

Interbull Centre Activity Report



February 2018 – May 2019

INTERBULL CENTRE

ACTIVITY REPORT FEBRUARY 2018 – MAY 2019¹

INTERBULL CENTRE

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



Until 1 November 2018, the Interbull Centre held the status of European Union Reference Laboratory (EURL) for Zootechnics (Bovine Breeding).

As of 1 November 2018, the Interbull Centre holds the status of European Union Reference Centre (EURC) for Bovine Breeding.



The Interbull Centre is ISO 9001:2015 certified.



¹ Presented at the 2019 Interbull Meeting, Cincinnati, USA June 2019



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**Haifa Benhajali, Valentina Palucci, Joanna Sendecká, Marcus Pedersén,
Eva Hjerpe, Carl Wasserman, Hans Persson, Jan-Erik Strömqvist,
Hossein Jorjani, Simone Savoia, Alexis Michenet, Toine Roozen.**

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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), and acts as the operational unit for Interbull and Interbeef, a permanent subcommittee and a working group of the International Committee for Animal Recording (ICAR), respectively.

Additionally, the Interbull Centre held the status of the European Union Reference Laboratory for Zootechnics (EURL-Z) until 1 November 2018, and became on that date the European Union Reference Centre for Zootechnics (Bovine Breeding).

For a more detailed description of our governance, infrastructure and services, I would like to refer you to the special issue of the Interbull Bulletin (No. 52², 2018) about the Interbull Centre.

The period covered by this Report has brought unforeseen changes amongst the Interbull Centre personnel. The (negative) impact that this could have had on the ability of the Centre in pursuing its goals has been minimal thanks to the availability of comprehensive documentation and the commitment of the remaining staff members: In fact, this Report will testify that a lot has been achieved regardless of such unfortunate changes.

I'd like to thank everyone who has contributed to this period's great achievements, but especially the current Team at the Interbull Centre for their enthusiasm and drive.

Also a special thank you to Dr Reinhard Reents who will leave the Steering Committee after 20 years, of which 13 years as Chairman. Reinhard you have been a great support and leader to me, and the rest of the Team!

This Report describes the activities at the Interbull Centre between 1 February 2018 and 31 May 2019.

Toine Roozen,

Interbull Centre Director

² <https://journal.interbull.org/index.php/ib/article/view/1438>

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), and consists (1 June 2019) of:

- Toine Roozen (MSc, MBA), Director
- Haifa Benhajali (PhD), Genetic Data Analyst - Genetics, R&D Coordinator. Service Owner GMACE & Interbeef
- Valentina Palucci (MSc), Genetic Data Analyst - Genetics, Quality Manager. Service Owner MACE & InterGenomics
- Joanna Sendicka (PhD), Genetic Data Analyst – Genetics. Service Owner – SNP services
- Simone Savoia (PhD), Genetic Data Analyst - Genetics
- Alexis Michenet (PhD), Genetic Data Analyst - Genetics
- Marcus Pedersén, Genetic Data Analyst - IT; Systems Administrator, IT Coordinator
- Carl Wasserman, Genetic Data Analyst - IT; Systems Developer
- Hans Persson, Genetic Data Analyst - IT; Programmer
- Jan-Erik Strömquist – Genetic Data Analyst - IT; 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

Committee and WG memberships:

- Interbull Technical Committee: Haifa Benhajali.
- ICAR DNA WG: Joanna Sendicka

New recruits

- **Simone Savoia (PhD), Genetic Data Analyst – Genetics**

Simone Savoia started at the Interbull Centre on 1 April 2019 and will be involved in both beef and dairy activities. Simone hails from Turin, Italy. After graduation of his Bachelor in “Livestock Science” at the University of Torino in 2009, he was employed by the Italian Piemontese cattle Breeders Association (ANABORAPI) to work as geneticist at the “Research and Development” Office. While working, he continued his education in “Livestock Science and Technologies” at the University of Torino, obtaining the degree of MSc with honors. He then attended several national and international post-graduate courses in the context of “Animal Breeding and Genetics”. In 2015 he started his PhD project in “Animal Science” at the University of Padova (Italy), which he combined with the activities at ANABORAPI. The research underlying the PhD was conducted within the project “QualiPiem” - Innovative tools for selection of meat quality in Piemontese breed.

- **Alexis Michenet (PhD), Genetic Data Analyst – Genetics**

Alexis Michenet started at the Interbull Centre on 15 April 2019 and will also be involved in both beef and dairy activities. After an Engineer degree in animal production, Alexis completed a PhD at INRA in 2016 on the subject of QTL detection and genomic selection of maternal performance of suckling cows.

Since, he has been working at Alice, in collaboration with INRA, to study the genetic determinism of new traits and the development of new genetic and genomic evaluations for beef and dairy cattle in collaboration with breeding companies.

- **Jan-Erik Strömqvist – IT; Programmer**

Jan Erik Strömqvist is working at the Interbull Centre since January 2018, starting with a three-month training period. Jan-Erik is a programmer, and assists with the optimisation and testing of software and databases in use at the Interbull Centre. This includes streamlining of processes, and conversion of Fortran/Bash/SAS software to “Python” in relation to the delivery of services for Interbull, Interbeef and GenoEx-PSE.

Departed members of staff:

- **Eva Hjerpe (MSc), Genetic Data Analyst – Genetics**

Eva Hjerpe has been part of the Interbull Centre staff since 2004 working on delivering and improving of dairy and beef services. Her contribution to the team and to the service offered by Interbull Centre has been invaluable. After 14 years in the animal breeding industry, Eva has decided it was time for a new challenge and started a new position as project manager at a humane genetics bio-bank in Göteborg, Sweden. We were extremely sorry to see her leaving and we all wished her all the best in her new chapter of her professional life.

- **Renzo Bonifazi MSc – Genetic Data Analyst – Genetics**

Renzo Bonifazi completed his BSc in Animal Productions and MSc in Animal Science at the University of Perugia (Italy), based on thesis work “Reliability in worldwide genomic evaluations of dairy cattle populations”, carried out while completing a traineeship at the Interbull Centre in 2016. Upon completion of his MSc, he returned to the Interbull Centre in May 2017 for a post-degree traineeship on beef evaluations, followed by temporary employment (October 2017 - March 2018), working on genetic data analysis of Interbeef evaluations using MiX99 software for Variance Component Estimation. Renzo left Interbull Centre to start his PhD studies (part-funded by Interbull and Interbeef) at Wageningen University & Research.

- **Monica Jansson**

Monica Jansson was for many years the silent force behind the publication of the Interbull Bulletin. She first published the paper versions, and, once the Interbull Bulletin was published online only, managed that process as well. Monica retired after 46 years at SLU.

- **Hossein Jorjani (DVM, PhD, Professor), Senior Genetic Data Analyst.**

Hossein has been part of Interbull Centre staff since 1998 and Interbull Centre’s senior geneticist. His main responsibilities have been research aimed at improvement of national data quality and improvement of the currently used methodology (MACE), such as finding more efficient ways to estimate genetic correlations among countries. Over the years Hossein has been Head of Department for Animal Breeding and Genetics (2014-2017), interim Director of Interbull Centre (2014-2015) and Interbull Centre Service Manager (2013-2018). The three months prior to his retirement on 31 May 2019, Hossein was on sabbatical leave.

We thank him for all his time and contributions at Interbull Centre and wish him all the best for his well-deserved retirement days.

1.2. Training, Courses, Meetings and Conferences

Staff was involved with the following courses, meetings and conferences. People indicated with ‘*’ provided a presentation.

Table 1.1: Attendance of events during 2018

Event	Location	Dates 2018	Attendee
DataGene	Melbourne, Australia	19-22 February 2018	Toine Roozen
Victoria Agriculture / La Trobe University	Melbourne	19-22 February 2018	Toine Roozen
Meeting with EC DG SANTE and EU Competent Authorities	Brussels, Belgium	8 March 2018	Toine Roozen*
Nordic Postgres Day	Oslo, Norway	13 March 2018	Haifa Benhajali, Carl Wasserman, Marcus Pedersén, Hans Persson
Interbull Centre Planning Meetings	Uppsala, Sweden	19-20 April 2018	Toine Roozen, Hossein Jorjani, Valentina Palucci, Haifa Benhajali, Joanna Sendeck, Eva Hjerpe, Carl Wasserman, Marcus Pedersén, Hans Persson
BC Platforms	Uppsala	3 May 2018	Toine Roozen, Hossein Jorjani
ISO Internal surveillance Audit	Uppsala	16 May 2018	Toine Roozen, Valentina Palucci, Carl Wasserman
GenTORE Annual Meeting	Edinburgh, UK	15-16 May 2018	Hossein Jorjani
Eurogenetics Meeting	Amsterdam, The Netherlands	16-17 May 2018	Haifa Benhajali
Interbull Centre Internal Workshop	Uppsala	21-22 May 2018	Toine Roozen, Hossein Jorjani, Valentina Palucci, Haifa Benhajali, Joanna Sendeck, Eva Hjerpe, Carl Wasserman, Marcus Pedersén, Hans Persson, Jan-Erik Strömqvist
ISO 9001:2015 Internal Auditing Course	Gothenburg, Sweden	30-31 May 2018	Valentina Palucci
PGcon (PostgreSQL conference)	Ottawa, Canada	30 May - 1 June 2018	Carl Wasserman
Apache Spark + AI Summit	San Francisco, USA	4-6 June 2018	Carl Wasserman
Statistical Methods for Genome-Enabled Selection by Daniel Gianola	Wroclaw, Poland	11-15 June 2018	Haifa Benhajali
ADSA Meeting (incl. Interbull-ADSA Symposium)	Knoxville, TN, USA	24-27 June 2018	Joanna Sendeck
Symposium in honour of Professor Robin Thompson	Edinburgh	29 June 2018	Hossein Jorjani
Interbull Technical Committee	Dubrovnik, Croatia	25, 28 August 2018	Toine Roozen (partly), Hossein Jorjani, Valentina Palucci* (partly), Haifa Benhajali*, Joanna Sendeck, Eva Hjerpe
Interbull Technical Workshop	Dubrovnik	25-26 August 2018	Toine Roozen, Hossein Jorjani*, Valentina Palucci*, Haifa Benhajali*, Joanna Sendeck, Eva Hjerpe
SNPMace WG meeting	Dubrovnik	26 August 2018	Toine Roozen, Hossein Jorjani

Table 1.1 (continued): Attendance of events during 2018

Event	Location	Dates 2018	Attendee
Joint Interbull-EAAP Symposium	Dubrovnik	27 August 2018	Toine Roozen, Hossein Jorjani*, Valentina Palucci, Haifa Benhajali, Joanna Sendeck, Eva Hjerpe
2018 EAAP meeting	Dubrovnik	27-31 August 2018	Hossein Jorjani
Meeting with Matthew Shaffer (DataGene, Interbull SC)	Uppsala	29 August 2018	Toine Roozen, Valentina Palucci, Carl Wasserman, Jan-Erik Strömqvist, Hans Persson
Interbeef workshop	Padova, Italy	11,12 October 2018	Toine Roozen, Eva Hjerpe*
Open Source Summit 2018	Edinburgh	22-24 October 2018	Carl Wasserman
Eurogenetics Meeting	Amsterdam	25-26 October 2018	Haifa Benhajali
Ansible automates in Stockholm	Stockholm	15 November 2018	Hans Persson
ISO re-certification Audit	Uppsala	15 November 2018	Toine Roozen, Valentina Palucci, Carl Wasserman, Jan-Erik Strömqvist, Haifa Benhajali, Hossein Jorjani, Joanna Sendeck, Eva Hjerpe, Marcus Pedersén
Lecture on Interbull/Interbull Centre activities as part of SLU course "HV0158 & HV0144 Animalieproduktion – idisslare" (Cattle production)	Uppsala	16 November 2018	Valentina Palucci*
SNPMace Meeting with Mike Goddard	Uppsala	26 November 2018	Haifa Benhajali, Toine Roozen, Hossein Jorjani

Table 1.2: Attendance of events during 2019

Event	Location	Dates 2019	Attendee
Gordon Conference in Quantitative Genetics and Genomics	Lucca, Italy	10-15 February 2019	Haifa Benhajali
Nordic Postgres Day	Copenhagen, Denmark	19 March 2019	Marcus Pedersén, Hans Persson
Interbeef Business Planning Meeting	Amsterdam, The Netherlands	4 April 2019	Toine Roozen
Nordic GS Workshop 2019	Billund, Denmark	24-25 April 2019	Toine Roozen
Interbeef Business Planning Meeting	Paris, France	25-26 April 2019	Toine Roozen, Haifa Benhajali
GenTORE Annual Meeting	Frick, Switzerland	7-9 May 2019	Toine Roozen
Eurogenetics Meeting	Amsterdam	13-14 May 2019	Haifa Benhajali
SMARTER meeting	Uppsala	27-28 May 2019	Toine Roozen, Valentina Palucci, Haifa Benhajail, Alexis Michenet

Table 1.3: Interbull Committee Meetings 2018-2019

Event	Location	Dates	Attendee
Steering Committee	Auckland, New Zealand	9, 10, 13 February 2018	Toine Roozen, Hossein Jorjani, Valentina Palucci
Steering Committee	Dubrovnik, Croatia	25-26 August 2018	Toine Roozen, Valentina Palucci, Haifa Benhajali (26 August)
Steering Committee	Conference calls	23 May 2018 12 December 2018 10 April 2019	Toine Roozen, Valentina Palucci
Technical Committee	Auckland, New Zealand	9, 13 February 2018	Toine Roozen, Hossein Jorjani, Valentina Palucci, Haifa Benhajali, Joanna Sendeck, Eva Hjerpe
Technical Committee	Dubrovnik, Croatia	28 August 2018	Toine Roozen, Hossein Jorjani, Valentina Palucci, Haifa Benhajali, Joanna Sendeck, Eva Hjerpe
Technical Committee	Conference call	29 November 2018	Haifa Benhajali, Hossein Jorjani*, Valentina Palucci, Toine Roozen

Table 1.4: Working Group Meetings by Conference call 2018-2019

Working Group	Dates	Attendee
Validation WG	28 February 2019 15 April 2019 16 May 2019	Valentina Palucci
SNPMace WG	7 May 2018 10 October 2018	Hossein Jorjani, Toine Roozen
SNPMace WG	5 April 2019 16 May 2019	Haifa Benhajali, Toine Roozen
DNA WG	25 September 2018 23 January 2019 15 May 2019	Joanna Sendeck
GREL WG	9 January 2019	Haifa Benhajali
GPS & Future MACE WG	4 February 2019	Haifa Benhajali
Interbeef WG/TC	7 March 2018 27 March 2018	Eva Hjerpe, Hossein Jorjani
	31 May 2018	Eva Hjerpe
	7 March 2019	Haifa Benhajali, Toine Roozen
Interbeef: exchange on genotype information	8 May 2018	Eva Hjerpe
Beef Phd Advisory Committee Meeting	12 September 2018	Toine Roozen, Hossein Jorjani
	19 March 2019	Toine Roozen

1.3. Consultants and Suppliers

Through consultancy agreements with the Canadian Dairy Network (CDN), the Irish Cattle Breeding Federation (ICBF) and the Czech Beef Breeders Association (CMBC), we have agreed collaborations with:

- **Dr Pete Sullivan** (CDN, Canada): works as a part time consultant (25%). In the current reporting period Pete's activities were mainly related to research activities for MACE, Future MACE and Validation.
- **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 Adjusted Weaning Weight (AWW) for Interbeef evaluations to the Interbull Centre.

1.4. Visitors

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

- **Matthew Shaffer** (DataGene, Australia; Interbull SC vice-chair) visited the Interbull Centre on 29 August 2018, and met with IT staff at the Interbull Centre, as well as the Director and Quality Manager. Matthew also met with DJ de Koning, co-Head of the Department of Animal Breeding and Genetics, SLU.
- **Lena Gibson**, an auditor within Bureau Veritas Certification Sverige AB, visited the Interbull Centre on 15 November 2018 to carry out an ISO 9001 re-certification audit. The re-certification went successfully with total absence of non-conformities found and a praise from the Lena about the strength and maturity of our Quality Management System.
- Starting 14 March 2019, three Swedish high school students, **Viktor Saka, Ludvig Westlund and Yasir** Narin spent, as part of their computer studies, two days a week for a total of 10 weeks at the Interbull Centre. Under the supervision of Marcus Pedersen, they were involved mainly in Linux development and administration, i.e. learning and testing how to install, configure and administer Linux systems and specific Linux applications/services like Fluid Keys, to easily be able to send encrypted messages. They had also the opportunity to try some programming in Python.
- On 26 November 2018, **Mike Goddard** attended the SNP Mace Project Meeting at the Interbull Centre. During the meeting, involving Mike Goddard, Hossein Jorjani, Haifa Benhajali and Toine Roozen, both technical issues (Interbull Centre's SNP Mace activities, Project Plan and Progress) and organisational/legal issues were discussed, with an emphasis on the handover of activities from Hossein to Haifa.
- **Per-Arne Fors**, consultant and experienced auditor, visited the Interbull Centre on 24 May 2019 to carry out an internal ISO 9001 audit. According to our internal audit plan this year was the time for the services, management and applied research processes to be audited. The internal audit concluded with several interesting opportunities for improvements for our Quality Management System and absolute absence of non-conformities.
- **Sophie Mattalia** (Institute d'Élevage, Interbull SC) and **Jean-Michel Astruc** (INRA, ICAR Sheep, Goats and Camelids WG) visited the Interbull Centre on 27 and 28 May 2019 to introduce the 'SMARTER project' – which also involves ICAR – which addresses resilience and efficiency in small ruminants, and to learn about Interbull Centres activities and organisation in relation to the international evaluation of cattle, and its role as an EU Reference Centre.
- **Mohammed Abdallah Ahmed Sallam** is a student from the 'Animal Science' Master at SLU who is having his training period at Interbull Centre. He will be working on International genomic evaluations methods with the focus on InterGenomics. Mohammad will be at ITBC for 6 months (from April to September 2019).

2. GOVERNANCE

2.1. Steering Committee membership

Sophie Mattalia (Interbull SC member since 2006) was proposed by the Interbull Business Meeting on 11 February 2018 for another 4-year term as Interbull SC member, representing France and Wallonia. Her membership was subsequently approved by the ICAR Board during the ICAR Board meeting on 27 March 2018.

2.2. Interbull Terms of Reference and Rules of Procedures

The Interbull SC Chair, Interbull Centre Director with input from the Interbull SC, ICAR CEO and ICAR President updated the Terms of Reference (ToR) for the Interbull Steering Committee. The ToR has become a 'lean' document focusing on the relationship between ICAR and Interbull SC, while the 'internal' organisation of Interbull (which were previously included in the ToR) have been addressed in a separate document.

Following approval by the ICAR Board of the new "*Terms of Reference for INTERBULL Sub-Committee*", the Interbull SC approved the "*Rules of Procedures for INTERBULL Committees*" at its SC meeting on 26 August 2018 in Dubrovnik. Both documents are available on: <http://interbull.org/ib/termsofreference>.

2.3. Chair and Vice Chair of the Interbull Steering Committee

During the Interbull SC meeting of 26 August 2018 its members elected, for the first time, a Vice Chair: The first Vice Chair is Matthew Shaffer, who has taken up this post with immediate effect.

Matthew Shaffer is the CEO of DataGene in Australia, and is an SC member, representing Oceania, since 2016. He was a member of the World Holstein Friesian Federation (WHFF) Council from 2005 until 2016, of which he served the last 4 years as President. From 2013 to 2016 he was also the Chair of the ICAR "Breed Associations" Working Group and a member of the ICAR "Parentage Recording" Working Group.

Reinhard Reents announced his decision to retire from the Interbull Steering Committee in June 2019 – which aligns with the end of his current term. Reinhard has served 20 years in the SC, of which 13 years as Chair. Vice Chair Matthew Shaffer will succeed Reinhard as Chair of the Interbull SC during the Interbull Annual Meeting in June 2019.

2.4. Code 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, Methods of international evaluation:** including a specific paragraph describing the methodology applied for InterGenomics.
- **Chapter 7, Data Exchange and time of evaluation:** including new timing for GMACE, timing for Truncated MACE and more information about test runs required files.

- **Appendix III, Interbull trend validation procedures:** including information on the Mendelian Sampling Trend test, the fourth official Interbull validation methods for conventional data.
- **Appendix X,** which provides details on the **AnimInfo** module in the Interbull Data Exchange Area (IDEA), which has been created to collect a wide range of reported information from National Genetic Evaluation Centres (NGECs) having access to IDEA and to use AnimInfo as an international exchange area for information on any animals that is present in the IDEA Pedigree module.

Interbeef Code of Practice

The [Interbeef Code of Practice](#) is updated in collaboration with the Interbeef WG and Interbeef Technical Committee as new services become available. The Interbeef Code of Practice is currently being updated to address changes that take account of the effects of the introduction of the Performance Database.

GenoEx-PSE Code of Practice

The GenoEx-PSE Code of Practice has been put into service. The latest update was related to “4.2 Service Users Obligations”, providing more specific details on ‘4.2.3 Targeted Animals’ for Parentage SNP Exchange on https://interbull.org/ib/pse_cop.

2.5. EU Reference Centre

On 8 March 2018, the Interbull Centre Director presented the Interbull Centre’s activities at a meeting of EC DG SANCTE and EU Competent Authorities. This meeting was also attended by Interbull Steering Committee members Marija Klopčič and Sophie Mattalia.

On 1 November 2018, the new European Union Animal Breeding Regulation ([EU Regulation 2016/1012](#)) came into force. This Animal Breeding Regulation addresses:

- a) zootechnical and genealogical rules for trade in breeding animals and their germinal products, and for their entry into the European Union;
- b) rules for the recognition of breed societies and breeding operations and for the approval of their breeding programmes;
- c) the rights and obligations of breeders, breed societies and breeding operations;
- d) rules for the entry of breeding animals in breeding books and breeding registers and for the acceptance for breeding.

From 1996 until 31 October 2018, the Interbull Centre fulfilled its role as European Union Reference Laboratory for Zootechnics. With the coming into force of EU Regulation 2016/1012, Interbull Centre took up its duties as the EU Reference Centre 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*” as previously published in the *Official Journal of the European Union* Issue L204/78, 5.8.2017³.

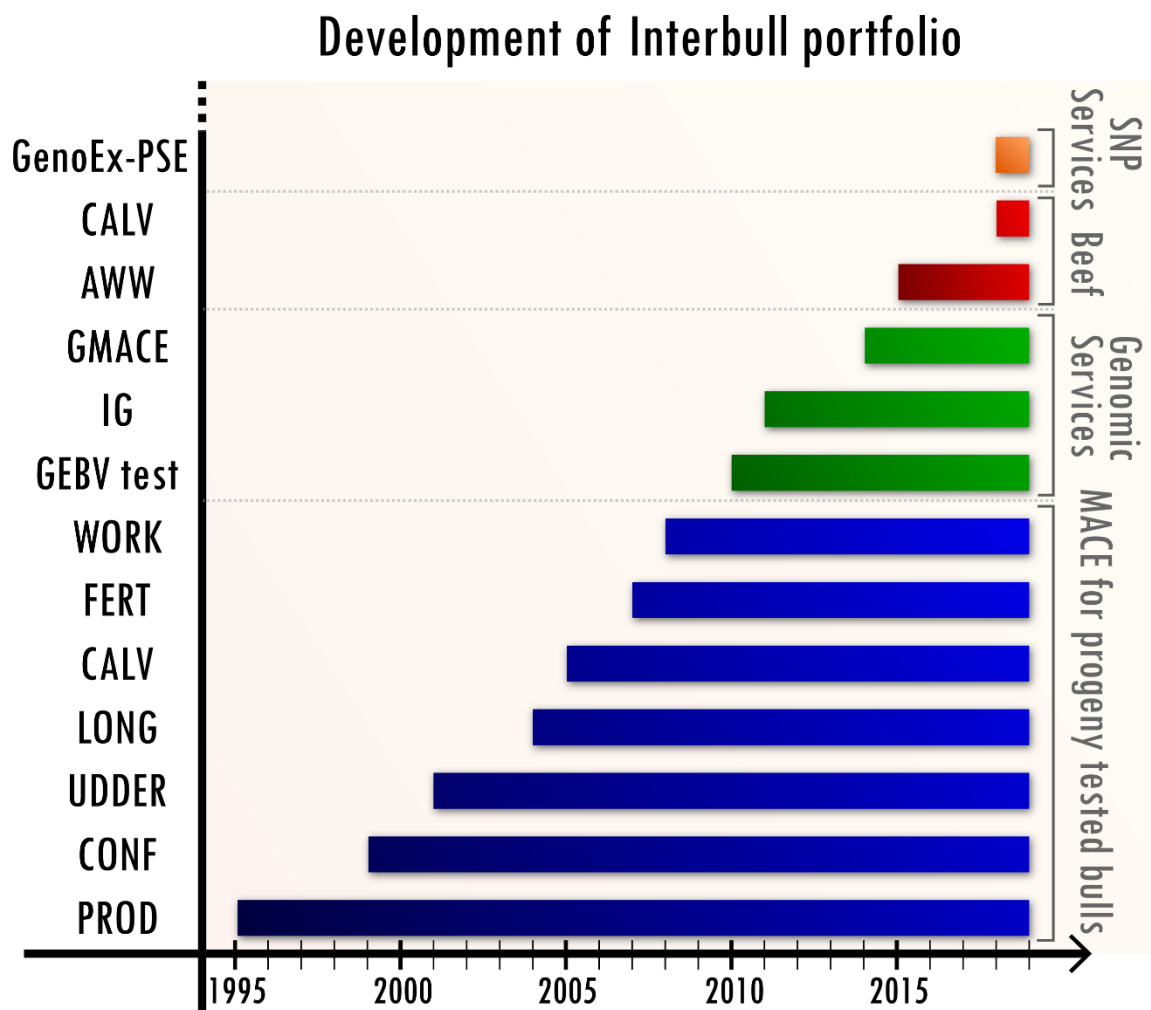
³ https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=uriserv:OJ.L_.2017.204.01.0078.01.ENG&toc=OJ:L:2017:204:FULL

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 for dairy, a new validation test was put into service (Mendelian Sampling Test) and Truncated MACE was introduced, and the exchange of information for genetic traits for the Holstein breed was launched. Calving Traits were evaluated for the first time through Interbeef. And the first exchange of SNP data to facilitate parentage verification occurred through GenoEx-PSE.

With the introduction of a new range of services related to SNP data, the departure of staff, and in a continuous effort to improve the delivery of services from the Interbull Centre, Service Owners have been appointed for all services as follows: MACE and InterGenomics – Valentina Palucci; GMACE and Interbeef – Haifa Benhajali; SNP Services (including GenoEx-PSE) – Joanna Sendekca. The Service Owners report to the Interbull Centre Director.

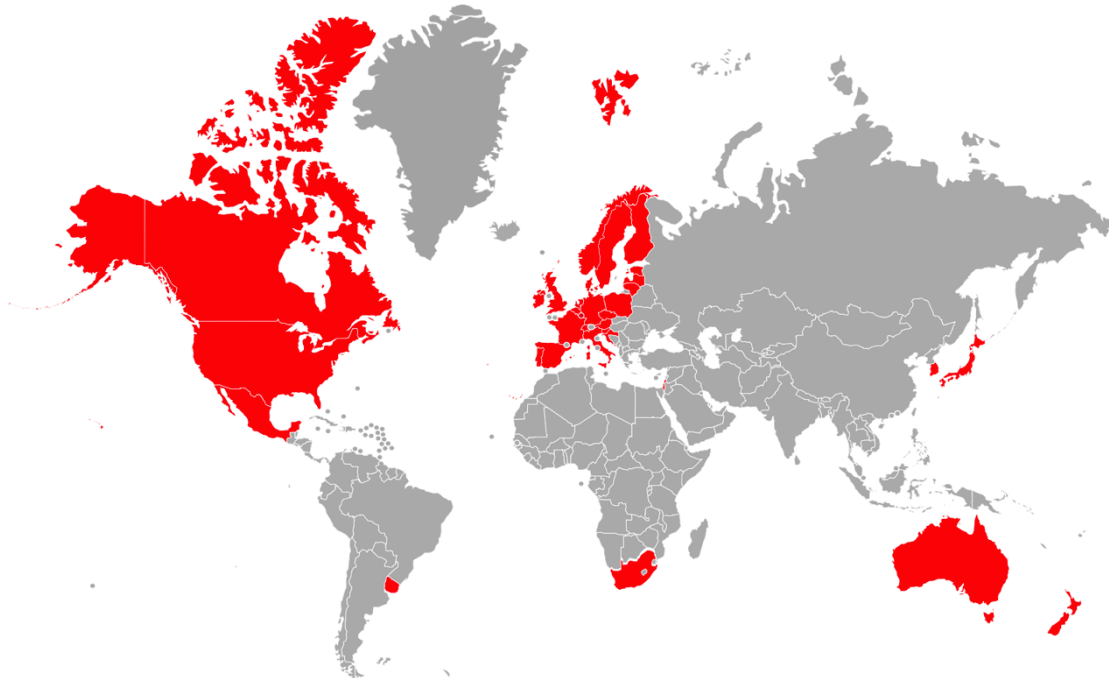
Figure 3.0: Development of Interbull Portfolio (May 2019)



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.

Figure 3.1: Interbull's Global Reach (May 2019)



1. 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.

2. Beef Evaluations

Africa: South Africa

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

Oceania: Australia

3. GenoEx-PSE

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

Asia: Japan (LIA)

3.2. Changes in Service Users and Genetic Evaluation Centres

Table 3.2 provides details on new Service Users and National Genetic Evaluation Centres during the reporting period. An explanation of the changes is provided underneath the table.

Table 3.2: Changes in Service Users and Genetic Evaluation Centres (February 2018-May 2019)

Organisation, country		Date	Service	Notes
Genetic Evaluations:				
ABRI Breedplan, Australia	Service user; NGEC	01-01-2019	Beef Evaluations	New
Herdbook CRV, The Netherlands	Service User	01-Aug-2018	Dairy Evaluations	Replacement
GENEVAL, France	NGEC	01-Nov-2018	Beef Evaluations Dairy Evaluations	Replacement
State Food and Veterinary Service of the Republic of Lithuania” (SFVS), Lithuania	Service User	01-Feb-2019	Dairy Evaluations	Replacement
SNP Services:				
vit, Germany	Service User	December 2018	GenoEx-PSE	New
LIA, Japan	Service User	December 2018	GenoEx-PSE	New
AIS, Slovenia	Service User	December 2018	GenoEx-PSE	New
ANAFI, Italy	Service User	December 2018	GenoEx-PSE	New
ANAPRI, Italy	Service User	December 2018	GenoEx-PSE	New
SEGES, Denmark	Service User	December 2018	GenoEx-PSE	New
ICBF, Ireland	Service User	December 2018	GenoEx-PSE	New
Geno, Norway	Service User	December 2018	GenoEx-PSE	New
NRIAP, Poland	Service User	March 2019	GenoEx-PSE	New

Evaluations:

- **Australia:** ABRI Breedplan joined the Interbeef Service for the first time in January 2019.
- **Lithuania:** As of 1 February 2019, “State Food and Veterinary Service of the Republic of Lithuania” (SFVS) is the Interbull Service User representing the Ministry of Agriculture of the Republic of Lithuania. The state enterprise “Agricultural Information and Rural Business Centre” will continue to be responsible for national genetic evaluations, and provide the necessary Lithuanian data to the Interbull Centre for the international genetic evaluation of bulls.
- **The Netherlands:** Due to the EU regulation which states that herd book organisations should be involved in, and responsible for the breeding goal and genetic evaluation, the responsibility for the genetic evaluation for bulls in The Netherlands was transferred from GES to the herd book CRV as of 1 August 2018. The herd book organisation was already responsible for the cow proofs. The genetic evaluation continues to be carried out by the Animal Evaluation Unit (AEU) which is part of CRV u.a. (the cooperative CRV).
- **France:** In application of the new European Regulation on Zootechnical and genealogical conditions for the breeding (2016/1012), INRA and IDELE stopped their routine activities concerning International genetic evaluations on 31 October 2018. GENEVAL is, as of 1 November 2018, responsible for the French national genetic evaluations for dairy and beef cattle, and took

over all areas of international genetic evaluations (pedigree, MACE, GMACE and Interbeef) for all breeds and traits. France Genetic Elevage continues as the Interbull Service User.

GenoEx-PSE:

- 8 Organisations signed the GenoEx-PSE Service agreement in 2018, taking advantage of the introductory service fee for 2018 and 2019. One organisation joined in March 2019. As of 31 May 2019, the GenoEx-PSE database contains information from these 9 organisations.

3.3. Quality Management

The agreement with auditor Bureau Veritas has been renewed for a period of three years. Bureau Veritas conducted a re-certification audit on 15 November 2018. The Interbull Centre was re-certified for services related to Interbull evaluations (MACE, GMACE, InterGenomics) and Interbeef evaluations; For the third year in a row, no non-conformities have been reported.

During 2018 the Interbull Centre's Quality Management System has been updated to reflect changes in the organisational structure at the Interbull Centre. Internal audits for the ISO 9001:2015 were held on 26 April and 16 May 2018 and a management review was held on 16 October 2018. During 2019 the necessary documentation has been prepared in order to include two new processes, ICAR Accreditation and GenoEx-PSE, in the Quality Management System. Our management and service processes, including the newly added ones, have been reviewed during the internal audit held on 24 May 2019. The 2019 management review and the external audit are scheduled in the autumn of 2019.



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

4.1. Validation of National EBVs and GEBVs

Validation of national EBVs and GEBVs is a crucial activity managed by Interbull Centre with the dual purpose of testing the consistency of the national genetic evaluation results before using them as input in a given international evaluation as well as assuring the users that the service provided by the Centre is reliable. Information on the validation methods offered by Interbull Centre, the timing and the reasons for a country to validate their data are all described in the Interbull Code of Practice.

At the moment, Interbull Centre offers five (5) different validation methods, four methods aimed to assess 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, GEBVtest.

Given the importance of having robust validation tests to apply on national data, Interbull could not be blind to all the changes happening in the genetic evaluation field especially in relation to possible genomic pre-selection in conventional EBVs. For this reason, a working group appointed by the Interbull Technical Committee is already looking at new validation approaches to offer countries with a well-established national genomic evaluation system the possibility to check the correctness of their national evaluations.

4.2. MACE Evaluations

Interbull Centre test evaluation runs were performed in September-October 2018 and January-February 2019. 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. Table 4.1 shows statistics on Interbull MACE evaluations.

Table 4.1: Size of the Interbull Centre operations for MACE

Multiple Across Country Evaluation (MACE)	Dec 2016	Dec 2017	Dec 2018
Countries	33	33	33
Evaluation breeds	6	6	6
Country-breed-trait combinations	1 899	1901	1937
Breed-trait evaluations	181	181	181
Animals in the pedigree database	27 896 152	29 450 570	34 643 754
Submitted national estimated breeding values	12 182 435	12 636 264	13 048 518
Qualified national estimated breeding values	6 654 381	6 880 265	7 171 732
Calculated international estimated breeding values	282 411 323	286 862 389	300 525 105
Distributed international estimated breeding values	106 979 713	107 380 799	111 976 925
Multiple Across Country Evaluation (MACE)	Sep 2016	Sep 2017	Sep 2018
Estimated across country genetic correlations	12 147	12 926	12 926
Validation tests ¹	150	160	99

¹ Subject to natural fluctuations

Figure 4.1: Degree of Participation to Mace evaluation

	Prod (3)	Conf (up to 33)	Udder (2)	Long (1)	Calv (4)	Fert (5)	Work (2)	Tot (50)	1904r vs. 1704r
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	11	150	+3
JER	12	10	9	9	-	9	6	55	+4
RDC	15	10	14	12	7	11	7	76	+5
SIM	13	-	12	6	-	-	-	31	0
Tot	86	56	79	62	30	54	31	398	
Incr	+2	+2	+3	+1	+1	+1	+2		+12

Routine international genetic evaluations for Brown Swiss, Guernsey, Holstein, Jersey, Red Dairy Cattle and Simmental were computed as scheduled in April, August and December 2018, and April 2019 for:

1. Production traits

- Switzerland joined the evaluation for the first time with JER during April 2018.
- Canada joined the evaluation for the first time with Milk Shorthorn (population code CAM) in the RDC breed in April 2018.
- Since April 2018 GENEVAL took over the responsibility to provide French national genetic evaluations for all Interbull evaluations.

2. Conformation traits

- Switzerland joined the evaluation for the first time with JER during April 2018
- Norway joined the evaluation with data for RDC chest width (CWI) and rump width (RWI) for the first time in December 2018.
- Canada joined the evaluation for the first time with Milk Shorthorn (population code CAM) in the RDC breed in April 2018.

3. Udder health traits

- Switzerland joined the evaluation for the first time with JER during April 2018
- Uruguay joined the evaluation for the first time with HOL scs data during April 2018.
- Switzerland joined the evaluation with real MAS data for HOL, BSW and SIM breeds during April 2019 evaluation.
- United States joined the evaluation with real MAS data for HOL during April 2019 evaluation.
- Canada joined the evaluation for the first time with Milk Shorthorn (population code CAM) in the RDC breed in April 2018.

4. Longevity

- Canada joined the evaluation for the first time with Milk Shorthorn (population code CAM) in the RDC breed in April 2018.

5. Calving

- Spain joined the evaluation for the first time with HOL in December 2017.

6. Fertility

- Italy joined the evaluation for the first time with HOL heifer conception (HCO) data in December 2018 evaluation.

7. Workability traits

- Switzerland joined the evaluation for the first time with JER during April 2018.

4.3. International Genomic Evaluation of Young Bulls (GMACE)

International genomic evaluation of young bulls (GMACE) is to date conducted for the Holstein breed only, with 12 countries submitting nationally genomic breeding value estimates (GEBV) for up to 38 traits. Statistics on GMACE evaluations are presented in table 4.2.

GMACE test runs were performed as scheduled in September-October 2018 and January-February 2019. GMACE Routine Runs were performed in April, August and December 2018 and April 2019.

Table 4.2 - Size of the Interbull Centre operations for GMACE

Genomic Multiple Across Country Evaluation (GMACE)	Dec 2016	Dec 2017	Dec 2018
Countries	33	33	33
Evaluation breeds	1	1	1
Country-breed-trait combinations	340	368	374
Breed-trait evaluations	38	38	38
Animals in the pedigree database	27 896 152	29 450 570	34 643 754
Submitted national estimated breeding values	19 428 147	23 186 480	26 811 378
Qualified national estimated breeding values	14 851 282	16 888 048	19 234 402
Calculated international estimated breeding values	155 263 850	160 730 713	182 673 348
Distributed international estimated breeding values ¹	536 340	488 685	458 789

¹ Change of publication rules during 2016

4.4. 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 4.3. The work on streamlining the process continued resulting on 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 4.3: Size of the Interbull Centre operations for InterGenomics

InterGenomics (Genomic evaluation of BSW populations)	Dec 2016	Dec 2017	Dec 2018
Countries	8	8	8
Country-trait combinations	278	280	280
Unique submitted genotypes	26 013	32 344	37 913
Genotypes entering imputation & genomic evaluation	23 571	28 329	32 557
Distributed international genomic estimated breeding values	6 385 844	7 932 400	8 579 480

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

Since its implementation in 2017, Interbeef service was based on the exchange of flat files through the Interbull FTP server. Starting from April 2019, all the files needed for the evaluation have been uploaded by countries via the Performance Database which has been integrated in Interbull's Data Exchange Area (IDEA), increasing the quality of checks made on the incoming data while at the same time making such process more efficient and streamlined.



Routine evaluations are performed two times per year in January and October. During the current reporting period, **Test Runs** were conducted in April and October 2018 and in April 2019.

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

Statistics on the latest Interbeef evaluation of the beef breeds Charolais, Limousin, Simmental, Hereford and Aberdeen Angus are presented in table 5.1.

Table 5.1: Size of the Interbull Centre operations for Interbeef

Interbeef	Jan 2017	Jan 2018	Jan 2019
Countries	7	7	9
Evaluation breeds	2	3	5
Country-breed-trait combinations	18	22	58
Animals in the pedigree database	28 256 603	29 965 798	35 109 302
Submitted phenotype records	7 890 490	8 234 838	40 734 117
International estimated breeding values	61 142 008	63 215 818	257 156 657
Distributed international estimated breeding values	1 344 841	1 407 786	6 805 936

5.1. Adjusted Animal Weaning Weight

In 2018 two countries joined the beef international evaluation. South Africa has joined the routine aww evaluation for Charolais (CHA) and Czech Republic has joined the routine aww evaluation for Beef Simmental (SIM).

Table 5.2: Breeds, number of populations and the number of publishable records in the distribution file for Adjusted Weaning Weight for the first routine run 2017, 2018 and 2019.

Breed	Trait	Populations in 1901r	Publishable records in the distribution file		
			1701r	1801r	1901r
CHA	aww	8: IRL, CZE, DFS, FRA, DEU, CHE, ZAF, AUS	561 820	585 945	1 057 516
LIM	aww	8: CZE, DFS, GBR, IRL, FRA, DEU, CHE, AUS	584 446	612 494	894 205
SIM	aww	5: DEU, DFS, CHE, IRL, CZE	198 575	209 347	252 494
AAN	aww	4: CZE, DEU, DFS, IRL	-	-	248 643
HER	aww	4: CZE, DEU, DFS, IRL	-	-	217 351

In 2019, Australia joined the animal weaning weight evaluation for Charolais and Limousine and crossbred animals were officially included. Following a decision from the Interbeef working group meeting in Auckland, February 2019, Aberdeen Angus (AAN) and Hereford (HER) breeds were also

officially included in the January 2019 routine evaluation. The number of breeds, populations participating in the routine evaluation in January 2017, January 2018 and January 2019 can be found in table 5.2.

5.2. Calving traits

The Nordic Countries (Denmark, Finland and Sweden) joined their national beef evaluations in the autumn of 2017 and are now sending data as one population (DFS). This explains the decrease in populations between the January routine evaluation in 2017 and 2019. In 2018, South Africa joined the calving evaluation for Charolais for the first time and the evaluation was extended to include the Simmental (SIM) breed. The number of breeds, populations participating in the routine evaluation in January 2017, 2018 and 2019 can be found in table 5.3.

Table 5.3: Breeds, number of populations and the number of publishable records in the distribution file for Calving Traits for the first routine run 2017, 2018 and 2019.

Breed	Trait	Populations in 1901r	Publishable records in the distribution file		
			1701r	1801r	1901r
CHA	Cae	4: CZE, DFS, FRA, IRL	--	642 679	669 463
	Bwt	5: CZE, DFS, FRA, IRL, ZAF	--	749 317	880 678
LIM	Cae	5: CZE, DFS, FRA, GBR, IRL	--	832 829	922 667
	Bwt	5: CZE, DFS, FRA, GBR, IRL	--	914 480	1 011 777
SIM	Cae	5: CZE, DFS, FRA, GBR, IRL	--	--	276 695
	Bwt	5: CZE, DFS, FRA, GBR, IRL	--	--	374 447

5.3. Exchange of genotype information

In the Interbeef Working Group meeting in Auckland, 2018 it was decided to test if the Interbull Centre's Database (IDEA/AnimInfo) could be used for exchanging information on whether an animal had been genotyped. Three countries tested the system during the spring of 2018 resulting in over 250 000 uploaded animals. Following a decision at the Interbeef Technical and Working Group meeting in October 2018, all member organisations participating in the beef evaluations have now the authority to upload this information into IDEA/AnimInfo. Members which have uploaded such information, will also be able to query or download all information that has been uploaded and shared with them.

6. OTHER, NEW and IMPROVED SERVICES – Interbull Centre

6.1. Mendelian Sampling Trend Validation Test

Trends in genetic variance benefit bulls coming from populations or year classes with increased genetic variance and lead to suboptimal selection decisions. Therefore, national evaluation centers and Interbull needed a method to observe possible trends in genetic variance. The MS Trend validation test has been developed by our colleagues from LUKE, Finland, based on previous research studies by Fikse et al., 2003; Lidauer et al., 2007 and Tyrisevä et al., 2011 which led to the development of the MS test software (Tyrisevä et al, 2012).

The following is a short summary of the main events since the development of the software:

- Nantes 2013: The Steering Committee accepted the recommendation from the Technical Committee to proceed with a pilot study.
- Berlin 2014: Revision of the first pilot study results pointed out a surprisingly high amount of combination (26%) failing the test. This led to an investigation on the type of data that countries utilised which revealed that for the majority of such combinations faulty data were used, and led to some software adjustments.
- September 2017: The software was applied to all breeds but limited to production traits.
- January 2018: The software was applied to all breeds, all traits. Final adjustments were made to the software.

After reviewing the latest results and hearing about the countries experiences on applying the validation test during the 2018 Interbull Technical Workshop held in Dubrovnik 2018, the Interbull Technical Committee recommended to the Interbull Steering Committee to adopt the software and adopt the Mendelian Sampling Validation Test as the fourth official Interbull validation method for conventional evaluation.

The Mendelian Sampling Validation Test has been introduced as a mandatory test as of January 2019. A guideline for helping countries interpreting the Mendelian Sampling Validation Test results has been prepared, and is together with other MS Test documentation available on the Interbull website: <http://www.interbull.org/ib/servicedocumentation>.

6.2. 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 was provided to the countries in May 2019, together with detailed information.

6.3. 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 will offer Truncated MACE as an additional service. Truncated MACE will be scheduled annually in October, starting in 2019.

Truncated MACE is expected to provide appropriate validation inputs for countries using foreign bulls in their reference population potentially providing MACE results for foreign bulls with no daughters in the participating country.

Participation to Truncated MACE will be made on a voluntary base. While Truncated MACE is open to all breeds and countries, it is expected that Truncated MACE will be of particular interest to breeds and countries having also a national genomic evaluation.

The cost of Truncated MACE will have to be covered by the participants in Truncated MACE. The fee will be €500 for organisations submitting data for a single breed, and €1000 for organisations submitting data for 2 or more breeds.

6.4. WHFF – Genetic Traits

Following a request from WHFF to assist with the **international exchange of information on these genetic traits**, the Interbull Centre’s database for the collection of additional animal information (‘AnimInfo’) has been adjusted for the collection of the WHFF genetic traits information. Subsequently, tests have been carried out with Interbull Centre’s customers in Germany, The Netherlands and Great Britain to test uploading of such information. During the reporting period, these three countries uploaded information on more than 290 000 genetic tests for over 115 000 Holstein cows and bulls to the Interbull Centre’s Database.

The purpose of AnimInfo is to collect reported information from NGECs having access to IDEA and to use AnimInfo as an international exchange area for information on any animals that is present in the IDEA Pedigree module. As AnimInfo does not verify or authorise any of the information reported by NGECs, the WHFF Council required a clear policy to enable the resolution of errors and conflicts: If conflicting information on a given type of information for the same animal is uploaded, the conflict needs to be resolved by the NGECs that provided the conflicting information. If they cannot resolve the conflict, they have to contact the bull owner and ask for assistance. Until the resolution of the conflicts both sets of data on the specific animal is disseminated. Following resolution, the correct information should be uploaded as soon as possible. In order to assist with the identification of such conflicts, the NGECs can receive a report from Interbull Centre including all conflicting information for a given type.

Currently 32 National Genetic Evaluations Centres (see www.interbull.org/ib/users_map); are involved in International Bull Evaluations for Holstein cattle. All 32 NGEC’s will have the opportunity to join the exchange of information on genetic traits which has been officially launched in May 2019 as soon as the relevant agreement are signed.

6.5. 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 breed code ‘RED’ and ‘HOL’ for Holstein, and country code ‘USA’ and ‘840’ for animals born in the USA have created several animal ID duplicate cases, leading to suboptimal genetic evaluations. In the continual effort to improve the service offered to its users, The Interbull SC has decided to support:

1. A proposal by the ICAR ID Subcommittee that addresses the use of both alphabetical and numerical Country codes (specifically USA/840, but also CAN/124), and

2. Plans developed by the Interbull Centre and a number of country representatives, to address the issues arising due to the use of Breed code 'RED' for red Holstein.

Breed code for Holstein

Implementation plans were made available to the Interbull Community ahead of the Technical Workshop in August 2018, and the RED/HOL changes were introduced before the September 2018 test run.

From the December 2018 Routine Run onwards:

1. The breed code 'RED' has been banned from IDEA pedigree, both red and black Holstein cattle will be identified using breed code 'HOL'.
2. The HOL red type information is preserved through the IDEA module "AnimInfo": this information will be distributed with each run, so that 'Red Holstein' lists can still be produced by individual countries wishing to do so.

90% of all RED breed codes have been converted to HOL. The remaining cases are a combination of old animals (67% have a birth year older than 1990) and/or animals for which the relative authoritative organisation does not have further information.

Country code for USA

In an ongoing effort to improve the accuracy of the identification, we continue to work on the correct use of the country code 'USA' and '840' for animals born/first registered in the USA. Once completed, one may expect that in exchange with the Interbull Centre:

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

Breed code for Simmental

In 2017, a new breed code for Simmental Beef (BSM) was introduced in an attempt to overcome issues with multiple organisations dealing with genetic evaluations (NGECs) of Simmental within one and the same country. This has however resulted in problems in other countries, affecting both dairy and beef evaluations for Simmental. Given the evolution of the problem, Interbull Centre has discussed this problem with the original countries that have multiple NGECs, as a result of which:

- i. The breed code for all Simmental animals will be: **SIM**
- ii. All animals with breed code 'BSM' will need to be cross-referenced in IDEA to the respective SIM animal.
- iii. Submission of new animals with breed code BSM will not be allowed anymore once this has been implemented
- iv. For exchange of pedigree data with Interbull Centre via IDEA, each country will need to nominate one organisation will be the authoritative organisation having the role to assure correctness of pedigree records.
- v. The proposed time for implementation of the above changes has been between June 13 and September 18 2019 (i.e. after the Beef April test run and before the commencing of the Beef October routine run).

6.6. 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, Canada.

As of 31 May 2019, 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). Note that this accreditation is a pre-requisite for organisations joining the GenoEx-PSE service (GenoEx.org) as reported in chapter 6.7. Further information is available on the ICAR website: 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:

- Agricultural Data Centre, Latvia - 2018-03-27
- Geno (for TINE), Norway - 2018-04-03
- Vereinigte Informationssysteme Tierhaltung w.V. (vit), Germany - 2018-04-05
- CRV, The Netherlands - 2018-04-06
- Nordisk Avelsvärdering (NAV) (for Växa Sverige), Sweden - 2018-04-16
- Czech Moravian Breeders' Corporation Inc, Czech Republic - 2018-11-28
- Qualitas (for Arbeitsgemeinschaft Schweizerischer Rinderzüchter (ASR)), Switzerland - 2018-12-05
- Estonian Animal Recording Centre (ARC), Estonia - 2019-01-11
- Irish Cattle Breeding Federation (ICBF), Ireland - 2019-01-14
- Studbook (for Agricultural Research Council), South Africa - 2019-02-04
- Scotland's Rural College (SRUC), Great Britain - 2019-02-20
- Croatian Agricultural Agency, Croatia - 2019-03-12
- The Breeding Services of the Slovak Republic, Slovak Republic - 2019-03-20

6.7. GenoEx-PSE

On 1 June 2018, GenoEx-PSE (Parentage SNP Exchange) was the first service to be launched on the Interbull Centre's International Genotype Exchange Platform. The main purpose of GenoEx-PSE is to provide a service for exchanging



standardised sets of SNP 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.

The GenoEx-PSE Annual Service Fee had previously been established at €1000. The Interbull Steering Committee acknowledged both the importance of GenoEx-PSE users being ICAR Accredited DNA Data Interpretation Centres, as well as the relevance of several organisations joining GenoEx-PSE before added value may be expected. It was therefore decided that no GenoEx-PSE service fees would be charged to those accredited organisations joining GenoEx-PSE in 2018, and a discount would apply for those joining in early 2019. Chapter 3.1 provides details on the organisations that had joined GenoEx-PSE by 31 May 2019.

GenoEx-PSE is available for any cattle breed; both beef and dairy. By 31 May 2019, genotypes of 64 breeds have been uploaded. Table 6.1 provides details on the major breeds and those that are under international genetic evaluation through Interbull.

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

Table 6.1: Size of the Interbull Centre operations for GenoEx-PSE

GenoEx-PSE Breed	Animals	% Male	Number of SNP per animal (%)			
			196-200	191-195	186-190	<186
Holstein	26913	96%	77.2	18.7	2.6	1.5
Red Dairy Cattle	24779	99.8	4.7	0.2	19.5	75.5
Brown Swiss	1844	29.7	28.4	54.1	11.3	6.2
Guernsey	0	-	-	-	-	-
Jersey	500	100	71.6	27	1.2	0.2
Simmental	842	100	68.3	28.5	17.8	1.4
Belgian Blue	238	100	15.1	79.4	4.2	1.3
Meuse Rhine Yssel	160	100	88.8	10	0.6	0.6
Charolais	327	100	27.5	66.7	5.5	0.6
Limousin	220	100	30.1	64.5	4.1	0.5
Aberdeen Angus	223	100	21.5	72.6	4	1.8
Hereford	112	100	30.4	62.5	6.3	0.9
Other*	529	100	28.2	65.2	4.3	2.3
Total	57021	94.3	42.6	13.3	10.3	33.8

* Other breeds include: AUB (Aubrac) - 46, BAQ (Blonde d'Aquitaine) - 50, BER (Belgium Red & White) - 1, BRF (British Frisian) - 50, DFR (Dutch Frisian) - 77, DXT (Dexter) - 13, GLW (Galloway) - 3, HLA (Highland Cattle) - 3, KER (Kerry) - 4, MGR (Murray-Grey) - 1, MON (Montbéliard) - 45, MSH (Dairy Shorthorn) - 84, NMD (Normandy) - 11, PAR (Parthenaise) - 41, PIE (Piedmont) - 29, RDP (Rouge des Pres) - 2, ROM (Romagnola) - 3, SAL (Salers) - 55, UCK (Uckermärker) - 6, WAG (Wagyu) - 5.

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

The SNPMace Project officially started 7 May 2018 with the signature of the research agreement. This was soon followed by letters of agreement with members of the InterGenomics Brown Swiss (IG-BSW) on the use of IG-BSW data in the SNPMace project.

The SNPMace Working Group exists of Enrico Santus (Chair), Toine Roozen (Secretary), Mike Goddard, Vincent Ducrocq, Esa Mäntysaari, Zengting Liu and Haifa Benhajali. Work is carried out by Abdulqader Jighly (Melbourne) and Haifa Benhajali (Interbull Centre). SNPMace WG meetings were held on 9 February 2018, 7 May 2018, 6 August 2018, 10 October 2018, 5 April 2019 and 16 May 2019.

In November 2018, a SNPMace project meeting was held in Uppsala where Toine Roozen, Hossein Jorjani, Haifa Benhajali discussed with Mike Goddard the technical issues of the project, the priorities for ITBC, and the handover of the project from Hossein to Haifa.

The SNPMace feasibility project was addressed during the 2018 Business Meeting in Auckland, and the 2018 Interbull Technical Workshop in Dubrovnik.

Interbull Centre used Brown Swiss data to run 6 national evaluations for the 6 countries included in the study (CHE, FRA, DEA, USA, SVN and ITA) using only national information. SNP solutions and ZRZ matrices for each of the countries were delivered to the team in Melbourne in July 2018. A first set of SNPMace SNP solutions were delivered back to Interbull Centre in August, 2018. Following the working group meeting in Dubrovnik, and given that the official InterGenomics evaluation is run using a single trait model, a new task was assigned to Interbull Centre; running a multi-trait evaluation that can be used to validate the SNPMace international solutions

In January 2019, ITBC delivered multi-trait SNP solutions to Melbourne and results from the comparison of the single and multi-trait GEBVs calculated by ITBC using genotypes to those based on the SNPMace solutions calculated by the team in Melbourne. The review of the results and the calculation process by ITBC and Melbourne team has led to the decision to restart all the calculations, single and multi-trait after removing any overlap in the phenotypic data used in the project. New single trait SNP solutions and ZRZ matrices were delivered to Melbourne in March 2019 to calculate new SNPMace solutions for all countries. The new validation study showed improvement in the correlations between the GEBVs calculated using ITBC solutions and SNPMace solutions. However, some problems related mainly to the small populations (FRA, SVN and USA) were detected. The single trait SNP solutions and GEBVs for those countries showed a very low genetic variance which was not seen in the case of the multi-trait evaluation. All investigations of the data and results including communication with the software developer (Paul VanRaden) did not lead to a good understanding of the root of the problem. The exclusion of the three small countries did not have any impact on the correlations calculated for the rest of the countries. SNPMace solutions are still highly correlated with the single trait solutions and not as high as expected when we compare to the multi-trait solutions. Two actions have been proposed to better understand the issue:

- ITBC to re-run all the evaluations using another software to see if the small variance is data related or software related;
- Melbourne to re-run the SNPMace software using other data to check if the results are due to data delivered by ITBC or to the software itself.

Because of either lack of resources or time needed, both actions have been scheduled after the 2019 Interbull Annual Meeting in Cincinnati. The preliminary results for the 6 countries will be presented during the 2019 Interbull Annual Meeting.

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

Interbull’s Genomic Pre-selection Working Group (GPS WG) was formed in February 2018 (ITC meeting, Auckland). Members of the group are Pete Sullivan, Esa Mäntysaari, Gerben de Jong and Haifa Benhajali. The WG activities started on May 2018. Four Web meetings (in addition to email communication) were held (9 May 2018, 8 June 2018, 8 August 2018 and 4 February 2019). The purpose of the WG was to develop a simulation method that can be used to mimic genomic pre-selection bias in MACE input. Haifa used a special version of Mix99 (provided by LUKE) to create a set of simulated data where a genomic pre-selection bias was introduced for one country (over 30). The pedigree and data structure were retained from the official MACE 1804r Routine run and a set of control and simulated data were used as input for the current MACE system. Results of the simulation and the use of simulated data in MACE were presented at the ITC meeting in Dubrovnik. The method developed by the WG was approved by the ITC and the recommendation was to add another scenario; one where the country does not take the GPS bias into account. Given the strong interaction between this WG and the Future MACE Project, ITC also recommended to extend the WG activities to include all Future MACE studies. The GPS WG group became thus the GPS & Future MACE WG.

During its conference call on 4 February 2019, the WG defined a new simulation method in order to mimic the situation where the country national system does not account for the GPS bias. Haifa is currently applying this method on MACE input data. Results will be presented at the Interbull open meeting in Cincinnati, June 2019.

Regarding Future Mace, the WG discussed the four potential areas of methodology research, on ways to accommodate genomic pre-selection at the national level within a future MACE model, that were presented in Dubrovnik: 1) New genetic grouping strategies; 2) Modifying the A-matrix with a 3rd parent; 3) Data augmentation for genomically culled bulls; 4) Bayesian priors based on GEBV-EBV at the national level. Pete has been exploring the first area (New genetic grouping strategies) in national models with some degree of success, and sees this as a logical starting point for Future MACE. Some of his work on 2) using a modified A-matrix and 3) with data augmentation has had limited success so far. The WG has not investigated the fourth area yet, but continues to consider this as a viable option. Leading up to the 2019 Interbull meetings in Cincinnati, Pete concentrates on the first area (genetic grouping), and will work on software developments to provide options Haifa can test on simulated data.

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

Countries have been asked to test the new standardised Interbull Method to calculate genomic reliabilities and to give feedback at the Interbull Technical workshop in Dubrovnik, 2018. The workshop session showed the interest for a standardised method that could allow an across country comparison of reliabilities. Some technical aspects still need to be investigated by the WG, for example the effect of allele frequencies on the estimated reliabilities. The current recommendation is to use the base population allele frequencies. Presentations from the workshop also showed the importance of giving recommendations on how to calculate the f value used for the reliability adjustment step.

The WG had a conference call in January, 2019 where Zengting Liu presented his findings about the impact of alleles frequency (base or current population estimates) on GREL. Minor impact was found and original recommendations of the WG were kept. The additional document about the use of the f factor was written by Zengting Liu and reviewed by the group. ITBC made it available online in May 2019 and distributed the information to the countries.

7.4. 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 of the group), 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).

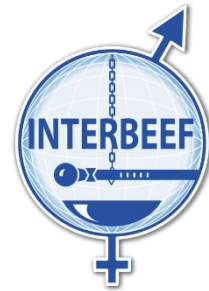
The WG had three conference calls in February, April and May 2019, and is reviewing the theory behind a new approach which combines the above two key elements and focus on the residuals between full and reduced data sets.

7.5. InterGenomics-Holstein (“IgHOL”)

Many of Interbull’s current customers from Holstein populations involved in MACE asked for an investigation on how the InterGenomics model could be used by Interbull Centre to provide services required for genomic evaluation to these countries. Following a first, promising InterGenomics-Holstein research run in 2017 to investigate the practical implementation of such service, a second InterGenomics-Holstein research run was organised in 2018. This run concentrated on increasing the InterGenomics-Holstein Reference Population. This was achieved through the data supplied by two additional countries, Israel and South Korea, as well as additional data from the original countries (Ireland, Slovenia, Uruguay, Portugal, Croatia and South Africa). The results were discussed during the 2018 Interbull Technical Workshop, where the countries involved in InterGenomics-Holstein shared their enthusiasm on the results of this run and progress since the first run in 2017. A number of technical issues (such as validation and reliabilities) have since been discussed by the Interbull Technical Committee and Steering Committee in November and December 2018. A new round of validation is underway at the Interbull Centre. Additionally, the potential benefits of sharing genotypes from exporting countries that would be willing to contribute genotypes of influential sires in the importing countries are being investigated. These are all steps towards a new routine service for Holstein, following the concept of research runs, pilot runs and a successful test run.

8. RESEARCH & DEVELOPMENT – Beef

For Interbeef research projects that are not performed by Interbull Centre, data 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

A data call for the research project for carcass traits was sent to member organisations on 2 August 2018. The research will be performed by ICBF, Ireland, and the traits of interest are Carcass weight (cwe), Carcass conformation (cco) and Carcass fat (cfa). The breeds included in the project are Charolais, Limousine and Simmental. Data was received from 4 countries (DFS, GBR, IRL and CHE) and - after renumbering animal and herd IDs - sent to ICBF on the 19 October 2018.

8.2. Fertility project

The fertility project is led by vit, Germany. The latest data call for the research project on fertility was sent to member organisations on 12 November 2018. With this data call, a program, written by vit researchers, to calculate future calving was distributed. Data from 6 countries (DFS, DEU, GBR, IRL, FRA, CHE) was transferred to vit in January 2019.

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. Among the Interbull validation methods, method III is most likely the method that could be adapted for use with beef evaluations. This issue will be discussed in Prague, 2019 and 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. Adjustment of the Interbeef processes to the implementation of the Performance database

As reported in §9.1, ITBC staff has developed and employed a Performance database that can be used by countries to upload the performance files they usually submit through the Interbull FTP server. The Interbeef processes have been reviewed and adjusted to the introduction of the Performance database. The Interbull Centre provided all the necessary tools to the countries to make this transition easy and smooth; a converting program to convert their usual flat files to XML files that can be uploaded to the database, a checking program to check the format and consistency of their files and manuals for each new software/module.

Starting with the April 2019 Interbeef Test Run, files are uploaded using the new Beef module in IDEA. As soon as the file submitted by the country is processed by the system, both the submitting organisation and ITBC staff have access to a full report about the data consistency with the previous run data. This report can be used by our customers to detect potential issues in their data and help

decide whether to submit the data they uploaded. All communication about the run is now done and saved in IDEA. The implementation of the new database has considerably improved the quality of the data used, and reduced the manual steps and time needed to check and extract data for the evaluation. All performance data used for Interbeef runs is now extracted from the Performance database. All the previous checking programs were replaced by the Beef_verify program that is run automatically inside IDEA every time data is uploaded. New programs were developed to manage the extraction step and to process the extracted data. The new processes were tested during the April 2019 Interbeef Test Run and results will be presented at the Interbeef Technical Meeting in Prague, June 2019.

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. IDEA Performance Database

During the current reporting period, ITBC staff developed and implemented a Performance Database to complement already existing systems such as AnimInfo, Pedigree Database and GenoEx-PSE.

The Performance database can be used by countries to upload (phenotypic) performance data. The Beta version of this new database was launched on 11 April 2019 and used to upload, check and extract data for the 2019 April Interbeef Test Run. The implementation of this latest database has already considerably improved the quality of the data used in the Interbeef evaluations, and provides opportunities for exchange and evaluations of an additional range of traits in beef, dairy and project activities.

Table 9.1: Interbull Centre Databases and Data Exchange

Platform	Database	Records	Breeds ⁺	First use	Comments
Interbull Data Exchange Area (IDEA)	Pedigree data	35 340 746	64	2009	Total Number of animals
	EBVs	40 045 829	25	2013	Number of EBVs in April 2019 Interbull Routine run
	Performance data	40 969 517	13	2019	Number of records in April 2019 Interbeef Test Run
	Genetic Traits	22 534	1	2019	Total number of records; Currently Holstein only
	Genotyped records for InterGenomics*	44 565	1	2014	Currently Brown Swiss only
International Genotype Exchange Platform	GenoEx-PSE: SNP Records for Parentage Verification	84 555	32	2019	

* Note that genotype exchange for InterGenomics evaluations takes place through the upload of flat files.

+ Breed is based on the Breed code in the Interbull ID.

9.2. System Maintenance and Development

During the current reporting period, most of Interbull Centre’s internal program repositories (including version control) have been converted from “mercurial” to “git”. At the same time a self-hosted version

of GitLab has been taken into production, that hosts all the git repositories. This gives an enhanced way to handle issues and documentation related, mainly, to repositories.

Security has been reviewed and improvements has been implemented; for example, an Intrusion Detection System has been introduced on servers, which monitors tampering and make sure of the integrity of files.

Testing and improvements have been done for backups, where complexity has been reduced to streamline and simplify the backup process and make process parallel to reduce time spent. Important systems have been upgraded to make use of the latest features and security enhancements.

Planning and testing of changes to meet future demands to be able to increase scalability and performance are in progress, mainly through the implementation calculating system that is integrated with a storage cluster. The system under development will have a job scheduler (Slurm) and a distributed/replicated cluster storage, which is built up in a modular way to be able to expand when demand is increasing.

The calculating servers contains processors with high clock frequency and large amount of RAM, with the possibility to run in parallel, to meet the requirements and the demands.

The storage cluster (gluster) is both distributed and replicated with multiple backups.

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 acknowledged.

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 plans:

“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.

In 2018 the SC approved a request for a change to the Interbull Service Calendar that will help with this planning, while respecting the release date schedules as specified in the Interbull Code of Practice. This has led to the pre-release of GMACE and InterGenomics evaluation results being one day earlier than originally scheduled.

This also led to the changes to the Interbull Service Calendar for 2019 onwards: the submission of GEBV (and files 733 and 734) and the GMACE and InterGenomics pre-release will happen one day earlier in comparison to previous years. These changes have been highlighted in the 2019 calendar.

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. 2018 Interbull Annual Meeting

From 10-13 February 2018 the Interbull Meeting was held in Auckland, New Zealand in conjunction with the 41st **ICAR biannual meeting** and the 11th **World Congress on Genetics Applied to Livestock Production (WCGALP)**.

The Interbull Technical Committee, Steering Committee and Scientific Advisory Committee, as well as the SNPmace WG met during the Interbull meeting.

Interbull Chair Reinhard Reents welcomed more than 120 participants from 34 countries to the Interbull Business Meetings on 10 and 11 February 2018. Interbull activities were presented by Reinhard Reents, Toine Roozen, Hossein Jorjani, Valentina Palucci, Joanna Sendeka, Enrico Santus and Brian Van Doormaal, Gert Pedersen Aamand and Andrew Cromie, covering Interbull Centre's organisational structure, personnel, finance, service and operations, and its role as the EU Reference Centre, as well as Interbull and ICAR governance and R&D activities, including SNPmace, ICAR Accreditation of DNA Data Interpretation Centres, GenoEx-PSE and Interbeef.

Five Open Meetings and two Business Meetings were held on 10 and 11 February, while on 12 and 13 February five joint Interbull-WCGALP scientific sessions were organised. A record 400 people attended the Interbull Open session 'Addressing the challenges of genomic selection in international genetic and genomic evaluations in dairy and beef cattle', and the other Open and Joint sessions were also well attended with audiences of 100-300.

Interbull Open Sessions:

1. Availability and use of genetic and genomic information in dairy and beef herd management;
2. R&D in (inter)national evaluations: Calving traits and fertility in dairy and beef cattle;
3. R&D in (inter)national evaluations: Implementation of new traits in dairy and beef cattle;
4. Free Communication;
5. Addressing the challenges of genomic selection in international genetic and genomic evaluations in dairy and beef cattle.

Joint Interbull-WCGALP sessions related to 'Methods and Tools' for:

1. Models and Computing Strategies;
2. Software;
3. GWAS;
4. Prediction (2 sessions).

Reports are available at www.interbull.org/ib/itbcreports, while presentations are available online for the Business Meeting (www.interbull.org/ib/bm_auckland_2018) and the Open and Joint Sessions (www.interbull.org/ib/presentation_auckland_2018).

Photos of these Meetings are available on: <http://interbull30years.blogspot.se/2018/02/interbull-meetings-auckland-nzl-2018.html>.

12.2. Joint Interbull-ADSA Symposium

As part of the 2018 ADSA annual meeting (24-27 June 2018, Knoxville, Tennessee, USA), ADSA and Interbull organised a Symposium on "***Phenotyping and genetics in the New Era of sensor data from automation***". This symposium, designed for scientists and students with an interest in genetic/genomic evaluations and breeding programs, and making use of new data collected automatically on individual animals and their environment.

The joint Interbull-ADSA symposium, chaired by Marj Faust, included presentations by six invited speakers covering various topics related to getting and handling data from automatic recording systems: Mariska van der Voort (Animal Breeding and Genetics Centre, Wageningen, the Netherlands), Gil Katz (Afimilk, Israel), Daniel Lefebvre (McGill University, Canada), Nicolas Gengler (Gembloux, Belgium), Miron Livny (University of Wisconsin, USA) and Nathan Miller (University of Wisconsin, USA). Presentations are available on: http://www.interbull.org/ib/2018_interbull_adsa_ppt

12.3. 2018 Interbull Technical Workshop

Sixty-five people participated in the Interbull Technical Workshop in Dubrovnik on 25 and 26 August 2018, during which "*SNPMace*", "*InterGenomics-Holstein*", "*Mendelian Sampling Test*" and "*Genomic Reliability*" were presented and discussed. Presentations are available on: www.interbull.org/ib/2018_interbull_ws. Interbull Committees, participating countries and Interbull Centre Staff are working on the follow up of these topics, and they will be addressed during the period leading up to the 2019 Interbull Annual Meeting. Photos of the meeting are available on <http://interbull30years.blogspot.com/2019/06/interbull-meetings-technical-workshop.html>

12.4. 2018 Interbull-EAAP Symposium

EAAP and Interbull, once again, organised very well attended joint sessions on the first day of the 69th Annual Meeting of EAAP in Dubrovnik:

- *Cow genotyping for genomic selection, management and marketing in cattle*
- *Optimization of a genomic breeding program for small-sized cattle populations*

Presentations are available on: http://www.interbull.org/ib/2018_itb_eaap_presentation.

Satellite meetings were organised for Interbull Steering and Technical Committees and InterGenomics-Holstein.

12.5. 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.). The Interbull Annual Meetings are scheduled to take place as follows:

- 2019 (June):** The 2019 Interbull Annual Meeting will be organised in collaboration with ADSA in Cincinnati, Ohio;
- 2020 (June):** The Joint ICAR-Interbull Meeting will be held in Leeuwarden, The Netherlands;
- 2021 (August):** The 2021 Interbull Annual Meeting will precede the EAAP meeting in Davos, Switzerland.

Other Interbull Meetings

Updated 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 2 issues of the Interbull Bulletin were published:

- No 53 (2018): Proceedings of the 2018 Interbull Meeting (Auckland, New Zealand, February 10 - 12 2018)
- No 54 (2018): Proceedings of the 2018 Interbull Technical Workshop (Dubrovnik, Croatia, August 25 - 26 2018).

13.2. Web Site



The Interbull website (www.interbull.org) has been updated with the latest information, and the website for the Genotype Exchange Platform (<https://GenoEx.org>) has been put into service. 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/>) and 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

- M.E. Goddard, A. Jighly, **H. Benhajali**, **H. Jorjani**, Z. Liu. 2018
SNPMace – A meta-analysis to estimate SNP effects by combining results from multiple countries. *Interbull Bulletin 54*, Proceedings of the 2018 Interbull Workshop, Dubrovnik, Croatia, August 25 - 26 2018.
<https://journal.interbull.org/index.php/ib/article/view/1464/1531>
- **A.W.M. Roozen**. 2019. "Interbull hjälpar till med att hitta de bästa tjurarna". Svensk Veterinär Tidning (Swedish Veterinary Journal), No. 5, 20 May 2019

Publication of additional information:

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