large-scale data analysis at the Interbull Centre.

The Interbull Centre continues to invest in infrastructure improvement in order to continue to provide an increasing number of services efficiently.

9.1. GenoEx-GDE

GenoEx-GDE (Genomic Data Exchange) builds on the International Genotype Exchange Platform (“GenoEx”) and is under the final stages of development and testing, prior to putting it into service.

GenoEx-GDE is a platform for exchanging genotypes in a standardised way and within a user group that is controlled by the data owner. It provides an easy way for exchanging large datasets, facilitating building reference populations, decreasing costs by avoiding re-genotyping the same individuals and encouraging development of genomic evaluation. Among other benefits to the users, it is worth mentioning the creation of a worldwide network, from which all the users benefit, expanding their available genotype information, increasing the data quality, resolving data and pedigree queries and this way being able to provide wider and more reliable services to their local customers. Because the data from different sources is standardized, it can be easily compared and merged.

GenoEx-GDE will be employed for the exchange of data in the InterGenomics services, prior to a roll-out to additional users.

9.2. IDEA Performance Database

Since its implementation in April 2019, further developments have been made to the IDEA Performance Database: the required time for uploading of performance records has been drastically improved and new features introduced such as the inclusion of a parameter and performance queries as well as the possibility to access a detailed list of all possible problematic animals highlighted by the verify program from the review page.

9.3. System Maintenance and Development

During the current reporting period, System administration has focused particularly on the following areas:

- To increase security in sharing passwords and other sensitive data from Interbull Centre, a new web platform has been developed, configured and setup, to ensure that sharing of passwords is handled in a secure manner and sensitive data will be accessible only to the person it is intended for.
- Webservers within the Interbull Centre that serve different type of services have been upgraded and restructured and additional backups have been deployed. The backups have been structured and configured such that, in the event of a failure, the downtime will be limited and the service will be up again with a shorter interruption.

- The Interbull Forum required features had become obsolete, so a replacement platform had to be found. A new forum “Vanilla” was chosen as a replacement as it fulfilled the requirements. Data from the old Interbull Forum was converted to the new database format and the new forum was tested before released to the public.
- The Interbull Bulletin was upgraded following a major software release which includes a different workflow and some additional features. The interface has also been modernized to give it an up-to-date “look and feel”.

10. RESEARCH & DEVELOPMENT – External funding

In addition to funds raised from service fees, research and development activities at the Interbull Centre are financed by grants from the Swedish University of Agricultural Sciences (SLU) and the European Union, Co-funding for the development of GenoEx-PSE services has also been granted by ICAR. Contributions of the above organisations to the development of Interbull Centre services are gratefully acknowledged. Contributions made to R&D activities from participating organisations leading to improved or expanded Interbull Centre services are also much appreciated and welcomed. Interbull Centre’s involvement in the following international consortia is focused on providing services to the project (enabling international exchange of data; quality control), and on developing services to the Interbull Community (several of whom are involved in the projects), in line with Interbull’s Strategic plan (2016-2018).

“GenTORE”

Project title: *Genomic management tools to optimise resilience and efficiency*

Project Period: 1 June 2017 – 31 may 2022 (60 months);

Funding source: European Commission; Horizon2020, Research and Innovation action;

Website: www.GenTORE.eu (or www.interbull.org/ib/gentore)

Twitter: [@GenTORE_2020](https://twitter.com/GenTORE_2020)



“ReDiverse”

Project title: Biodiversity Within and Between European Red Dairy Breeds - Conservation through Utilization

Project Period: 1 September 2017 – 31 August 2020 (36 months);

Funding source: European Commission; Era-Net SUSAN (ID 29)

Website: www.interbull.org/ib/rediverse

“International Genetic and Genomic Evaluations of Beef Cattle”

Project Period: 1 May 2018 – 1 May 2022 (48 months);

Funding source: ICBF, ICAR, Interbull

Phd Project carried out by PhD Candidate Renzo Bonifazi. The aim of this research is to investigate some of the upcoming challenges in beef international evaluations. The research question can be further divided into four objectives:

1. How to improve genetic parameter estimation across Interbeef populations and provide reliable estimates when few genetic links exist among populations?
2. Which is the most appropriate genomic model for beef cattle international evaluations and how much gain in term of genomic reliability can be achieved through international cooperation?
3. Which is the most efficient way to integrate beef international genetic and genomic proofs at the national level?
4. How to include difficult-to-measure traits in international beef evaluations?

11. SERVICE CALENDARS

Schedules for International dairy and beef evaluations at the Interbull Centre are released upon approval by the Interbull Steering Committee and the Interbeef Working Group respectively. The Service Calendars are scheduled well in advance so that national genetic evaluation centres and the Interbull Centre can plan their activities accordingly.

The latest service calendars are available online:

- Interbull, dairy: www.interbull.org/ib/servicecalendar
- Interbeef, beef: www.icar.org/index.php/technical-bodies/working-groups/interbeef-working-group

12. MEETINGS

12.1. 2019 Interbull Annual Meeting

From 21-25 June 2019 the Interbull Meeting was held in Cincinnati, Ohio, USA in conjunction with the 41st **ADSA Annual Meeting**.

The Interbull Technical Committee and Steering Committee, as well as the SNPMace WG met during the Interbull meeting.

Reports are available at www.interbull.org/ib/itbcreports, while presentations are available online for:

- Business Meeting: https://interbull.org/ib/bm_cincinnati_2019
- Open Meetings: https://interbull.org/ib/programme_cincinnati_2019
- Joint Interbull-ADSA Meetings: https://interbull.org/ib/ppt_joint_itbc_ada

Photos of these Meetings are available on: <http://interbull30years.blogspot.com/2019/07/interbull-meetings-cincinnati-usa-2019.html>

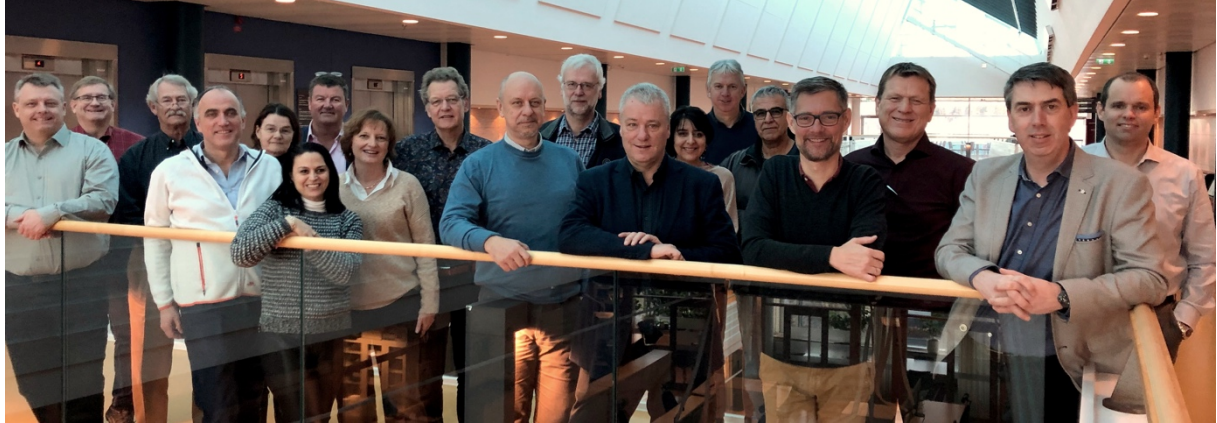
12.2. Interbeef Meetings

Interbull Centre staff attended three Interbeef Meetings during the reporting period.

- The **Annual Interbeef meeting** was held during the ICAR meeting in Prague, Czech Republic. The meetings on 17 and 18 June 2019 included sessions for the Interbeef WG, Interbeef Technical Group and Interbeef Service Users.
- During the Interbull Annual Meeting in Cincinnati, a joint “**Interbeef/Interbull meeting on dairy beef**” explored interests in undertaking relevant research, with the goal of providing genetic/genomic evaluation services for beef traits from the dairy herd in the future.
- From 4-6 November 2019, Interbeef WG and Technical group met in Switzerland during the **Interbeef Workshop**, adopting the Interbeef Code of Practice, addressing technical issues, and discussing the results of the first Interbeef Country Pilot evaluation, involving Slovenia.

12.3. 2020 Interbull Strategic Planning Meeting

The Strategic Planning Meeting was held in Uppsala, Sweden, on 23 and 24 January 2020 and was attended by representatives from the Interbull Steering Committee (SC), the Interbull Technical Committee (ITC), ICAR, the Interbull Centre, and Interbeef as well as key Interbull service users. Further details regarding the Strategic Plan are included under Governance.



Participants to the Interbull Strategic Planning Meeting (at the Interbull Centre, Uppsala, Sweden)

12.4. Future Meetings

Interbull Annual Meetings

The SC agreed to organise the Interbull Annual Meetings jointly with ICAR in even years (2020, 2022, etc.), while alternating the odd years between EAAP (2021, 2025 etc.) and ADSA (2019, 2023, etc.). Due to the COVID-19 Pandemic, this schedule has required an adjustment for 2020 and 2021, resulting in joint Interbull-ICAR meetings in two consecutive years:

2021 (April): The Interbull-ICAR meeting that was originally scheduled for June 2020, has been rescheduled for the last week of April 2021.

2022 (June): The Joint ICAR-Interbull Meeting will be held in Canada.

Other Interbull Meetings

The 2021 Interbull Annual Meeting was originally scheduled to precede the EAAP meeting in Davos, Switzerland. Due to the rescheduling of the joint Interbull-ICAR meeting in Leeuwarden from 2020 to 2021, an Annual Meeting in Davos in 2021 is no longer appropriate. We continue working with the local organisers in Davos to seek alternatives, such as Technical Workshop, to be organised in Davos.

Information on future Annual Meetings and other meetings that may be of interest to the Interbull Community can be found on https://interbull.org/ib/ibc_future_events.

13. COMMUNICATIONS and PUBLICATIONS

13.1. Interbull Bulletin

The Interbull Bulletin contains the state-of-the-art in genetic evaluation methods, as well as the most recent information on national and international implementations. During the period comprehended by this report the following issue of the Interbull Bulletin was published:

- No 55 (2019): Proceedings of the 2019 Interbull Meeting (Cincinnati, Ohio, USA, June 2019)

<https://journal.interbull.org/index.php/ib>

13.2. Web Site



The websites for Interbull (www.interbull.org) and the Genotype Exchange Platform (<https://GenoEx.org>) have been updated with the latest information.

Information has been provided to ICAR for updating ICAR's website, especially in relation to:

- Interbeef (<https://www.icar.org/index.php/technical-bodies/working-groups/interbeef-working-group/>);
- ICAR Accreditation of DNA Data Interpretation Centres (<https://www.icar.org/index.php/certifications/certification-and-accreditation-of-dna-genetic-laboratories/two-new-dna-based-services/dna-data-interpretation-centres/>)

13.3. LinkedIn

The Interbull Centre company page is available on LinkedIn: Interbull Centre staff members have linked their individual profiles to the company profile.

13.4. Publications of Interbull Centre staff as authors or co-authors

During the current reporting period, Interbull Centre staff (co-)authored the following publications:

- Jighly A., Benhajali H., Liu Z. and Goddard, M.I E. 2019. SNPMap - A meta-analysis to estimate SNP effects across countries. Interbull Bulletin 55:108-115.
- Michenet A, Boichon D, Saintilan R, Phocas F and Venot E. A single-step, multiple-trait genomic evaluation model increases the accuracy for suckling performance in beef cows. Proceedings of the ICAR Conference in Prague, CZ, 17-21 June 2019
- Savoia S, Bittante G, Albera A. Innovative tools for phenotypic characterization and genetic improvement of meat quality in the Piemontese breed. Proceedings of the ICAR Conference in Prague, CZ, 17-21 June 2019
- Sullivan P.G., Mäntysaari E.A., DeJong G. and Benhajali H. Modifying MACE to accommodate genomic preselection effects. Interbull Bulletin 55: 77-80.

Publication of additional information:

- Interbull Centre Activity Report and Finance Report: <http://interbull.org/ib/itbcreports>
- Pictures of the Meeting in Cincinnati are in the 'Hall of Fame': <http://interbull30years.blogspot.se>

13.5. References

- Sullivan, P.G. 2016. Defining a Parameter Space for GMACE. Interbull Bulletin 50:85-93.

Appendix 1: Interbull and Interbeef WG and TF compositions.

Interbull Centre personnel are members of various Committees, Task Forces and Working groups. Full membership for these groups is provided below. Within brackets are members of the Interbull Centre team who regularly attend the meetings of the group, even though not official members of the respective group.

ICAR's Sub-Committees and Working Groups:

- **Interbull Steering Committee:**
Matthew Shaffer (Chair), Brian Van Doormaal (Vice-Chair), Gerben de Jong, Marija Klopčič, Sophie Mattalia, Gert Pedersen Aamand, Enrico Santus, Urs Schnyder (Toine Roozen, Valentina Palucci).
- **ICAR ID Subcommittee:**
Jo Quigley (Chair), Kaivo Ilves, Folkert Vonken, Valentina Palucci, Othon Reynoso Campos.
- **ICAR DNA WG:**
Brian Van Doormaal (Chair) André Eggen, Suzanne Harding, Dariusz Kamola, Michael Keane, Sandra Kipp, Raffaele Mazza, Matthew McClure, Romy Morrin-O'Donnell, Nilesh Nayee, Ezequiel Nicolazzi, Joanna Sendeka, Wim van Haeringen, Jiansheng Qiu.
- **Interbeef WG:**
Andrew Cromie (Chair), Robert Banks, Emma Carlén, Mike Coffey, Maruo Fioretti, Laurent Griffon, Svenja Strasser, Japie van der Westhuizen (Toine Roozen, Simone Savoia, Alexis Michenet, Haifa Benhajali).

Steering Committee's Working Groups and Task Forces:

- **Interbull Technical Committee:**
Gert Pedersen Aamand, Gerrit Kistemaker, Tom Lawlor, Paul VanRaden, Zengting Liu, Raphael Mrode, Esa Mäntysaari, Gerben de Jong, Peter Sullivan, Haifa Benhajali (Toine Roozen, Valentina Palucci, Joanna Sendeka, Simone Savoia, Alexis Michenet)



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