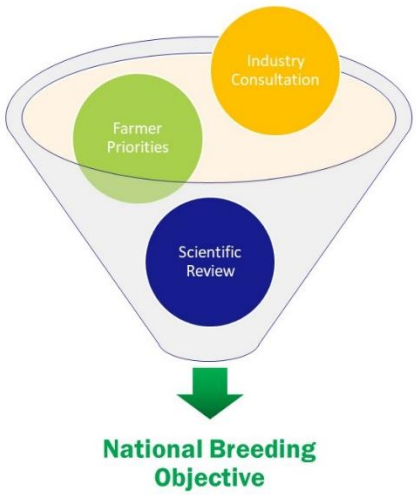
National Breeding Objective 2025

Options Paper

Your herd. Your asset. Your future.



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DataGene

Solutions for Herd Development

Contents

Acknowledgements

Prepared by Thuy Nguyen, Peter Thurn, Michelle Axford, Lee Monks, Gert Nieuwhof, Matthew Shaffer (DataGene) on behalf of the Genetic Evaluation Standing Committee.

The Genetic Evaluation Committee: Tim Jelbart (Chair until January 2025), Sam Simpson (Chair from February 2025), Daniel Abernethy, Andrew Aldridge, Janet Auchterlonie, Glen Barrett, Steph Bullen, Rohan Butler, Rob Derksen, Thuy Nguyen, Trevor Parrish, Bruce Ronalds, Matt Shaffer, Ruidong Xiang, Tim Weller.

This research was conducted by:

- Thuy Nguyen, Michelle Axford, Peter Thurn, Lee Monks, Gert Nieuwhof, Peter Williams, Matthew Shaffer (DataGene).
- Dan Watson (Down To Earth Research).
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- All participants of the online survey, in-depth interviews and stakeholder meetings.

1. Executive Summary

The National Breeding Objective (NBO) describes the collective breeding priorities for Australian dairy herds. Its purpose is to enable farmers to breed herds that meet the future needs of the Australian dairy industry. The current National Breeding Objective for the Australian dairy industry is aimed at increasing net farm profit and improved sustainability. It is expressed through the three breeding indices: Balanced Performance Index (BPI), Health Weighted Index (HWI) and Sustainability Index (SI). The NBO is updated every 5 years to ensure it adapts to changing dairy business operating conditions, advancements in breeding technologies, and new knowledge.

Following an extensive review that included consultation, bio-economic modelling and index testing, the following recommendations are proposed:

1.1. Key recommendations to industry

1. All indices and all breeds
   To reflect changes in the market, update pricing for milk components and input costs. Specifically, this means:
   - Changing the protein:fat ratio from 2:1 to close to 1:1.
   - Updating feed costs but keeping the same ratio with milk.
   - Shifting to using forecast milk prices.
2. Health Weighted Index
   Enhance to better reflect the needs of seasonal herds with pasture-based systems by adding calving ease and gestation length.
3. The base (the average animal for breeding values)
   Update in line with international best practice (Interbull).
4. Potential new breeding indices
   Further investigate the value to industry of an index specifically for hotter regions and one for total mixed ration (TMR) operations.
5. Communication
   Consider activities to improve industry understanding of the Feed Saved ABV and breeding strategies to increase teat length and improve rear teat placement.

2. Context

The National Breeding Objective (NBO) describes the collective breeding priorities for Australian dairy herds. Its purpose is to enable farmers to breed herds that meet the future needs of the Australian dairy industry. The current National Breeding Objective for the Australian dairy industry is aimed at increasing net farm profit and improved sustainability. It is expressed through the three breeding indices: Balanced Performance Index (BPI), Health Weighted Index (HWI) and Sustainability Index (SI). To remain effective, the NBO must adapt to changing dairy business operating conditions, advancements in breeding technologies, and new knowledge.

DataGene reviews the NBO and its associated indices every five years, with additional reviews conducted as necessary. The review undertaken in 2014 resulted in the introduction of three indices – Balanced Performance Index (BPI), Health Weighted Index (HWI), and Type Weighted Index (TWI) in 2015. Since then, there has been a positive and sustained increase in the utilisation of Australian indices. The BPI, HWI and SI are critical tools for ranking bulls, cows, and herds, enabling farmers to select superior genetics that deliver long-term productivity, profitability, and sustainability.

Some changes that have been implemented since then include:

- a change to the trait weightings for BPI and HWI and the discontinuation of the TWI following a review held in 2020.

- In August 2022, DataGene released the Sustainability Index (SI) for fast tracking the reduction in greenhouse gas emission intensity.
- In December 2022, the weight on milk volume in the indices was updated to better reflect the current Australian milk pricing. As a result, the volume penalty was removed from the indices, but the feed/energy cost to produce a kilogram of fat, a kilogram of protein and a litre of milk was retained.

The purposes of the 2024/2025 NBO review are to:

- Check that the National Breeding Objective as expressed through the BPI reflects farmer needs for breeding sustainable and profitable herds over the next 10 years.
- Develop and refine indices based on strong scientific principles that are in line with farmer preferences and meet the agreed NBO.
- Inform the future direction of DairyBio research priorities.

The process of the review is guided by DataGene's Genetic Evaluation Standing Committee and can be found in the Discussion Paper. DataGene co-ordinates the review activities that involve consultation with industry stakeholders and scientific analysis that includes input from Down To Earth Research (DTER), Dairy Australia, EverAg, Agriculture Victoria Research and AbacusBio. Implementation is planned for December 2025.

This document outlines options and recommended changes based on the findings from consultation activities and scientific review. It provides a foundation for industry discussion and decision and acts as a record of the consultation and index formulation process.

The different stakeholder groups involved in different stages of the process are described in

Table 1.

Table 1. NBO Review process and timeline

Stage	Timing	Stakeholders involved
Identify key themes	Apr 2024	Genetic Evaluation Standing Committee
Discussion Paper	May 2024	Genetic Evaluation Standing Committee
Compile economic & genetic statistics	May – Aug 2024	DataGene, EverAg Agriculture Victoria Research
Consultation (survey, interviews, stakeholder meetings)	Jun – Aug 2024	Farmers, breed organisations, bull company managers, service providers, Regional Development Programs, DataGene social media
Determine options to test	Sep 2024	DataGene
Calculate economic values	Oct – Dec 2024	AbacusBio DataGene
Options paper	Feb 2025	DataGene, Genetic Evaluation Standing Committee
Stakeholder discussion & agreement	Mar – Jun 2025	Genetic Evaluation Standing Committee, bull company managers breed organisations, Dairy Australia Farm team
Stakeholder agreement	Jul 2025	Genetic Evaluation Standing Committee
Build and test	Jul – Nov 2025	DataGene ABV Team and external testers
Roll out	Dec 2025	Rollout to industry via public ABV release

3. Consultation Summary

A key component of an NBO review is to explore perceptions, attitudes, and usage of Australian Breeding Values (ABVs) and indices among farmers and herd improvement (HI) industry personnel. In this review, we employed a mixed-method approach, including a quantitative survey of 217 dairy farmers and 38 herd improvement (HI) personnel, alongside 20 qualitative in-depth interviews with dairy farmers.

While the results reflect insights from a broad cross-section of the industry, the survey specifically targeted dairy farmers using artificial insemination (AI). This approach may have introduced some bias, as participants with strong opinions (both positive and negative) toward herd genetics may have been more likely to respond. Consequently, the data represents the perspectives of respondents and may not fully reflect the views of the entire dairy farming population.

Nationally, 54% of dairy farmer respondents have at least some registered cattle and 46% are solely commercial dairy farms. Holstein are the most common breed of cattle on respondent farms (61%). This is reflected across all regions, except among DairyTas respondents, where crossbred cows dominate. In total, Jerseys are the main breed of cows on 18% of respondent farms, crossbreds (17%) and red breeds (13%). The results are consistent with Dairy Australia survey data. Note that while the main breed of cow was requested, respondents were able to select more than one main breed.

Findings of the online survey and in-depth interviews revealed the Balanced Performance Index (BPI) remains highly influential across regions, breeds, and production systems. While there is clear demand for a pasture-based index, opinions on a Total Mixed Ration (TMR) index were polarised, and farmers in hot and humid climates expressed interest in an index specific for their region. Jersey breeders demonstrated strong reliance on existing Australian indices and did not express strong support for a breed-specific index.

Between August and October 2024, DataGene conducted meetings stakeholders from bull companies, resellers, breed organisations, farmers, industry, and research. These sessions aimed to present findings from earlier consultations, gather feedback on key themes, and gain new insights. This feedback was more specific and nuanced when compared to the survey finding, however the feedback largely aligned with previous results, highlighting four main themes:

- Production remains key for farm income The negative weighting applied to milk litres in the BPI formula (reflecting feed cost associated with milk volume) is poorly understood.
- Simplicity is preferred. Most of the things farmers want in their herd are consistent across feeding systems and already included in the existing indices.
- Feed Saved ABV is not well understood, lacks credibility due to low reliability, and requires extension support for wider adoption. However, feed efficiency was viewed to be important, further highlighting the complexity around this trait.
- Consistent support for updating the base.

The combined feedback from, the stakeholder consultation for the 2025 NBO review conducted by DataGene through an online survey, in-depth interviews, and stakeholder meetings, found:

1. Strong support for the Balanced Performance Index (BPI)
2. Clear support for a seasonal calving/pasture-based index
3. Some support for a specific index tailored for hotter regions
4. Polarised views on the need for a specific index for TMR herds
5. Little support for a Jersey-specific index.

These results have provided the framework for our index testing.

4. Index Options

4.1. Key changes to input parameters

During the NBO Review, researchers applied updated economic and physical parameters to a bio-economic model that is used to calculate the weighting applied to each trait in an index.

The methodology for determining economic weights for production traits has changed from relying on historical prices to using evidence-based, forecast prices. There is a 3-year lag between index implementation and the first calving of animals bred using the new information, so it is important that prices reflect this timeframe. Milk pricing experts, EverAg (Jo Bills and Steve Spencer), provided several scenarios to review before settling on a scenario that looked at an intermediary 5-year average milk price (milk prices 2025-2029). The result of this was a change from a 2020 milk solids price of $6.18 per kg to a projected price of $8.43 per kg.

In line with the relative changes to fat and protein payments, there was a greater emphasis on fat compared to previous indices and this had a significant impact on all indexes that were tested.

Feed costs were updated based on data from Dairy Australia's Dairy Farm Monitor Project with a constant ratio of feed cost to milk income maintained.

The starting point in this project was to apply updated parameters to the current BPI (BPI24). From there, several options have been developed, tested and presented below. The options explore the themes developed in the early consultation period of the project and take on board the feedback collected through the NBO survey and consultations. For each option, the economic weights, response to selection and percent emphasis are presented. The logic behind the options is discussed in more detail later in this report.

4.2. Testing results for index options

More than 30 different index options were tested and these options varied by input values and model assumptions to meet differing goals. The purpose of this section is to describe the results of this testing. For brevity, the options have been filtered to include those that are most likely to meet the requirements of the Genetic Evaluation Standing Committee and stakeholders.

The relationship between the model inputs, economic values, trait weightings, trait relationships (correlations) and expected response to selection is shown in Figure 1.

Table 2 provides a brief summary of the index, along with its pros and cons. Table 3 and Table 4 report the economic values for each index as it is the economic values that change the weighting applied to each trait. Table 3 shows indices based on BPI and Table 4 shows indices based on HWI and SI.

The most important consideration when comparing indices is the outcome that is expected based on the population of cows and the AI bulls used to produce the herd's next generation. This is expressed as response to selection to the change that is likely to be made by using each index as the main breeding index in a population of cows over a period of 10 years. These values are presented by breed, beginning with Table 5. These tables are presented in ABV units. For example, the **BPI25_Proposed** is expected to produce a genetic change of 3.451 protein kg/cow in a 10-year period in Holsteins. In addition, Figure 2, Figure 3, Figure 5, Figure 6, Figure 8, and Figure 9 present the standardised change (in trait standard deviation units) that scales the responses so that they can be graphed together.

Each breed has its own population of breeding stock that contributes towards the next 10 years of progress. The response to selection for each index is presented, separately, for Holstein, Jersey and Red Breed populations.

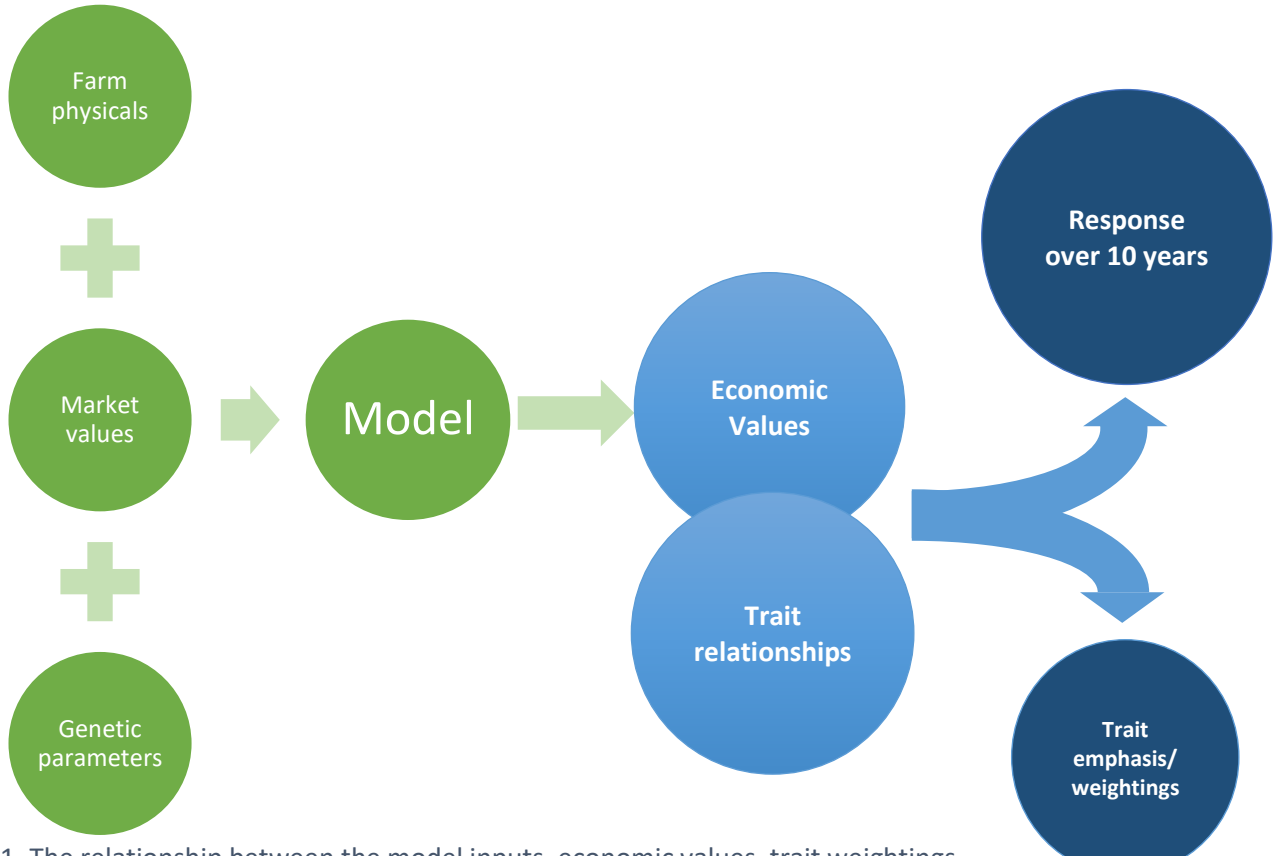

Figure 1. The relationship between the model inputs, economic values, trait weightings, trait relationships (correlations) and expected response to selection.

Table 2. Summary of index options

Label	Description	Pros	Cons
BPI24	Current BPI		Economic values are outdated
BPI25	The current BPI with updates made to the values of fat, protein, feed, labour and other economic parameters. In this option, the projected milk values for 2028-33 were used.		Lower confidence in future milk price values.
BPI25_1626	BPI25 with feed price adjusted in line with milk solids price.		Lower confidence in milk price values
BPI25_2529	BPI25 with intermediary forecast 2024/25 to 2028/29.	Sensible milk price and feed cost values Favours protein, fat, cell count	Fertility response lower than current BPI
BPI25_2226	BPI25 using average milk price of 3 year historic and 1 year forecast.	Similar to BPI25_2529	Not aligned with future milk price forecast
BPI25_Teat	BPI25_2529 with some of the weight on mammary system partitioned to teat length and rear teat placement		Virtually no improvement in teat length or placement and reduced gains for mammary
BPI25_Proposed	BPI25_2529 with fertility value increased to match BPI24 response to selection	Faster gains for fat, survival, SCC Fertility similar to BPI24	Slower protein gain
JeBPI24	Current Jersey BPI		
JeBPI25_2529	Jersey versions of all BPI indices were tested but not included here, for brevity. Parameter used are similar to BPI25_2529, except that there is no Feed Saved for Jersey.		
JeBPI25_Proposed	JeBPI25_2529 with fertility value increased to match JeBPI24 response to selection	Faster gains for fat, cell count, mastitis, fertility, udder depth Teat length is neutral	Slower gains for protein, milk volume, type
HWI24	Current HWI		
HWI25	Updated HWI with forecast milk price	More production compared to HWI24	Lower gains in fertility and feed saved All HWI options have slower gains in production compared to BPI & SI
HWI25_Sea_Proposed	HWI25 for seasonal calving herds. HWI25 except Overall Type value set to 0, Milking Speed and Temperament adjusted for slightly shorter average lactation lengths. It also includes new traits: Calving Ease and Gestation Length	Compared to HWI25, stronger gains in fertility, mastitis, udder depth and calving ease. More production	Decline in mammary system and overall type
HR_Proposed	BPI for hotter regions – Same as BPI25_2529 except: Survival value adjusted upwards, cell count and mastitis based on local cell count parameters, Milking speed and Temperament based on longer average lactation length. Overall Type is doubled, Feed Saved is halved. Heat load of Toowoomba was applied (1,442 THI units over 60 per year)	Strong gains for heat tolerance. Stronger gains for mastitis resistance and survival, type and mammary compared to BPI	Lower production and fertility gains
TMR_Proposed	TMR – Same as BPI25_2529 except: Milk upweighted by 30% (reflecting a phenotypic response greater than a 1:1 per kg or litre of ABV), Survival adjusted upwards, Milking speed and temperament based on longer average	Compared to proposed BPI: more production (including milk), similar fertility and cell count	Faster decline in feed efficiency and slower gains for fertility

	lactation length (332 days) as well as 3 times a day milking, Feed Saved increased to full weight to reflect energy saved by not walking / grazing.		
SI24	Current SI		
SI25_Proposed	Updated with new greenhouse gas intensity values Uses forecast milk price	Similar strengths in production, compared to current SI	Compared to BPI, Milk L increases and expect slower gains in fertility

The economic values for each index tell us the multiplier used in the index calculation. Use this number across the indices to see where there is more or less emphasis on each trait. This isn't a useful number to compare between traits within an index because each ABV trait group has a different scale and range.

Table 3. Economic values for BPI-based index options

	Current BPI	BPI25_2529	BPI25 _Proposed	Current Jersey BPI	JeBPI25 _Proposed	TMR _Proposed	HR _Proposed
Protein	6.76	7.95	7.95	6.76	7.95	10.33	7.95
Fat	2.08	5.67	5.67	2.08	5.67	7.37	5.67
Milk	-0.08	-0.09	-0.09	-0.08	-0.09	-0.12	-0.09
Survival	7.20	14.29	14.29	7.20	14.29	17.07	17.07
Fertility	6.94	8.25	14.02	6.94	14.02	8.25	8.25
Somatic cell count	0.69	1.26	1.26	0.69	1.26	1.33	1.52
Mastitis resistance	6.75	10.89	10.89	6.75	10.89	10.89	13.35
Milking speed	5.02	6.52	6.52	5.02	6.52	9.88	6.55
Temperament	3.60	0.97	0.97	3.60	0.97	1.48	0.98
Mammary system	2.76	3.59	3.59	2.76	3.59	3.59	3.59
Udder depth	0.82	1.08	1.08	0.82	1.08	1.08	1.08
Overall type	1.36	2.7	2.7	1.36	2.70	3.22	5.39
Pin set	0.78	1.55	1.55	0.78	1.55	1.85	1.55
Feed saved	0.19	0.21	0.21	0	0	0.42	0.10
Calving ease	0	0	0	0	0	0	0
Gestation length	0	0	0	0	0	0	0
Heat tol (protein)	0	0	0	0	0	0	572.83
Heat tol (fat)	0	0	0	0	0	0	408.95
Heat tol (milk)	0	0	0	0	0	0	-6.41

Table 4. Economic values for HWI and SI-based index options

	Current SI	SI25_Proposed	Current HWI	HWI25_Sea _Proposed
Protein	17.49	13.17	4.36	5.12
Fat	2.82	7.61	1.35	3.68
Milk	-0.08	-0.09	-0.06	-0.05
Survival	20.21	23.22	7.20	14.29
Fertility	6.94	8.25	14.11	22.86
Somatic cell count	0.69	1.26	0.69	1.26
Mastitis resistance	8.70	12.61	6.75	10.89
Milking speed	5.02	6.52	5.02	6.46
Temperament	3.60	0.97	3.60	0.97
Mammary system	2.79	3.59	3.59	4.66
Udder depth	0.82	1.08	0	0
Overall type	1.36	2.7	1.36	0
Pin set	0.78	1.55	0.78	1.55
Feed saved	0.72	0.74	0.39	0.42
Calving ease	0	0	0	0.90
Gestation length	0	0	0	-3.14
Heat tol (protein)	0	0	0	0
Heat tol (fat)	0	0	0	0
Heat tol (milk)	0	0	0	0

Testing results for index options: Holstein

Use this table to compare the expected responses over 10 years of breeding. The units are the unit of measure. For example, the expected response for the BPI25_Proposed is +3.451 kg protein and this is less than the current BPI (+4.066 kg protein).

Table 5. Response to selection for current and index options in Holstein cattle, described in trait units.

	Unit	Current BPI	BPI25 _Proposed	TMR	HR	Current HWI	HWI25 _Sea _Proposed	Current SI	SI25 _Proposed
Protein	kg	4.066	3.451	4.033	2.278	1.611	1.960	6.244	4.673
Fat	kg	8.308	9.798	11.424	7.458	3.894	5.854	7.533	10.670
Milk	L	-20.35	-22.62	-14.033	-17.403	-68.49	-43.79	87.14	25.55
Survival	pct	1.598	1.634	1.500	1.928	1.581	1.659	1.419	1.534
Fertility	pct	2.654	2.670	1.865	2.321	4.004	3.864	1.841	1.851
Somatic cell count	score	12.217	12.504	11.513	13.902	11.361	12.305	10.463	11.727
Mastitis resistance	unit	1.713	1.680	1.439	1.995	1.862	1.857	1.307	1.475
Milking speed	unit	0.152	0.138	0.190	0.136	0.141	0.104	0.017	0.092
Temperament	unit	0.094	0.027	0.067	0.096	-0.030	-0.062	0.101	0.058
Mammary system	unit	-0.020	-0.052	-0.016	0.772	-0.267	-0.386	-0.265	-0.117
Udder depth	unit	1.033	0.996	0.744	1.628	1.313	1.220	0.552	0.703
Teat place rear	unit	-0.050	0.100	0.193	0.367	-0.379	-0.225	-0.167	0.113
Teat length	unit	-0.915	-1.056	-1.059	-1.008	-0.851	-1.027	-0.686	-0.999
Overall type	unit	-0.136	-0.182	-0.133	0.738	-0.484	-0.667	-0.405	-0.287
Pin set	unit	-0.230	-0.264	-0.285	-0.128	-0.138	-0.194	-0.169	-0.281
Feed saved	kgdmi	-2.711	-6.493	-7.472	-11.191	16.449	9.023	1.616	-2.515
Calving ease	unit	0.436	0.458	0.426	0.354	0.450	0.508	0.415	0.438
Gestation length	d	-0.695	-0.742	-0.732	-0.590	-0.557	-0.750	-0.699	-0.740
Heat tol	unit	-1.009	-0.873	-1.314	0.622	0.089	-0.079	-1.750	-1.432
LWT	kg	-0.577	-0.575	-0.510	-0.048	-1.136	-1.125	-0.739	-0.695

Use these figures to visually compare the expected responses over 10 years of breeding. The units are standardised so that the traits can be more easily compared.

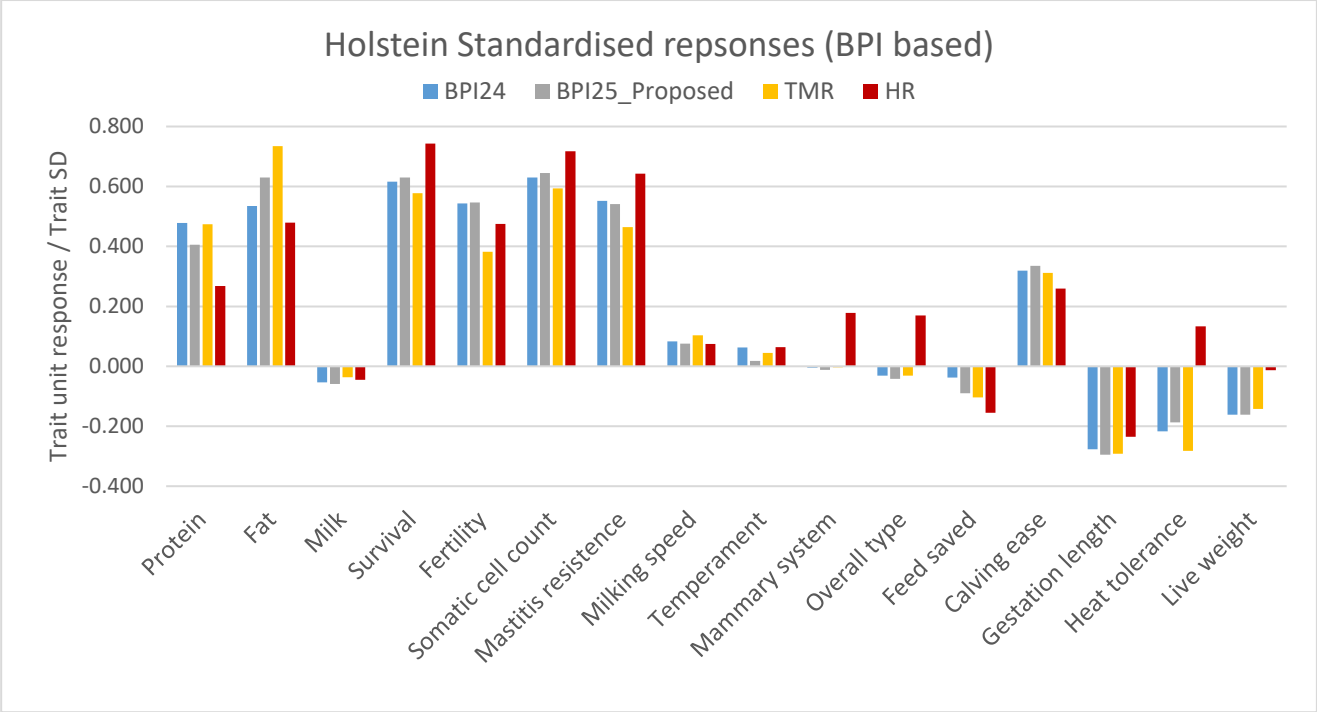

Figure 2. Holstein standardised response for indices with a BPI base. BPI24 is the current index. BPI25_Proposed is the proposed update to BPI, TMR is for TMR herds, HR is tuned for herds in hot and humid regions.

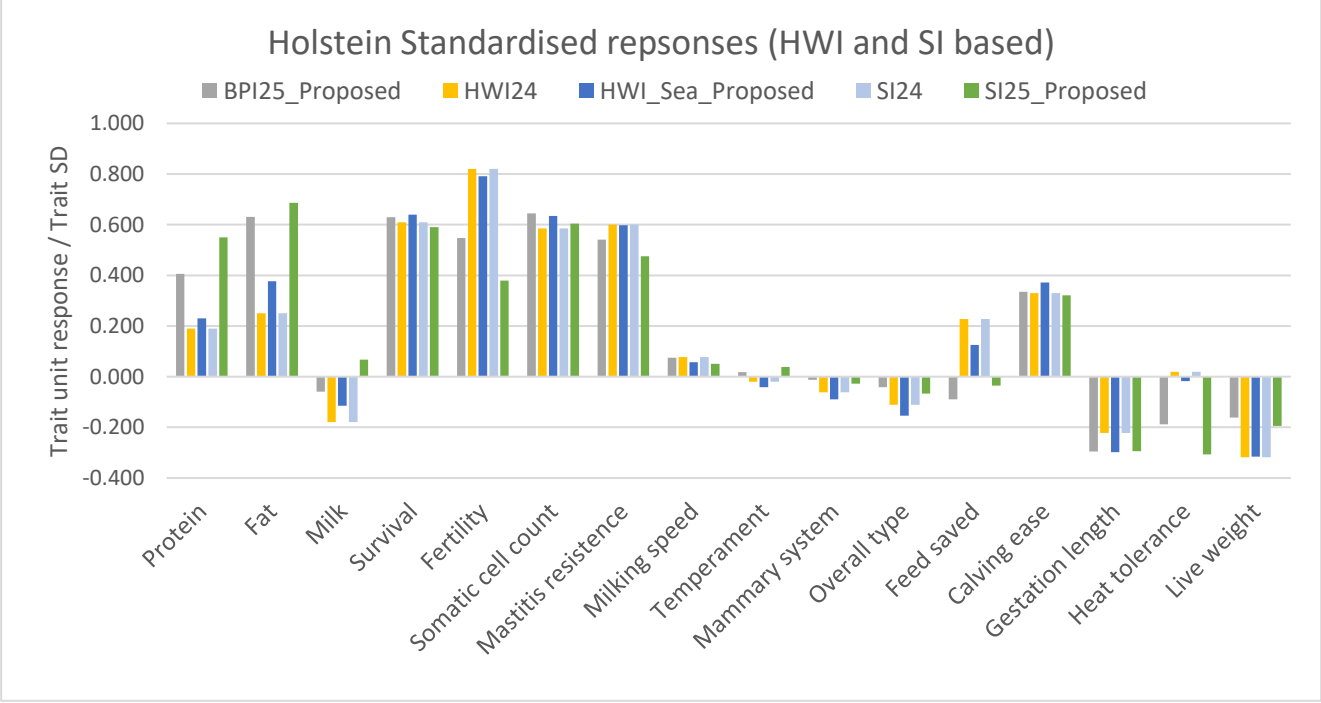

Figure 3. Holstein standardised response for indexes with a HWI or SI base. HWI24 is the current index. HWI25 is the updated index, Proposed HWI_Sea_Proposed is the proposed Seasonal index, SI24 is the current SI and SI25 is the updated index.

A popular way to compare indices is to look at the percent emphasis of a trait or trait group. The relative emphasis of each trait group is shown in Figure 4 where the emphasis placed on trait groups can be compared to the current BPI. For example, Figure 4 shows that there is more weight on fat and less weight on milk in the BPI25_Proposed compared to the current BPI24. Weighting does not account for relationships between traits and the properties of each trait which means it does not reflect the expected change in the population.

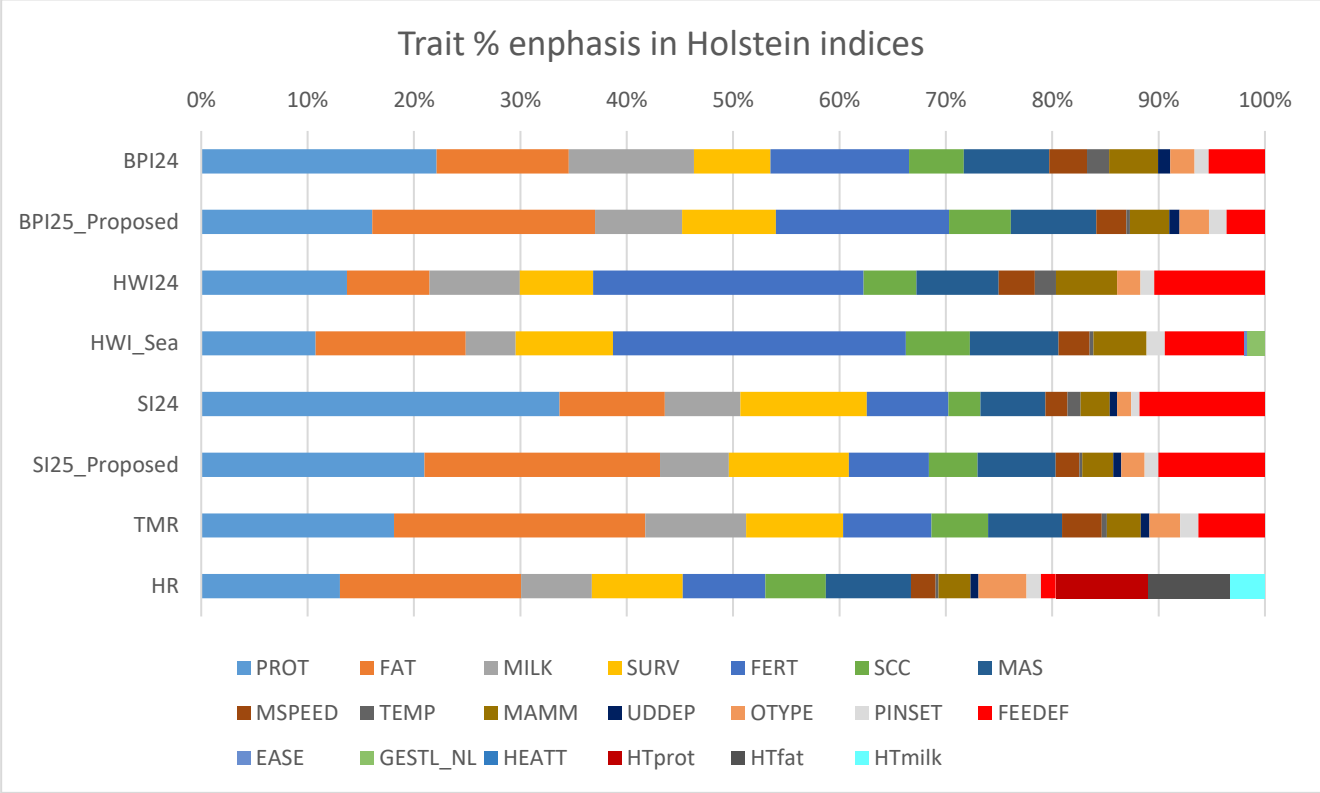

Figure 4. Trait percent weightings in indices for Holstein

Testing results for index options: Jersey

Table 6. Response to selection for current and index options in Jersey cattle, described in trait units. Shaded in green are proposed indices.

		Current Jersey BPI	JeBPI25_ Proposed	Current HWI	JeHWI25 _Sea _Proposed	Current JeSI	JeSI _Proposed
Protein	kg	4.435	3.774	2.101	2.017	6.242	5.029
Fat	kg	6.583	7.120	3.821	4.579	5.986	7.453
Milk	L	46.357	35.620	14.211	18.222	147.599	88.232
Survival	pct	1.457	1.437	1.466	1.379	1.543	1.552
Fertility	pct	0.623	0.926	1.878	1.995	-0.115	0.143
Somatic cell count	score	7.836	8.870	9.412	10.395	5.363	7.353
Mastitis resistance	unit	1.189	1.325	1.585	1.692	0.683	1.010
Milking speed	unit	0.238	0.159	0.101	0.032	0.220	0.213
Temperament	unit	0.284	0.101	0.143	-0.049	0.374	0.237
Mammary system	unit	0.790	0.383	0.676	0.029	0.950	0.674
Udder depth	unit	0.422	0.630	0.973	1.052	-0.013	0.311
Teat place rear	unit	0.422	0.152	0.529	0.084	0.609	0.330
Teat length	unit	-0.193	-0.005	-0.142	0.049	-0.305	-0.139
Overall type	unit	0.946	0.580	0.579	0.021	1.120	0.866
Pin set	unit	0.642	0.577	0.427	0.357	0.841	0.780
Feed saved	kgdmi	-5.841	-4.884	-0.911	0.209	-3.605	-3.336
Calving ease	unit						
Gestation length	d	-0.134	-0.099	-0.068	-0.142	-0.140	-0.110
Heat tol	unit	-1.189	-1.004	-0.279	-0.292	-1.618	-1.408
Live weight	kg	0.444	0.374	0.076	-0.007	0.280	0.261

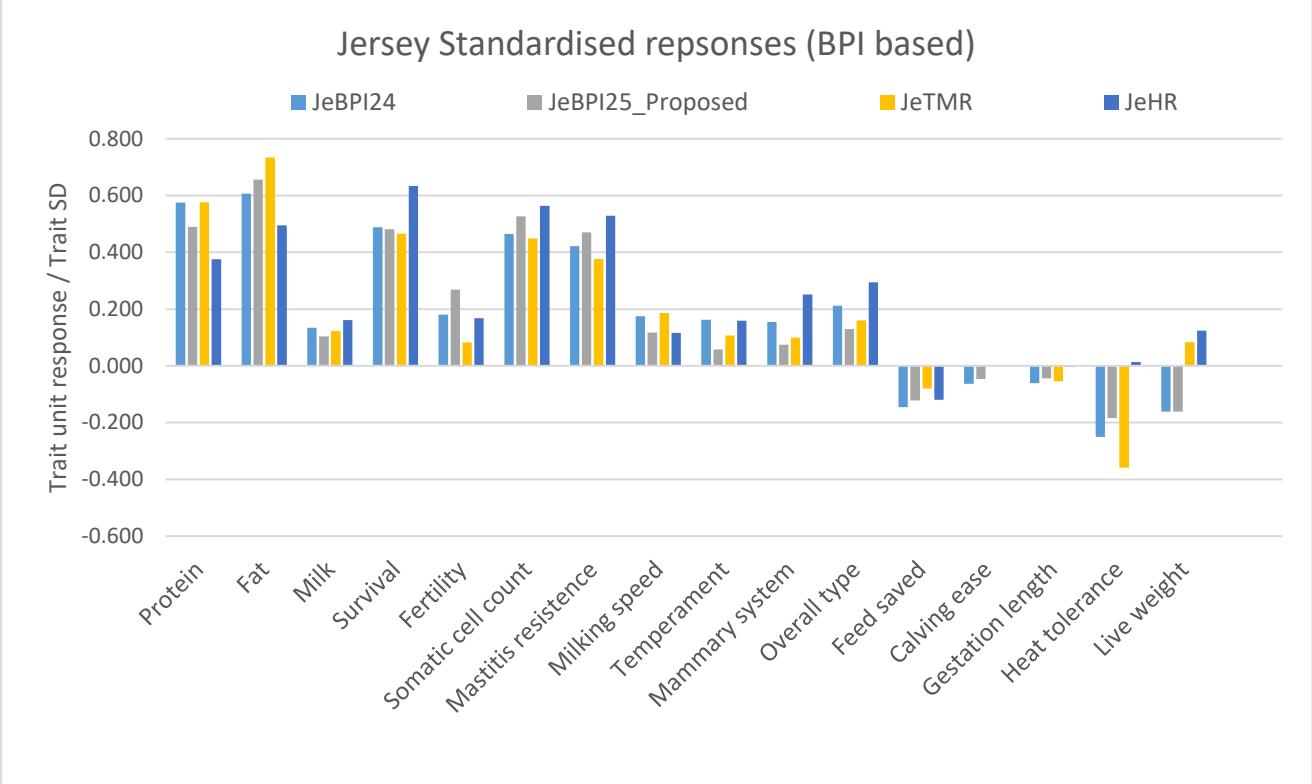

Figure 5. Jersey standardised response for indices with a BPI base. JeBPI24 is the current index. JeBPI25_Proposed is the proposed update to BPI, JeTMR is tuned for TMR herds, JeHR is tuned for herds in hot and humid regions.

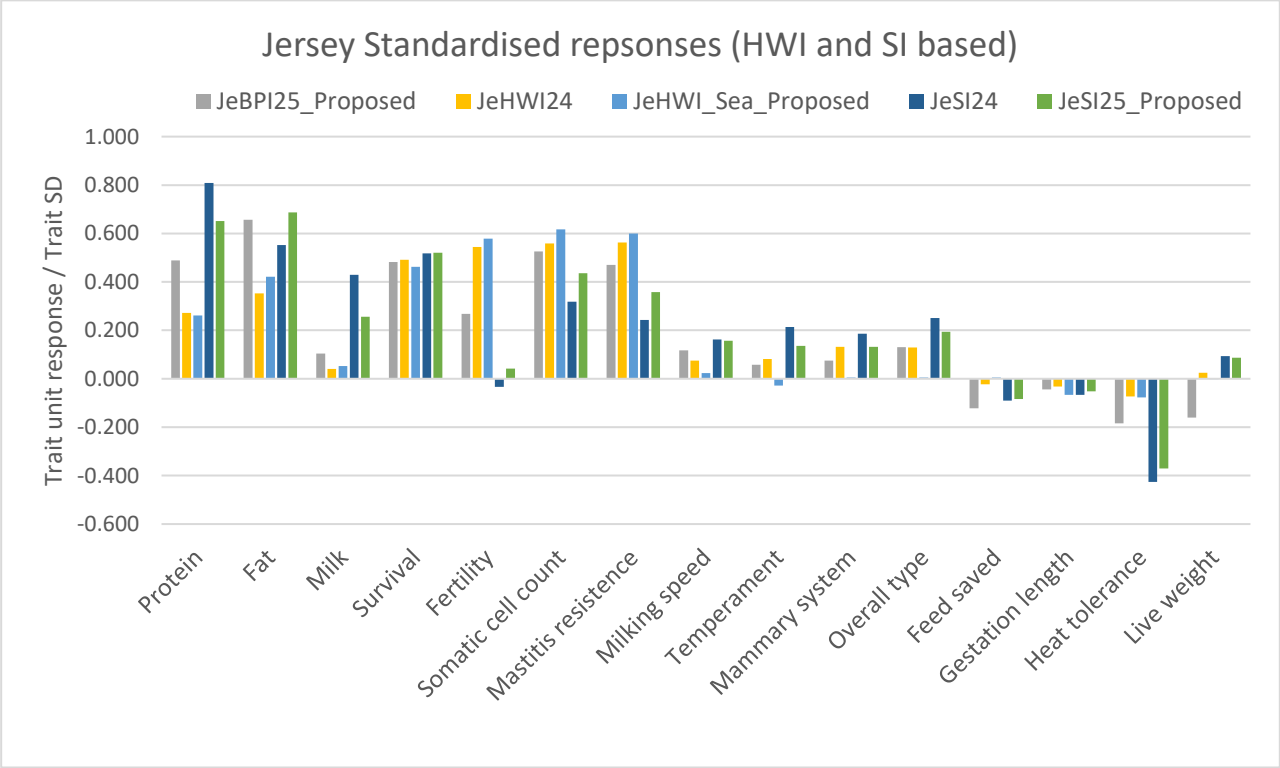

Figure 6. Jersey standardised response for indexes with a HWI or SI base. HWI24 is the current index. JeHWI25_Sea_Proposed is the proposed Seasonal index, JeSI24 is the current SI for Jersey and JeSI25_Proposed is the updated index.

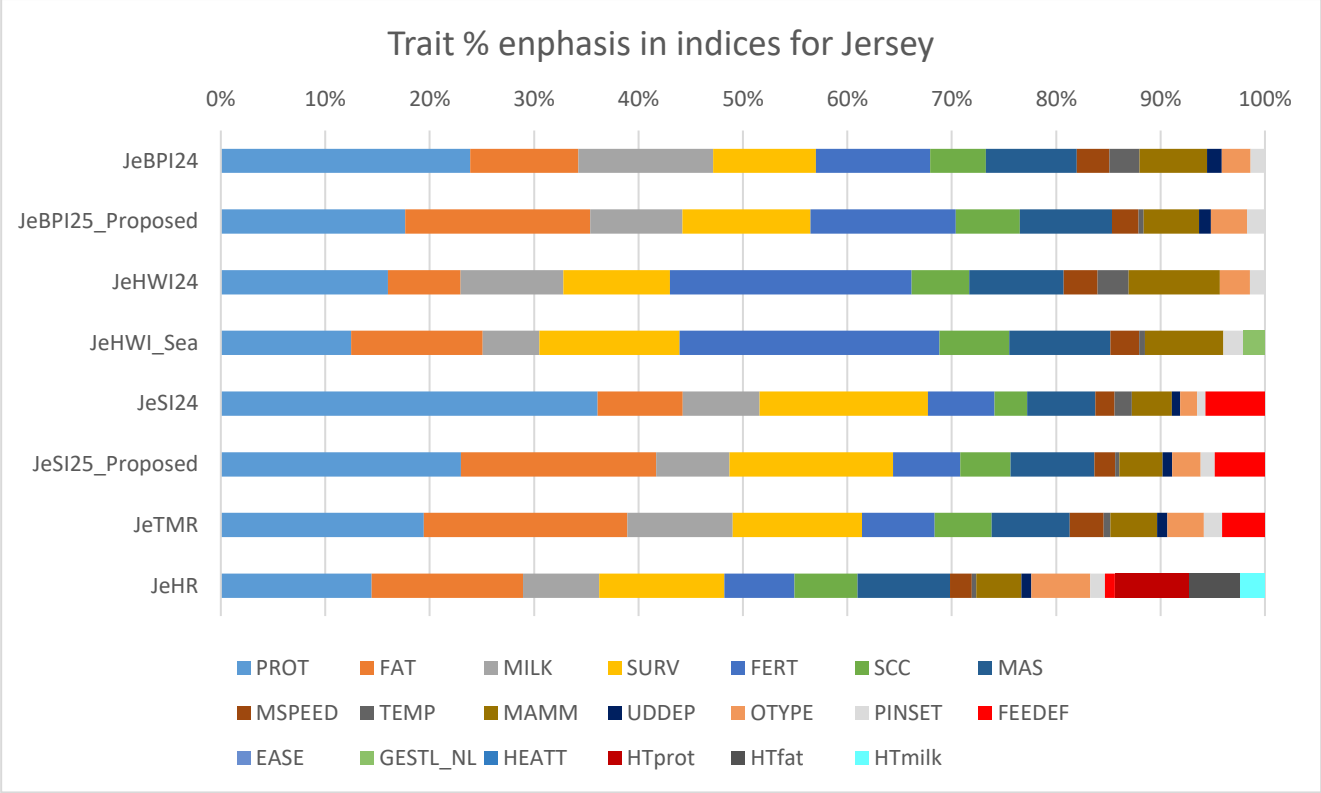

Figure 7. Trait percent weightings in indices for Jersey

Testing results for index options: Australian Red (UUUU)

Table 7. Response to selection for current and index options in Australian Red breed (UUUU) cattle, described in trait units. Shaded in green are proposed indices.

		Current BPI	ReBPI25 _Proposed	Current HWI	ReHWI25_S ea _Proposed	Current ReSI	ReSI25 _Proposed
Protein	kg	8.542	7.624	4.676	5.029	11.319	9.272
Fat	kg	8.089	9.381	2.984	4.574	8.000	10.207
Milk	L	133.356	129.929	11.141	47.957	256.044	198.210
Survival	pct	0.648	0.765	0.122	0.232	0.487	0.831
Fertility	pct	0.206	0.089	2.230	2.041	-0.101	-0.595
Somatic cell count	score	8.806	9.702	10.640	11.418	3.093	6.624
Mastitis resistance	unit	0.983	1.135	1.113	1.223	0.215	0.748
Milking speed	unit	0.104	0.016	0.029	-0.106	-0.059	-0.013
Temperament	unit	0.256	0.217	0.087	0.044	0.188	0.225
Mammary system	unit	0.249	0.302	-0.515	-0.660	-0.364	0.255
Udder depth	unit	-0.100	-0.037	-0.079	-0.229	-0.951	-0.332
Teat place rear	unit	-1.049	-0.985	-1.113	-1.048	-0.796	-0.794
Teat length	unit	0.096	0.095	-0.036	-0.053	-0.003	0.032
Overall type	unit	0.536	0.770	-1.312	-1.226	0.282	0.807
Pin set	unit	0.595	0.626	0.914	1.091	0.707	0.642
Feed saved	kgdmi	-11.728	-14.681	9.110	5.538	-8.860	-12.827
Gestation length	d	-0.151	-0.079	-0.511	-0.559	-0.152	0.019
LWT	kg	0.854	1.061	-0.692	-0.435	0.667	0.938

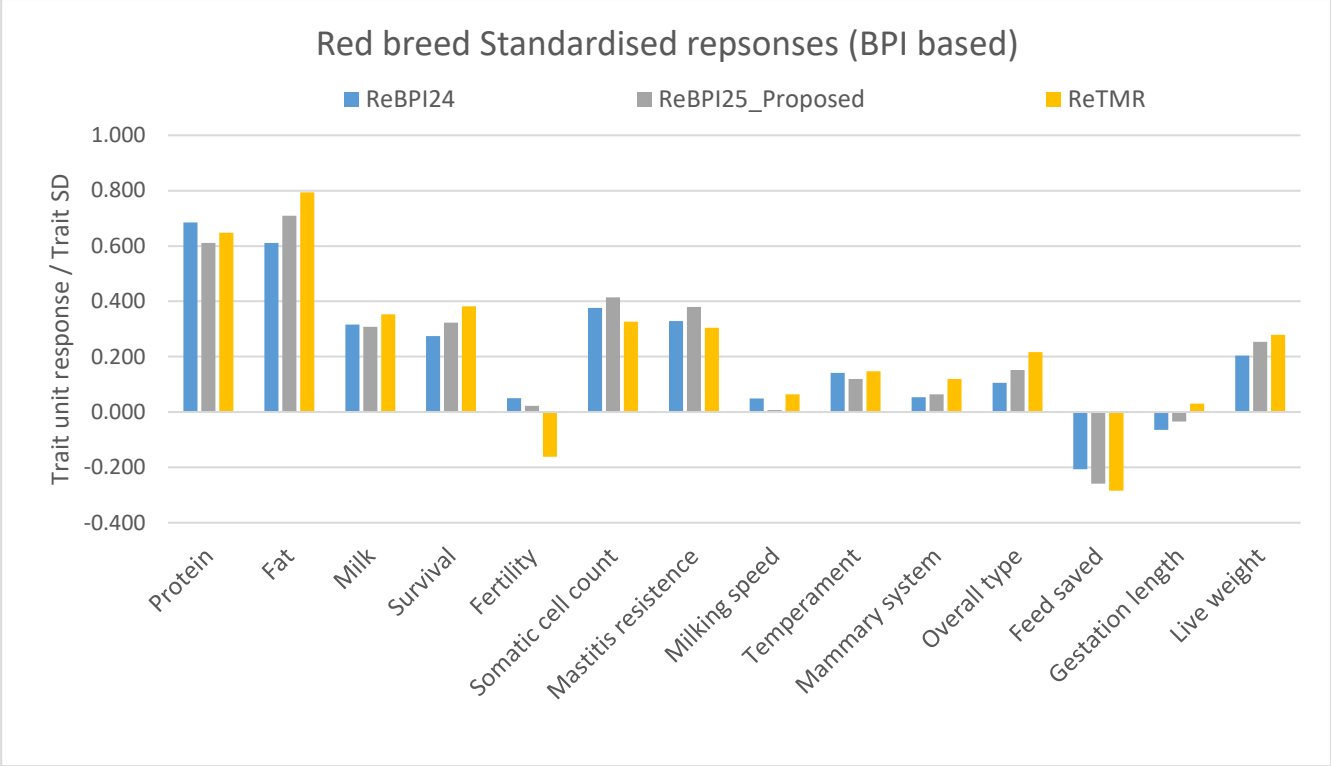

Figure 8. Australian Red standardised response for indexes with a BPI base. ReBPI24 is the current index. ReBPI25_Proposed is the proposed update to BPI, ReTMR is tuned for TMR herds.

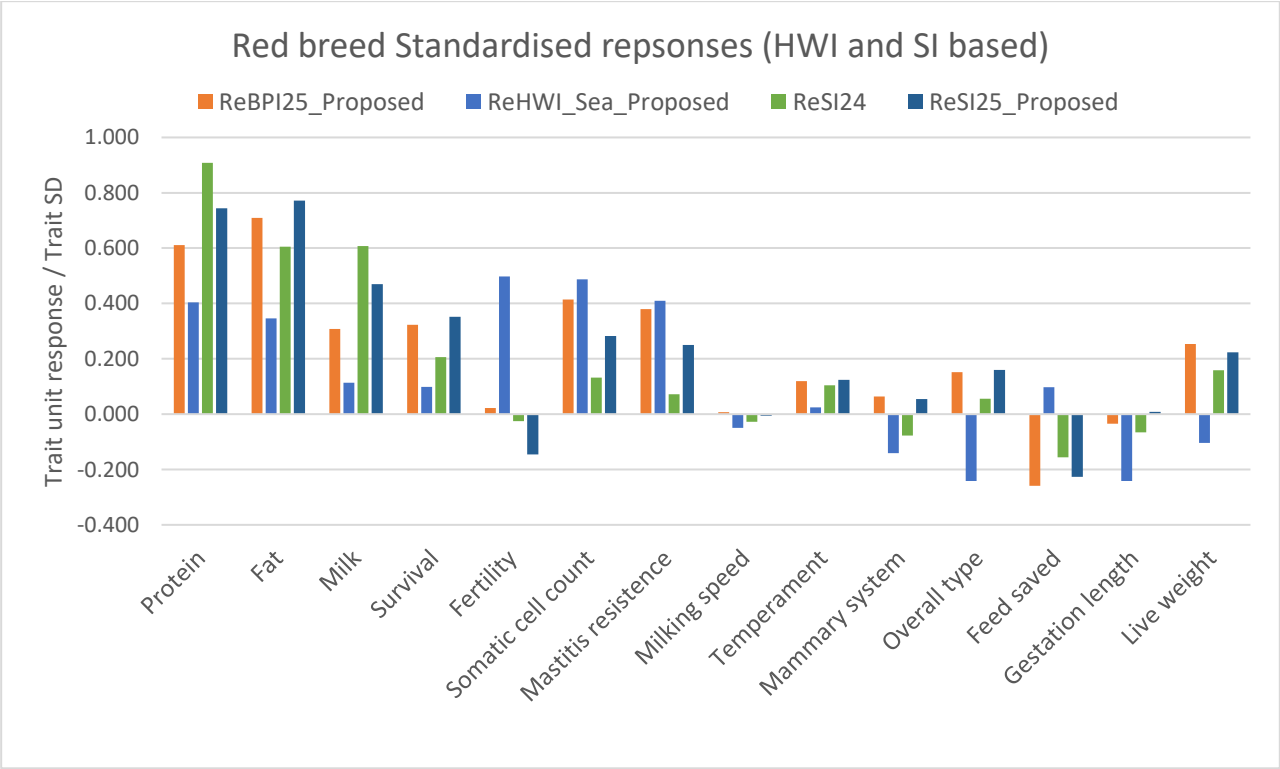

Figure 9. Australian Red standardised response for indexes with a HWI or SI base. ReHWI24 is the current index. ReHWI_Sea_Proposed is the proposed Seasonal index, ReSI24 is the current SI and ReSI25_Proposed is the updated index.

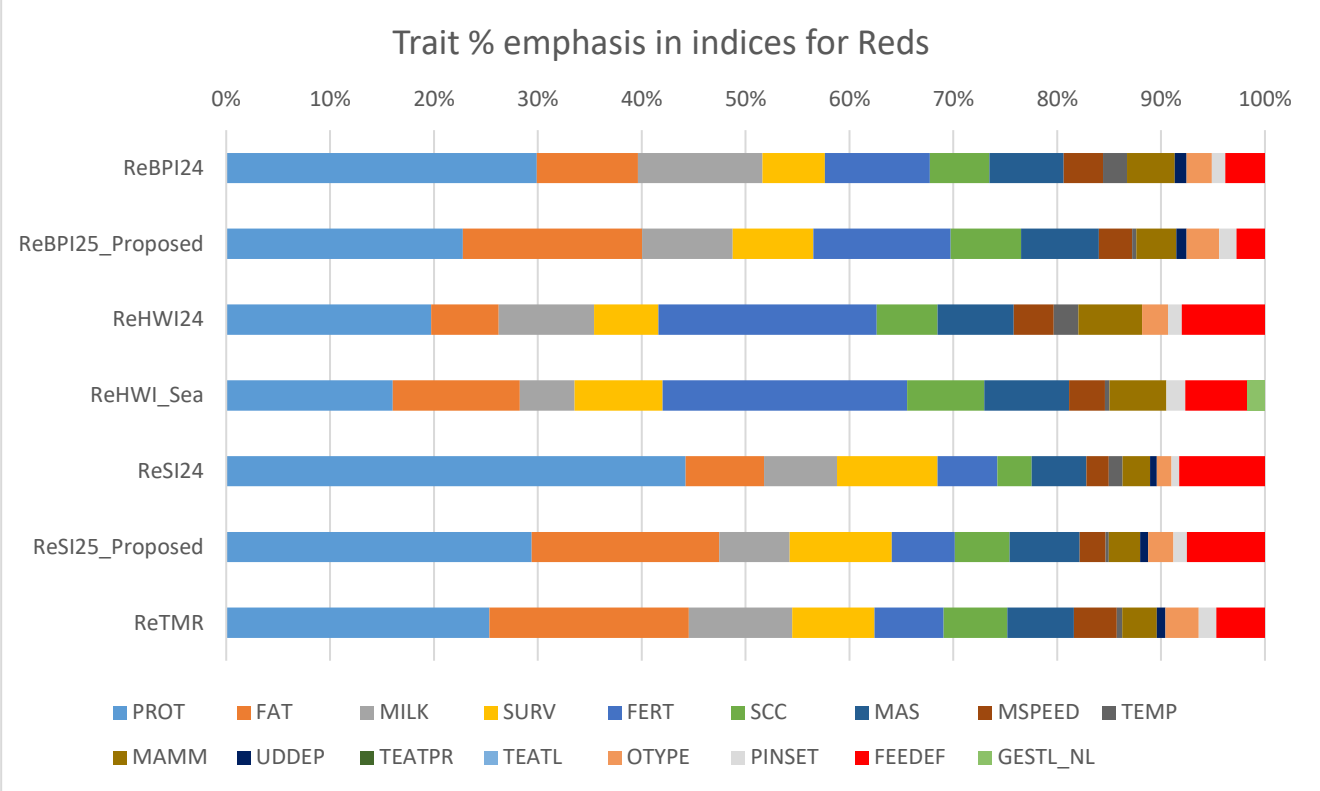

Figure 10. Trait percent weightings in indices for Australian Red

4.3. Updating the base (also known as the average)

In the past 12 months, DataGene has reviewed its methodology for setting the base. For some traits such as type, only animals with phenotypic observations were included in the base group. This has the potential to lead to a degree of bias due to, using the conformation example, a small and decreasing number of cows classified annually. It also ignores animals that may be genomically tested that are not included in the base calculation due to not having phenotypic information.

Interbull's recommendation for the setting of the base is as follows:

a. Use cows.
b. Use birth year.
c. Use ALL animals that entered national GES.
d. Use average genetic merit (EBV).
e. Use stepwise change of genetic base.
f. Use cows born 5 years before the onset of the new 5-year period.
g. Change the base in the first evaluation in the years ending with 0 or 5.

DataGene propose adopting the Interbull recommendations which will mean an expanded group of animals is used for the setting of the base. This should reduce the bias in the setting of the base (especially for traits with decreasing volumes of phenotypic data) and stabilise the base for the less numerous breeds. DataGene also propose that industry adopts a 5 yearly base roll that coincides with the regular NBO reviews.

The impact of changing the current base to the ICAR recommendation, using August 2024 Public Release ABVs is in Table 8 Table 8. Effect of base change 2025 on selected ABVsand Table 9. The numbers are the effect on final ABVs, e.g. all Fat ABVs in the Ayrshire breed would drop by 2.6 kg. All Milk ABVs in the Jersey breed would drop by 212.5 litres.

This base is currently much higher than for a broader group of cows (as defined by the ICAR recommendation) for most traits and breeds. Table 9 shows the impact on ABVs from shifting to the 2020 born cows base for conformation traits. In Holstein and Jersey there will be big jumps for Mammary System and Overall Type. Reds would see a small drop in Overall Type ABVs.

Table 8. Effect of base change 2025 on selected ABVs

Breed	Fat	Milk	Protein	ASI	Fertility	Survival	SCC	Mastitis Resistance
A	-2.6	-11.7	-2.4	-20.5	-2.9	-0.8	6.0	0.0
B	-6.5	-156.2	-6.4	-44.2	0.4	0.2	1.2	0.2
D	-9.9	-386.5	-8.2	-44.3	7.7	-0.8	-13.0	-0.6
F	-9.2	36.0	-3.6	-46.7	-6.0	-5.4	-28.5	-2.8
G	-5.8	-124.4	-4.3	-30.8	-1.6	-4.2	-7.5	-1.1
I	-0.3	24.2	0.5	0.6	-0.7	-1.5	-14.2	-2.6
J	-9.2	-212.5	-8.6	-59.6	0.0	-5.8	-19.5	-2.1
U	-8.2	-135.6	-7.9	-59.4	1.8	-1.1	-7.0	-1.1

Table 9. Effect of base change 2025 on ABVs for conformation traits

Trait	A	D	I	U	F	G	J
Overall Type	1.8	-6.3	0.7	-0.4	4.1	2.5	3.0
Mamm	4.8	-4.3	-0.2	-0.7	4.2	0.0	3.1
Dairy Strength	-2.1	-3.2	1.1	-0.6	0.6	1.3	1.4
Feet & Legs	-1.5	-2.1	-0.9	2.0	1.4	3.7	1.5
Rump	-0.9	-0.5	1.4	0.2	0.7	2.0	2.0
Angularity	-1.1	-2.5	0.4	-1.5	1.2	0.3	2.8
Body Depth	-3.0	-2.6	0.7	-0.7	-0.2	1.3	0.0
Body Length	0.0	0.0	0.0	0.0	0.0	0.0	1.4
Bone Quality	3.6	2.5	1.1	-1.4	1.9	-1.2	4.2
Cent Lig	3.9	-1.2	-0.2	-2.2	3.7	-1.8	2.3
Chest Width	-3.1	-0.9	1.0	1.2	-1.0	1.7	0.1
Foot Angle	-1.4	-1.5	-0.8	1.9	1.0	0.9	1.2
Fore Ud Att	1.7	-5.2	-1.1	0.9	1.4	1.8	1.1
Heel Depth	3.8	-2.8	-2.0	-0.7	2.9	0.0	1.7
Loin	-2.4	-4.9	1.1	0.0	0.0	1.7	1.9
Muz W	-2.4	-4.3	0.8	0.6	-0.5	-1.0	0.7
Pin Set	-0.9	1.5	1.2	-0.2	-0.1	5.4	1.2
Pin W	2.0	-1.4	0.9	1.3	2.5	0.7	1.3
Rear AH	6.0	-1.1	0.4	1.2	3.3	3.4	2.3
Rear AW	0.5	-4.0	0.5	-0.4	1.9	-0.4	2.1
R Leg	-1.0	-2.3	-0.1	2.1	0.2	2.5	0.9
R Set	2.3	0.0	-0.9	-0.7	-0.3	-3.5	-0.2
Rump L	0.0	0.0	0.0	0.0	0.0	0.0	0.8
Stat	4.9	-1.6	1.1	-0.3	3.9	4.1	1.0
Teat L	-1.6	-1.4	-0.6	0.0	-1.2	-3.1	-0.9
Teat PF	2.5	-1.3	-0.2	-2.2	2.3	-3.8	1.1
Teat PR	2.5	-1.0	0.3	-2.6	2.5	-1.8	1.7
Ud Dep	4.7	-2.2	-0.2	-0.1	2.1	2.1	0.6
Ud Tex	3.1	-1.5	-0.1	-2.0	4.0	-2.3	4.1

Workability traits have a non-linear adjustment that makes these calculations more complex. The impact of a base change for these traits on BPI is expected to be small.

A few traits like calving ease, gestation length and heat tolerance, will also be affected by a change in base, but this does not currently affect BPI, however, may impact some of the proposed new indices.

4.4. Index and trait naming

Index and trait names are meaningful as they are a quick and simple way of portraying a value that can sometimes seem complicated. Table 10 shows the current and proposed naming options for the updated/new indexes.

Table 10. Current and proposed naming options for Australian breeding indices

Name	Current acronym	Options
Balanced Performance Index	BPI	Balanced Performance Index
Sustainability Index	SI	Sustainability Index
Health Weighted Index	HWI	Health Weighted Index
New seasonal calving / pasture-based index		Health Weighted Index Seasonal Calving Index
TMR Index		TMR Index High Input Index TMR System Index Intensive System Index
Hot Areas Index		Hot Areas Index Hot Regions Index Northern States Index Sub-Tropical Index Warmer Climate Index Hot Humid Index
Feed Saved		Feed Saved Feed Efficiency

5. Appendices

5.1. Formative reports

This options paper draws upon detailed reports prepared during this review process.

- AbacusBio report
- NBO discussion paper, November 2020
- Fat:Protein price ratio, EverAg report and discussion with AbacusBio during model testing

5.2. Key parameters used in the models

Table 11. Milk price values used in Australia's main economic index (BPI) over time

Parameter, unit	2015	2020	2022	2025
Milk fat price, A$/kg	3.22	3.63	3.63	3.83
Milk protein price, A$/kg	7.77	7.26	7.26	4.60
Milk volume charge, A$/L	0.03	0.03	0.00	0.00
Milk price, A$/L	0.42	0.46	0.46	0.637
Payment on milk solids, A$/kg of milk solids	5.71	6.18	6.18	8.43

For additional information on historical indices, refer to

Byrne, T.J., B.F.S. Santos, P.R. Amer, D. Martin-Collado, J.E. Pryce, M. Axford. 2016. New breeding objectives and selection indices for the Australian dairy industry, Journal of Dairy Science, 99:8146-8167, https://doi.org/10.3168/jds.2015-10747.

Axford, M., B. Santos, K. Stachowicz, C. Quinton, J.E. Pryce, P. Amer. 2021. Impact of a multiple-test strategy on breeding index development for the Australian dairy industry. Animal Production Science 61: 1940-1950. https://doi.org/10.1071/AN21058.

5.3. Selected ABV correlations

Table 12. Selected ABV correlations (Holstein)

	Protein	Fat	Milk	Survival	Fertility	Somatic cell count	Mastitis resistance	Mammary system	Overall type	Feed saved	Calving ease	Gestation length	Heat tolerance
Protein	1.00	0.35	0.58	0.10	-0.08	0.18	-0.01	-0.06	-0.06	-0.26	0.16	-0.21	-0.60
Fat		1.00	-0.02	0.15	-0.06	0.23	0.02	-0.04	-0.09	-0.30	0.22	-0.26	-0.41
Milk			1.00	0.15	-0.24	0.12	-0.06	0.19	0.12	-0.24	0.01	-0.07	-0.18
Survival				1.00	0.31	0.58	0.47	0.29	0.27	-0.18	0.17	-0.16	0.19
Fertility					1.00	0.27	0.35	-0.25	-0.29	0.26	0.30	-0.18	0.18
Somatic cell count						1.00	0.74	0.07	0.06	-0.13	0.20	-0.20	0.07
Mastitis resistance							1.00	0.01	0.05	0.06	0.11	-0.05	0.18
Mammary system								1.00	0.74	-0.32	-0.15	0.15	0.25
Overall type									1.00	-0.38	-0.25	0.21	0.21
Feed saved										1.00	0.05	0.10	0.11
Calving ease											1.00	-0.34	-0.07
Gestation length												1.00	0.10
													1.00

Table 13. Selected ABV correlations (Jersey)

	Protein	Fat	Milk	Survival	Fertility	Somatic cell count	Mastitis resistance	Mammary system	Overall type	Feed saved	Gestation length	Heat tolerance
Protein	1.00	0.49	0.56	0.11	-0.23	-0.06	-0.14	0.04	0.14	-0.22	-0.10	-0.56
Fat		1.00	-0.08	-0.04	-0.07	0.10	0.00	-0.19	-0.10	-0.20	-0.09	-0.43
Milk			1.00	0.40	-0.25	0.06	-0.03	0.34	0.35	-0.16	-0.05	-0.12
Survival				1.00	-0.10	0.27	0.22	0.53	0.56	-0.17	0.00	0.06
Fertility					1.00	0.33	0.39	-0.39	-0.45	0.24	0.05	0.23
Somatic cell count						1.00	0.84	-0.18	-0.18	0.17	0.11	0.10
Mastitis resistance							1.00	-0.17	-0.19	0.23	0.10	0.17
Mammary system								1.00	0.90	-0.24	-0.03	0.09
Overall type									1.00	-0.41	-0.07	0.00
Feed saved										1.00	0.13	0.10
Gestation length											1.00	0.13
Heat tolerance												1.00

Table 14. Selected ABV correlations (Aussie Red)

	Protein	Fat	Milk	Survival	Fertility	Somatic cell count	Mastitis resistance	Mammary system	Overall type	Feed saved	Gestation length
Protein	1.00	0.49	0.80	-0.08	0.07	-0.12	-0.19	-0.22	0.02	-0.16	-0.13
Fat		1.00	0.41	0.23	-0.29	0.00	0.00	0.11	0.24	-0.31	0.06
Milk			1.00	0.00	-0.09	-0.12	-0.16	-0.15	0.14	-0.22	-0.05
Survival				1.00	-0.52	0.10	0.20	0.51	0.40	-0.33	0.22
Fertility					1.00	0.02	-0.08	-0.51	-0.54	0.34	-0.35
Somatic cell count						1.00	0.88	0.09	0.04	-0.04	0.06
Mastitis resistance							1.00	0.13	0.13	-0.09	0.09
Mammary system								1.00	0.54	-0.35	0.18
Overall type									1.00	-0.80	0.24
Feed saved										1.00	-0.13
Gestation length											1.00

5.4. Selected index correlations

Table 15. Selected index correlations (Holstein)

	BPI 24	BPI25 Proposed	HWI25_Sea Proposed_	SI25_ Proposed	HR_ Proposed	TMR_ Proposed
BPI 24	1.000	0.982	0.921	0.960	0.909	0.961
BPI25 Proposed		1.000	0.929	0.970	0.920	0.978
HWI25_Sea_Proposed			1.000	0.847	0.865	0.845
SI25_Proposed				1.000	0.869	0.988
HR_Proposed					1.000	0.888
TMR_Proposed						1.000

Table 16. Selected index correlations (Jersey)

	BPI 24	BPI25 Proposed	HWI25_Sea Proposed_	SI25_ Proposed	HR_ Proposed	TMR_ Proposed
BPI 24	1.000	0.981	0.876	0.960	0.925	0.972
BPI25 Proposed		1.000	0.923	0.980	0.940	0.973
HWI25_Sea_Proposed			1.000	0.804	0.870	0.823
SI25_Proposed				1.000	0.902	0.989
HR_Proposed					1.000	0.907
TMR_Proposed						1.000

Table 17. Selected index correlations (Australian Red)

	BPI 24	BPI25 Proposed	HWI25_Sea Proposed_	SI25_ Proposed	HR_ Proposed	TMR_ Proposed
BPI 24	1.000	0.980	0.838	0.948		0.955
BPI25 Proposed		1.000	0.842	0.957		0.980
HWI25_Sea_Proposed			1.000	0.715		0.724
SI25_Proposed				1.000		0.985
HR_Proposed					1.000	
TMR_Proposed						1.000