



## CENTRE FOR GENETICS

### Bull ranking and results of genetic evaluations

In 2018 the web page with bull ranking was developed further in order to include information on availability of semen. Thanks to this, the ranking of bulls presented on the CGen website was enriched with new functionality that allows quick and easy access to information about which bulls are available on the Polish market. Most importantly, both the ranking and bull card, display information on which company offers semen of a given bull. If a bull is available, his card will contain information that „semen is available at”, along with a list of companies that offer semen of this individual. However, if the bull registration process has not been completed, the bull will have a status „semen available soon”. As a result of changes introduced in the bull ranking, a new column named „semen access” was added. The introduction of this service has changed the way bulls are presented. Currently, the default ranking is displayed only for individuals who have been marked as „available” by semen distributors. Naturally, one can still generate a full ranking containing all bulls evaluated in a given season (also those that have not been marked as available on the CGen website). To do this, one has to select „All bulls” from the context menu instead of the default „Available semen”.

The ranking of bulls was also enriched with information on the availability of conventional and sexed semen. Additionally, there is a possibility to generate a bull ranking for a particular type of semen and a selected supplier. The current list includes twenty two companies selling bull semen on the Polish market.

The new functionality was introduced as a response to the needs of breeders and semen distributors. In addition to changes in the presentation of bull ranking, the bull card was also updated. Currently, the panel presenting semen availability was divided into two parts. The first panel contains companies offering conventional and the second sexed semen of a given bull. We encourage everyone to use the bull ranking, which is available at [www.cgen.pl/indeksy/ocena](http://www.cgen.pl/indeksy/ocena).

| Rank | ID             | Name      | PF    | Production | Conformation | Fertility | Somatic cells | Longevity | Semen access |
|------|----------------|-----------|-------|------------|--------------|-----------|---------------|-----------|--------------|
| 1    | US3014562366   | BRAVENESS | 157 * | 138        | 127          | 130       | 120           | 139       | 2            |
| 2    | DE1405290977   | TOPMODEL  | 155 * | 129        | 133          | 108       | 118           | 143       | 1            |
| 3    | 84003134971749 | LAVONTE   | 154 * | 137        | 120          | 113       | 121           | 145       | 2            |
| 4    | DE003104580609 | Lentob    | 154 * | 146        | 123          | 109       | 109           | 141       | 1            |

## Development of models for genetic evaluations

Production traits and somatic cell count were the first group of traits for which the evaluation system was developed. The key element of this system is a new model for breeding value evaluation. In 2018 CGen passed the Interbull validation for milk yield, fat yield and protein yield. This confirms CGen's competence to conduct genetic evaluations. In 2018, a model for calving ease was also developed. Interbull validation is planned for early 2019. Calving ease is one of the most important factors affecting the economic profit on the farm and should be an important element of the breeding program. Even though in Poland phenotypic information for calving ease is collected, genetic evaluation of this trait is not conducted. Polish breeders had been asking for introduction of routine breeding value assessment for a long time. That is why, the Centre for Genetics (CGen) PFHBiPM started a project aimed at meeting the needs of breeders. A detailed analysis of the data allowed us to create a model for evaluation of calving ease. Estimated heritability for direct and maternal effects was 6.6 and 3.5%, respectively. These values are at the level of other European countries, such as France (6.6% and 3.2%, for direct and maternal effects, respectively) or the Netherlands (6.8% and 4.8%).

The second new trait for which a new model was developed was lactation persistency. Persistency of lactation is defined as the ability to maintain stable milk yield during lactation. Lactation curves of persistent cows are more flat after the peak of lactation, than in the case of cows with low lactation persistency, where after the peak a rapid decrease in milk yield is observed. Based on the literature and own research, one of three definitions of lactation persistency was chosen. Heritability of this trait was estimated, genetic trends were determined, and correlations between milk yield and persistency were analysed. The existing system for genetic evaluations was modified to include lactation persistency. This trait is not subject to official Interbull validation. Internal validation of the model was performed.



### Inbreeding

Inbreeding depression is defined as a decrease in the productivity of animals caused by an increase in inbreeding. It applies to both production and functional traits. The causes of this phenomenon are seen in the decrease of genetic variability and increase in the occurrence of unfavorable alleles. In an intensively selected population, it is impossible to avoid mating of related animals. The whole population of cows under milk recording in Poland is more or less related to each other. Centre for Genetics estimated inbreeding using all of the available pedigree records. This allowed us to perform continuous monitoring of trends and determine the impact of inbreeding on production traits, i.e. milk yield, protein yield, and fat yield. Inbreeding had a negative effect on all of the analysed traits. Increase of inbreeding by 1% resulted in a decrease of 305 day milk yield by 19.61 kg, 20.21 kg, 21.09 kg in lactation 1, 2 and 3, respectively. A similar trend was observed for fat and protein yield, where the estimated inbreeding depression was 0.85 kg, 0.94 kg, 1.04 kg and 0.60 kg, 0.68 kg, 0.65 kg, respectively. Inbreeding depression is particularly severe for the breeder

because it has a direct effect on the profitability of production. The effect of inbreeding depression translates into economic losses caused by unfavorable mating of individuals in terms of inbreeding. For example, the average level of inbreeding of cows in the first lactation in 2018 in Poland was 3.6%. This means that the average loss in productivity of each cow as a result of unfavorable mating was 71 kg of milk, 3 kg of fat and 2 kg of protein. The level of inbreeding of already living individuals cannot be changed, but it is possible to limit the level of inbreeding of the future generation. This will lead to an increase of profit per cow with the same amount of labour and costs.



### International cooperation

Centre for Genetics started a cooperation with the University of Georgia (UGA) in the United States to implement novel methods into genetic evaluations in Poland. In the last week of November 2018, a representative of the PFHBiPM Center for Genetics visited Athens (GA, USA). This was a part of an ongoing cooperation with the team of prof. Ignacy Misztal which is going to facilitate the implementation of the latest technologies in genetic evaluations in our country. As part of this cooperation, the CGen team received access to the world's leading software for genomic and conventional evaluations. Work is also underway to introduce new and more accurate genomic evaluation methods. It looks like the Polish breeders will not have to wait long for the results of this cooperation.

Another important international link was created between Centre for Genetics and dr hab. Janusz Jamrozik who works with Canadian Dairy Network (CDN). It is one of the leading units working on development and implementation of new methods for genetic evaluation of dairy cattle. For many years it has been entirely financed by breeders and breeding companies, which themselves decide on the direction of development. PFHBiPM invited dr Jamrozik to visit to Centre for Genetics in October 2018. This allowed us to take advantage of his experience in creation a hoof health index, which is being developed by CGen.

Centre for Genetics also takes part in meetings and initiatives conducted by EuroGenomics Cooperative such as harmonisation of genetic evaluations. This project is focused on development of a golden standard for traits that are evaluated by EuroGenomics member countries. This is going to provide a standardised methodology for genetic evaluation in all member countries and increase accuracy of evaluations. Participation in this project enables us to achieve greater benefits from the data exchanged within the framework of the EuroGenomics Cooperative. The main advantage of the project will be a better quality of genetic evaluations.



### "CGen trimming" project

The Centre for Genetics is pursuing "CGen trimming" project to improve hoof health on Polish farms. This will be achieved by genetic selection and better herd management. CGen is currently developing methods for genetic evaluation of hoof health. Herd management can be improved through reports generated by "CGen trimming" application. Hoof trimmers involved in the

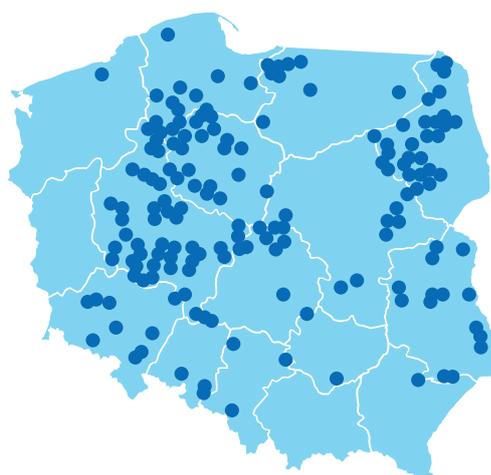
project record information on cow health status and hoof disorders during farm visits. Identification and recording of lesions is based on “ICAR Claw Health Atlas” which was translated into Polish. “CGen trimming” project was conducted according to schedule for 2018. Hoof trimmers were still recording information on hoof health. More companies started using “CGen trimming” application. There were two workshops for trimmers (preliminary and periodical) and 32 trimmers from 15 companies received certificates. The aim of the training courses was to maintain high quality data recording.

**Table 1. List of companies whose employees received training certificates in 2018.**

| Company  | Phone number |
|--|--------------|
| BZDĘGA MICHAŁ UTRZYMANIE I PIELĘGNACJA ZWIERZĄT                      | 602 151 733  |
| DOROTA BAŁDYGA PHU AD-KOR BAŁDYGA                                    | 502 077 252  |
| KOPYTKO - KOREKCJA RACIC GRZEGORZ WYREMBAK                           | 660 889 142  |
| KOREKCJA RACIC KAROL JAROCH  | 785 333 998  |
| KOREKCJA RACIC PAWEŁ ŻELECHOWSKI                                     | 514 466 038  |
| KOREKCJA RACIC PRZEMYSŁAW CIEŚLAK                                    | 510 327 812  |
| KOREKTPOL ZAMBRÓW PIOTR JAŻWIŃSKI KATARZYNA JAŻWIŃSKA SPÓŁKA CYWILNA | 692 146 967  |
| MICHAŁ OŁDZIEJEWSKI  | 694 048 944  |
| PRO CARE DANIEL TYBOROWSKI   | 606 237 273  |
| PROFESJONALNA KOREKCJA RACIC INŻ. TECH. WET. ARKADIUSZ KULPIŃSKI     | 669 407 430  |
| SZYMON ZAJĄCZEK  | 539 923 670  |
| TOMASZ GRENIK  | 535 983 524  |
| USŁUGI WETERYNARYJNE MICHAŁ HĄDZLIK                                  | 601 147 917  |
| USŁUGI ZOOTECHNICZNE "ZOOSEMIK"                                      | 605 363 347  |
| ZDROWE RACICE SP. Z O.O.   | 794 020 088  |

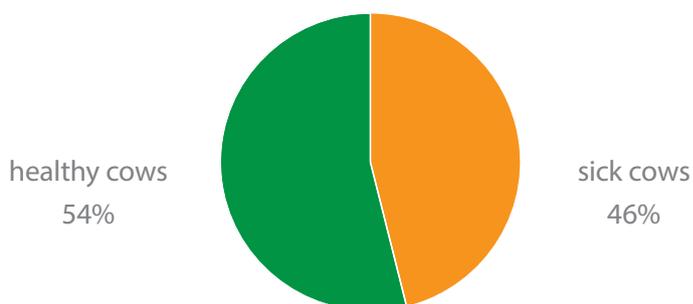
Herds with health data recording were located across the whole territory of Poland. The highest number of herds were in wielkopolskie (67), kujawsko-pomorskie (34), podlaskie (34) and dolnośląskie (17) voivodeships. It should be mentioned that in dolnośląskie a quarter of all cows participated in the project.

**Map 1. Location of herds in “CGen trimming” project**



Information recorded by hoof trimmers in 2018 comprised 53 219 records from 29 006 cows. Every record refers to one trimming. A lot of cows have only one trimming recorded because of the early stage of data collection. It should be mentioned that over 40% of cows are primiparous. Apart from that 2083 records refer to heifers. It is a good situation because a lot of youngstock will have recorded information about hoof health in the future for the whole life. It will have an impact on accuracy of genetic evaluations. Majority of records are from routine visits on farms and others refer to interventions. Such division is important for breeders due to costs of treatment.

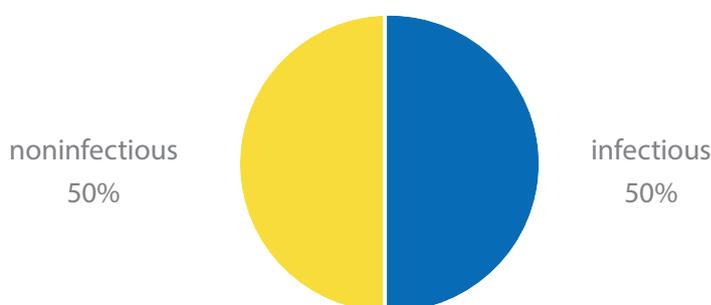
**Figure 1. Health status at trimming.**



Results from analyses shows that 46% of cows that were trimmed had at least 1 hoof disease (Figure 1). It is comparable to other countries. For example a similar result was reported in Canada and a bit lower in Spain.

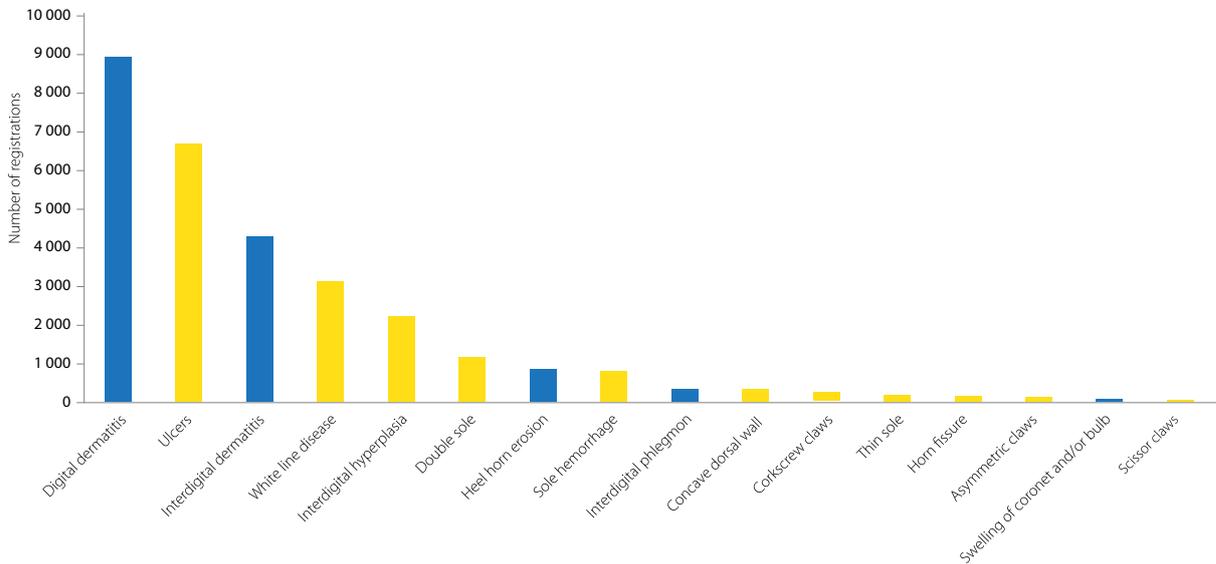
Additionally, CGen analysed only new lesions (lesions which were not reported for at least 4 months on a given claw). Disease were divided into two groups - infectious and noninfectious. Infectious diseases were: digital dermatitis (DD), interdigital dermatitis (ID), heel horn erosion (HHE) and interdigital phlegmon (IP). Noninfectious diseases were: ulcers (U), white line disease (WLD). In the analysed population these two types of diseases had equal incidence (Figure 2).

**Figure 2. Incidence of infectious and noninfectious hoof lesions in Polish population (only new cases).**



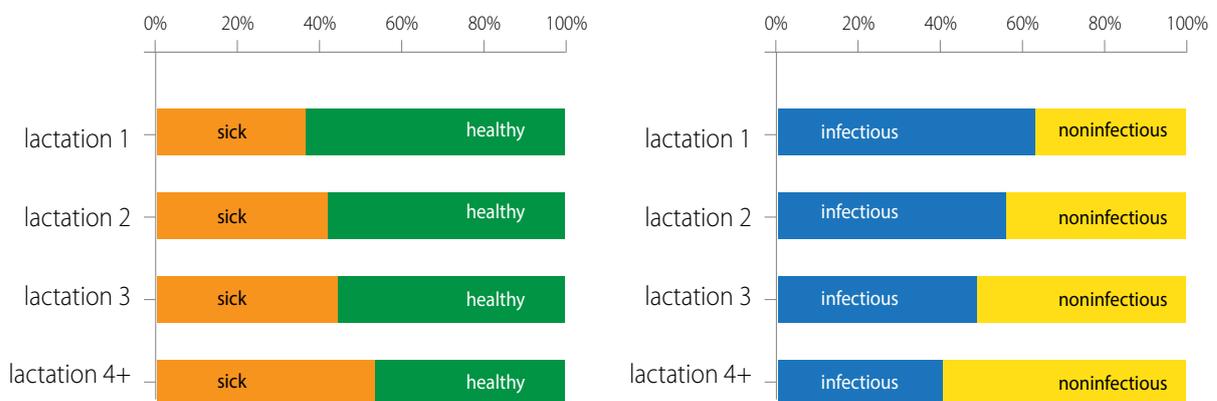
More than a half of recorded lesions are represented by two of them (Figure 3). The most frequent disease is digital dermatitis (DD) which is also a problem in other countries. The next one is ulcers (U) present in all herds with at least 100 recordings. All hoof lesions were described in "Hodowla i Chów Bydła" monthly from June 2018.

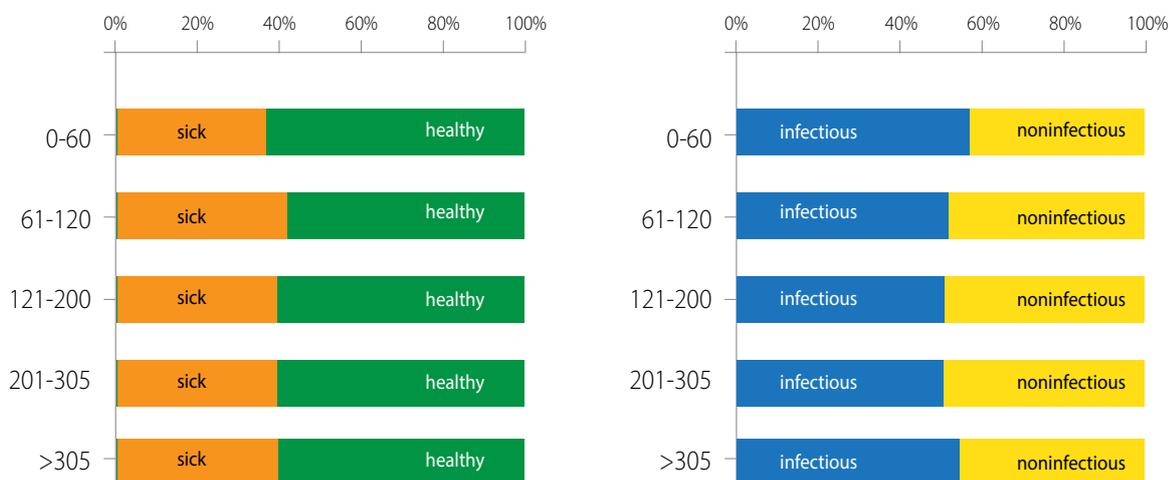
**Figure 3. Occurrence of each hoof health disease in the analysed population (only new cases).**



Sickness rate and occurrence of hoof lesions type in each lactation and stage of lactation are important information for breeders. On average, the amount of sick cattle increases with the number of lactation in Polish population. At the same time, the frequency of noninfectious lesions increases s/p/e of diseases are related to age of cattle (Figure 4). Trends during lactation are not so clear. New cases occur a bit more frequently around the peak of lactation and shortly afterwards - around 61-120 days in milk. It should be noticed that a lot of new infectious cases occur before 60 days in milk and at the end of lactation (Figure 5).

**Figure 4. Sickness rate and occurrence of hoof lesion types in lactations (only new cases).**



**Figure 5. Sickness rate and occurrence of hoof lesion types in stages of lactations (only new cases).**

All of the above mentioned information about hoof health problems was included in annual reports. Each breeder who participated in the project will receive such a report from his hoof trimmer.

In 2018 CGen also performed initial genetic analyses. It was shown that resistance of Polish Holstein-Friesian cows to digital dermatitis (DD) has a genetic background. Heritability of digital dermatitis was 0.11. More records will enable CGen to perform more detailed analyses. Moreover, connection between phenotypic records and genotypes will allow us to develop genomic evaluations for DD. It will be a first step towards genetic improvement of hoof health in Poland. Subsequently, CGen is going to analyse other lesions to develop a hoof health index. The economic index will serve as a basis for selection of heifers and optimisation of mating.

“CGen trimming” project has strong potential. High quality of records will help to manage a herd in easier way and to make genetic evaluations of hoof health. Maintaining support from breeders and hoof trimmers can help to achieve results fast and get important feedback.



### Economic selection index

In 2018 a project focused on development of the first Polish economic index for Holstein-Friesian cattle was continued. CGen in cooperation with AbacusBio Limited - experienced specialists in selection indexes development for a lot of cattle breeds, prepared an index with economic meaning of traits. Economic index allows us to express breeding value in a monetary way using Polish currency - zloty. It can facilitate making important breeding decisions. Moreover, the use of genetic selection will be more effective and will lead to maximisation of profits through optimal selection.

Polish economic index was developed to meet the breeders needs. It was possible to get to know their preferences through a web survey. It was opened for a period of 4 months between 1 May and 31 August 2018. In the first part of the survey, respondents answered questions about farm character and breeding practice. In the second part, respondents were choosing which one of two economically similar traits is a problem in their herds. As a result, CGen received 359 completed surveys, out of which 87% were filled in by breeders and dairy farmers. Others were filled in by employees of the Polish Federation of Cattle Breeders and Dairy Farmers and artificial insemination companies. Analysis showed that Polish breeders consider functional traits as important ones and which can be improved by genetics. The survey showed that the majority of problems in herds is caused by lameness, ketosis, survival, mastitis and calving difficulty.

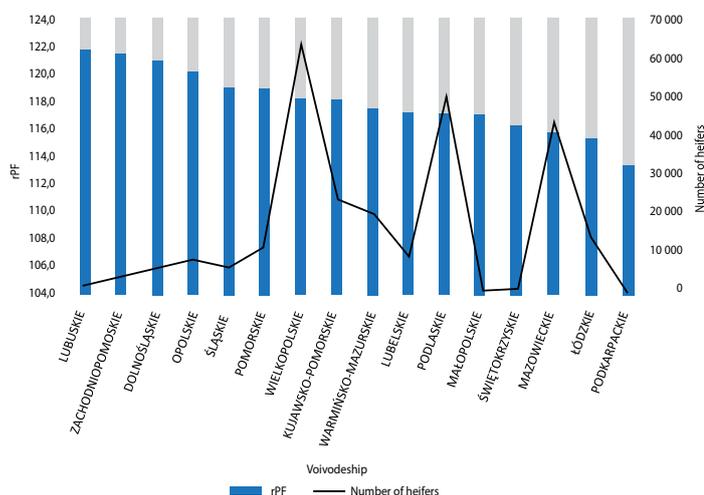
At the same time some breeders made their production and rearing of young stock costs available for CGen. They were complemented by information about the structure of Polish milk recording herds. Additionally information from Statistics Poland, Polish Chamber of Milk, agricultural and food institutions and dairies were also included. Analysis of historical records and trends provided an overview of economical situation of Polish breeders and milk producers. The above mentioned sources of information served as a basis to define economic indicators for traits included in the index. Additionally, index weights were prepared also for traits which are currently not evaluated in Poland but breeders would like to improve them in the future. Because of that these traits could be added to the index in the future. Polish economic selection index will most likely be implemented in 2019.



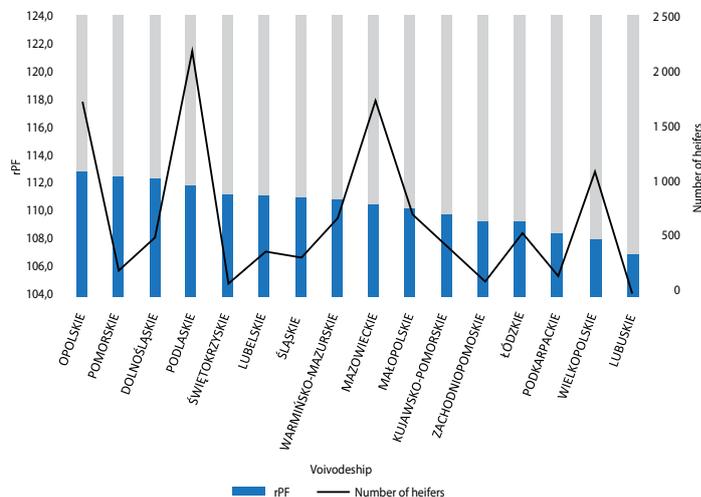
### Heifer ranking

Centre for Genetics calculates parental index of registered heifers and young bulls up to the age of 24 months. Figures below show mean parental index for HO (Figure 6) and RW heifers (Figure 7) born in 2018 divided into voivodeships.

**Figure 6. Mean parental index of HO heifers born in 2018 divided into voivodeships calculated based on 2018.3 evaluation period.**



**Figure 7. Mean parental index of RW heifers born in 2018 divided into voivodeships calculated based on 2018.3 evaluation period.**



CGen publishes rankings of top 5 000 heifers based on parental index. The ranking is updated on a weekly basis and it is available at [www.cgen.pl/indeksy](http://www.cgen.pl/indeksy).



### Herd ranking

CGen publishes a ranking with 1 000 best herds based on mean parental index of heifers. Herds with a minimum of 5 registered heifers are included in the ranking. Ranking is updated three times a year after every new genetic evaluation and it is available at [www.cgen.pl/indeksy](http://www.cgen.pl/indeksy).



### 1st Genetics Forum

The Centre for Genetics, the Cattle Breeding Division and the Milk Recording Division of Polish Federation of Cattle Breeders and Dairy Farmers organised the 1st Genetics Forum. Over 400 cattle breeders, dairy farmers and representatives of breeding organizations and dairies attended the conference in Poznan on 1 October 2018. Presentations were related to the development of Polish economic index, progress in genetic evaluations in Poland and usage of new technologies in cattle breeding. Moreover, herd management based on genotyping in Germany and France was shown. Recordings of all talks and presentations are available at [www.cgen.pl/forum-genetyczne](http://www.cgen.pl/forum-genetyczne).

76% of interviewees said they would like to attend the next edition of this event. That is why the 2nd Genetics Forum will be organised in autumn of 2019.



### **Other activities**

Knowledge transfer was performed by publishing 20 articles in "Hodowla i Chow Bydla" and one original scientific paper "Challenges in inbreeding estimation of large populations based on Polish Holstein-Friesian cattle pedigree" in the Journal of Applied Genetics (2018; 59 (3): 313-323). Moreover, CGen extended the list of items in the online dictionary for better understanding of genetics and breeding.

### **Contact details**

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