

Daughter Fertility, Daughter Calving Ability and Calving Ability Indexes by breed

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Introduction

In April 2007, at the last GEB meeting, CDN presented a report which illustrated a revised Daughter Fertility (**DF**) index, and a newly proposed Calving Performance (**CP**) index (Miglior et al., 2007). At the GEB meeting, both indexes were provisionally approved with the following recommendations:

- a) Daughter Fertility index be based on the following traits and relative weights; Non-Return Rate in Cows (50%), Calving to First Service (-15%), First Service to Conception in Cows (-25%) and Age at First Service (-10%).
- b) Daughter Calving Performance index be based on the following traits and relative weights; Maternal Calf Survival at First Calving (36%), Maternal Calf Survival at Later Calvings (24%), Maternal Calving Ease at First Calving (24%) and Maternal Calving Ease at Later Calvings (16%).

Since then, there has been some discussion among GEB members about the nomenclature of the calving index, and also about proposing an index which includes only direct calving performance EBV. The name of the Daughter Calving Performance index was changed to Daughter Calving Ability (**DCA**) index. In order to streamline the presentation of proofs related to direct calving performance, a new index has been proposed, called Calving Ability (**CA**), based on the following traits and relative weights; Calving Ease at First Calving (64%), + Calving Ease at Later Calvings (16%), Calf Survival at First Calving (16%) and Calf Survival at Later Calvings (4%)(Van Doormaal, 2007).

Furthermore, the GEB recommended that CDN change the proof expression to Relative Breeding Values (**RBV**) with an average of 100 and a standard deviation of 5 for all traits other than LPI, production, type and SCS. For reproductive performance traits, the trait expression has been modified to have high RBV always desirable. Thus, the scale of all interval female fertility traits have been reversed, i.e. a bull with a high RBV for calving to first service, first service to conception, age at first service or days open, means that this bull is expected to sire daughters with shorter CTFS, FSTC, AFS and DO.

The objective of this report is to present the three indexes by breed, and specifically to report RBV correlations among traits of interest for Holstein, Ayrshire and Jersey breeds, using the new trait expression and desirability scale.

Data and Analysis

Data from August 2007 evaluation run were included in the analysis. RBV correlations were calculated only for bulls with official LPI, with official code for DF (for the female fertility correlations), and with official code for DCA (for the calving traits). For all tables, the significance *P* value is included below each correlation value (*in italics*). When it is not reported it means that the *P* value was highly significant (less than 0.01). The old definition of DF is also included for comparison when female fertility traits are analyzed, and current MCE and CE are included for comparison when calving traits are analyzed. The Appendix includes top LPI (official August 2007) list for all breeds with RBV female fertility and calving traits.

Holstein

Table 1 reports the RBV correlations among female fertility traits in the Holstein breed. The new DF had much higher desirable correlations with all interval traits than the old DF. Also, the correlation with NRR in cows (the main trait of interest) was 9 percentage points higher with the new DF. The correlation with

age at first service was not different than zero. The correlation between the new and old DF was 0.8. A separate analysis (not shown) has identified the change of model (16-traits vs. 4-trait) as the major reason for this expected change between old and new DF indexes.

Table 2 reports the RBV correlations among calving traits in the Holstein breed. Daughter Calving Ability (DCA) was highly correlated with all maternal calving traits, and Calving Ability (CA) was highly correlated with all direct calving traits. DCA was positively correlated with DF (0.37). The current MCE had a correlation of 0.69 with DCA, while the current CE had a correlation of 0.79 with CA. It is intended that DCA and CA replace MCE and CE, respectively, on bull proof sheets and sire proof profiles.

Ayrshire

Table 3 reports the RBV correlations among female fertility traits in the Ayrshire breed. The new DF had much higher desirable correlations with all interval traits in cows than the old DF. Also, the correlation with NRR in cows (the main trait of interest) was 11 percentage points higher with the new DF. The correlation with age at first service was 0.17 (desirable, $P = 0.01$). The correlation between the new and old DF was 0.8, as in Holsteins.

Table 4 reports the RBV correlations among calving traits in the Ayrshire breed. As, for Holsteins, DCA was highly correlated with all maternal calving traits, and CA was highly correlated with all direct calving traits. One notable exception was Calf Survival in later calvings (CS-LC), whose correlation with any index/trait was mostly not significantly different than zero. DCA was positively correlated with DF (0.36). The current MCE had a correlation of 0.66 with DCA, while the current CE had a correlation of 0.73 with CA.

Jersey

Table 5 reports the RBV correlations among female fertility traits in the Jersey breed. As in Holsteins and Ayrshire, the new DF had much higher desirable correlations with all interval traits in cows than the old DF. Also, the correlation with NRR in cows (the main trait of interest) was 13 percentage points higher with the new DF. The correlation between the new and old DF was 0.68, markedly lower than in Holsteins and Ayrshires.

Table 6 reports the RBV correlations among calving traits in the Jersey breed. As in Holsteins and Ayrshires, DCA was highly correlated with all maternal calving traits, and CA was highly correlated with all direct calving traits. One notable exception, as in Ayrshires, was Calf Survival in later calvings (CS-LC), whose correlation with any index/trait was mostly not significantly different than zero. Different than Holsteins and Ayrshires, DCA was not correlated with DF. A reason could also be the lower number of bulls for Jerseys in the analysis compared to Holsteins and Ayrshires. The current MCE had a correlation of 0.59 with DCA, while the current CE had a correlation of 0.52 with CA.

Other Breeds

Similar analysis was performed for Brown Swiss, Guernsey, Milking Shorthorn and Canadienne. Tables are not reported as the number of bulls was very low for these four breeds:

- a) Brown Swiss: N = 68 (female fertility traits) and N = 54 (calving traits);
- b) Guernsey: N = 27 (female fertility traits) and N = 28 (calving traits);
- c) Milking Shorthorn: N = 9 (female fertility traits) and N = 9 (calving traits);
- d) Canadienne: N = 9 (female fertility traits) and N = 9 (calving traits);

It should be noted that for these four breeds there are no currently evaluations for calving ease (direct or maternal). Thus, DCA, CA and the RBV for individual traits will be new information.

Conclusion and Recommendations

Based on analysis of RBV correlations, a common formula for each index is recommended for all breeds as follow:

Daughter Fertility (**DF**) = 0.5 NRRc + 0.25 FSTCc + 0.15 CTFS + 0.10 AFS

Daughter Calving Ability (**DCA**) = 0.36 MCS-FC + 0.24 MCS-LC + 0.24 MCE-FC + 0.16 MCE-LC

Calving Ability (**CA**) = 0.64 CE-FC + 0.16 CE-LC + 0.16 CS-FC + 0.04 CS-LC

References

Miglior, F., A. Sewalem, G. Kistemaker, and B. J. Van Doormaal. 2007. Indices for Daughter Fertility and Calving Performance in Holsteins. Report to Genetic Evaluation Board, March 2007, St Hyacinthe, QC.

Van Doormaal, B.J., G.J. Kistemaker and F. Miglior. 2007. Implementation of Reproductive Performance Genetic Evaluations in Canada. *In press* Interbull Bulletin.

Accepted Industry Terminology

English	French
<p>Daughter Fertility (DF)</p> <p>Age at First Service Non Return Rate in Heifers First Service to Conception in Heifers Calving to First Service Non Return Rate in Cows First Service to Conception in Cows Days Open</p>	<p>Fertilité des filles (FF)</p> <p>Âge à la 1^{re} insémination Taux de non retour chez les génisses 1^{re} insémination à la conception chez les génisses Vêlage à la 1^{re} insémination Taux de non retour chez les vaches 1^{re} insémination à la conception chez les vaches Jours ouverts</p>
<p>Calving Ability (CA)</p> <p>Calving Ease at First Calving (Direct) Calving Ease at Later Calvings (Direct) Calf Survival at First Calving (Direct) Calf Survival at Later Calvings (Direct)</p>	<p>Aptitude au vêlage (AV)</p> <p>(Facilité de) vêlage de la progéniture issue de primipares (Facilité de) vêlage de la progéniture issue de multipares Survie de la progéniture issue de primipares Survie de la progéniture issue de multipares</p>
<p>Daughter Calving Ability (DCA)</p> <p>Maternal Calving Ease at First Calving Maternal Calving Ease at Later Calvings Maternal Calf Survival at First Calving Maternal Calf Survival at Later Calvings</p>	<p>Aptitude des filles au vêlage (AFV)</p> <p>Facilité de vêlage des filles primipares Facilité de vêlage des filles multipares Survie des veaux des filles primipares Survie des veaux des filles multipares</p>

Table 1. RBV correlations among female fertility traits in Holsteins (N = 3,245)

	DF	AFS	NRRh	FSTCh	CTFS	NRRc	FSTCc	DO
	New form							
DF	0.80	-0.01	0.59	0.55	0.12	0.82	0.68	0.56
<i>Old formula</i>		<i>0.42</i>						
DF		0.02	0.53	0.68	0.34	0.91	0.95	0.86
<i>New formula</i>		<i>0.22</i>						
AFS			-0.27	0.01	0.26	-0.22	-0.05	0.09
				<i>0.47</i>				
NRRh				0.75	-0.21	0.65	0.53	0.29
FSTCh					0.06	0.65	0.69	0.53
CTFS						-0.02	0.37	0.73
						<i>0.17</i>		
NRRc							0.83	0.59
FSTCc								0.90

AFS = Age at first service; DF = Daughter Fertility (Old: current formula; New: new formula for 2008); CTFS= Calving to first service; DO = Days Open; FSTCc= First service to conception in cows; FSTCh= First service to conception in heifers; NRRc= Non return rate in cows; NRRh= Non return rate in heifers

Table 2. RBV correlations among calving traits in Holsteins (N = 4,058)

	CE	DCA	CA	MCE-FC	MCS-FC	MCE-LC	MCS-LC	CE-FC	CS-FC	CE-LC	CS-LC	DF
	New form.											
MCE	0.42	0.69	0.39	0.84	0.44	0.81	0.25	0.38	0.28	0.36	0.24	0.17
CE		0.27	0.79	0.33	0.15	0.31	0.12	0.77	0.56	0.83	0.45	0.06
DCA			0.30	0.84	0.88	0.66	0.70	0.29	0.27	0.27	0.18	0.37
CA				0.38	0.16	0.33	0.16	0.98	0.81	0.86	0.65	0.06
MCE-FC					0.61	0.82	0.32	0.38	0.27	0.34	0.21	0.23
MCS-FC						0.35	0.58	0.15	0.17	0.15	0.08	0.35
MCE-LC							0.19	0.32	0.25	0.32	0.20	0.19
MCS-LC								0.14	0.19	0.12	0.12	0.34
CE-FC									0.73	0.83	0.58	0.06
CS-FC										0.59	0.76	0.02
												<i>0.18</i>
CE-LC											0.46	0.09
CS-LC												0.03
												<i>0.06</i>

DCA = Daughter Calving Ability; CA = Calving Ability; MCE = current maternal calving ease; CE = current direct calving ease; CE-FC = Direct calving ease at first calving; CE-LC = Direct calving ease at later calvings; CS-FC = Direct calf survival at first calving; CS-LC = Direct calf survival at later calvings; MCE-FC = Maternal calving ease at first calving; MCE-LC = Maternal calving ease at later calvings; MCS-FC = Maternal calf survival at first calving; MCS-LC = Maternal calf survival at later calvings

Table 3. RBV correlations among female fertility traits in Ayrshire (N = 237)

	DF New form	AFS	NRRh	FSTCh	CTFS	NRRc	FSTCc	DO
DF <i>Old formula</i>	0.80	0.07 <i>0.31</i>	0.60	0.54	0.17 <i>0.01</i>	0.81	0.65	0.56
DF <i>New formula</i>		0.17 <i>0.01</i>	0.43	0.57	0.31	0.92	0.92	0.83
AFS			-0.14 <i>0.03</i>	0.13 <i>0.04</i>	0.34	-0.11 <i>0.08</i>	0.02 <i>0.78</i>	0.18
NRRh				0.74	-0.22	0.54	0.37	0.16 <i>0.01</i>
FSTCh					-0.06 <i>0.34</i>	0.58	0.52	0.35
CTFS						-0.01 <i>0.86</i>	0.29	0.70
NRRc							0.82	0.60
FSTCc								0.88

AFS = Age at first service; DF = Daughter Fertility (Old: current formula; New: new formula for 2008); CTFS= Calving to first service; DO = Days Open; FSTCc= First service to conception in cows; FSTCh= First service to conception in heifers; NRRc= Non return rate in cows; NRRh= Non return rate in heifers

Table 4. RBV correlations among calving traits in Ayrshire (N = 214)

	CE	DCA	CA	MCE-FC	MCS-FC	MCE-LC	MCS-LC	CE-FC	CS-FC	CE-LC	CS-LC	DF New form.
MCE	0.29	0.66	0.33	0.77	0.45	0.80	0.16 <i>0.02</i>	0.28	0.28	0.32	0.09 <i>0.17</i>	0.23
CE		0.36	0.73	0.37	0.20	0.36	0.20	0.71	0.43	0.74	0.17 <i>0.01</i>	0.10 <i>0.13</i>
DCA			0.42	0.85	0.83	0.73	0.67	0.37	0.35	0.40	0.12 <i>0.07</i>	0.36
CA				0.44	0.24	0.42	0.24	0.97	0.76	0.80	0.13 <i>0.05</i>	0.18
MCE-FC					0.61	0.83	0.31	0.40	0.33	0.44	0.03 <i>0.67</i>	0.27
MCS-FC						0.46	0.44	0.19	0.27	0.20	0.18	0.37
MCE-LC							0.19	0.37	0.33	0.41	0.10 <i>0.15</i>	0.13 <i>0.05</i>
MCS-LC								0.21	0.17 <i>0.01</i>	0.23	0.08 <i>0.23</i>	0.27
CE-FC									0.65	0.74	0.03 <i>0.71</i>	0.18
CS-FC										0.45	0.18	0.16 <i>0.02</i>
CE-LC											0.11 <i>0.11</i>	0.11 <i>0.10</i>
CS-LC												0.01 <i>0.89</i>

DCA = Daughter Calving Ability; CA = Calving Ability; MCE = current maternal calving ease; CE = current direct calving ease; CE-FC = Direct calving ease at first calving; CE-LC = Direct calving ease at later calvings; CS-FC = Direct calf survival at first calving; CS-LC = Direct calf survival at later calvings; MCE-FC = Maternal calving ease at first calving; MCE-LC = Maternal calving ease at later calvings; MCS-FC = Maternal calf survival at first calving; MCS-LC = Maternal calf survival at later calvings

Table 5. RBV correlations among female fertility traits in Jersey (N = 142)

	DF	AFS	NRRh	FSTCh	CTFS	NRRc	FSTCc	DO
	New form							
DF	0.68	0.01	0.64	0.48	-0.05	0.75	0.56	0.35
<i>Old formula</i>		<i>0.92</i>			<i>0.53</i>			
DF		0.11	0.51	0.59	0.33	0.88	0.94	0.79
<i>New formula</i>		<i>0.20</i>						
AFS			-0.19	0.04	0.25	-0.18	0.03	0.15
				<i>0.66</i>		<i>0.03</i>	<i>0.73</i>	<i>0.07</i>
NRRh				0.65	-0.13	0.61	0.50	0.26
					<i>0.12</i>			
FSTCh					0.00	0.58	0.58	0.39
					<i>0.96</i>			
CTFS						-0.08	0.38	0.79
						<i>0.32</i>		
NRRc							0.78	0.47
FSTCc								0.86

AFS = Age at first service; DF = Daughter Fertility (Old: current formula; New: new formula for 2008); CTFS= Calving to first service; DO = Days Open; FSTCc= First service to conception in cows; FSTCh= First service to conception in heifers; NRRc= Non return rate in cows; NRRh= Non return rate in heifers

Table 6. RBV correlations among calving traits in Jersey (N = 141)

	CE	DCA	CA	MCE-FC	MCS-FC	MCE-LC	MCS-LC	CE-FC	CS-FC	CE-LC	CS-LC	DF
	New form											
MCE	0.12	0.59	0.10	0.72	0.38	0.75	0.16	0.12	0.08	-0.03	0.02	-0.05
	<i>0.16</i>		<i>0.22</i>				<i>0.06</i>	<i>0.16</i>	<i>0.32</i>	<i>0.70</i>	<i>0.79</i>	<i>0.58</i>
CE		0.02	0.52	0.09	-0.02	0.10	-0.05	0.46	0.21	0.62	0.15	-0.08
		<i>0.84</i>		<i>0.27</i>	<i>0.77</i>	<i>0.24</i>	<i>0.56</i>	<i>0.01</i>	<i>0.01</i>	<i>0.08</i>	<i>0.08</i>	<i>0.35</i>
DCA			0.09	0.76	0.87	0.49	0.65	0.12	0.07	-0.14	0.16	0.10
			<i>0.30</i>					<i>0.15</i>	<i>0.40</i>	<i>0.10</i>	<i>0.06</i>	<i>0.25</i>
CA				0.11	0.00	0.03	0.12	0.93	0.66	0.52	0.21	-0.15
				<i>0.19</i>	<i>0.97</i>	<i>0.69</i>	<i>0.16</i>				<i>0.01</i>	<i>0.08</i>
MCE-FC					0.54	0.73	0.20	0.14	0.09	-0.07	-0.03	-0.06
							<i>0.02</i>	<i>0.10</i>	<i>0.26</i>	<i>0.44</i>	<i>0.70</i>	<i>0.46</i>
MCS-FC						0.22	0.44	0.05	-0.02	-0.15	0.13	0.11
						<i>0.01</i>		<i>0.56</i>	<i>0.78</i>	<i>0.07</i>	<i>0.13</i>	<i>0.19</i>
MCE-LC							-0.03	0.06	0.01	-0.03	-0.02	0.05
							<i>0.77</i>	<i>0.51</i>	<i>0.95</i>	<i>0.75</i>	<i>0.84</i>	<i>0.54</i>
MCS-LC								0.12	0.15	-0.10	0.26	0.14
								<i>0.17</i>	<i>0.09</i>	<i>0.22</i>		<i>0.10</i>
CE-FC									0.41	0.40	0.01	-0.16
											<i>0.92</i>	<i>0.05</i>
CS-FC										0.17	0.39	-0.04
										<i>0.04</i>		<i>0.61</i>
CE-LC											0.07	-0.15
											<i>0.38</i>	<i>0.07</i>
CS-LC												0.21
												<i>0.01</i>

DCA = Daughter Calving Ability; CA = Calving Ability; MCE = current maternal calving ease; CE = current direct calving ease; CE-FC = Direct calving ease at first calving; CE-LC = Direct calving ease at later calvings; CS-FC = Direct calf survival at first calving; CS-LC = Direct calf survival at later calvings; MCE-FC = Maternal calving ease at first calving; MCE-LC = Maternal calving ease at later calvings; MCS-FC = Maternal calf survival at first calving; MCS-LC = Maternal calf survival at later calvings

Appendix. Table A. Top LPI list with details of reproductive indices and traits (Holstein)

Bull ID	Name	Year	LPI	Female Fertility Traits							Maternal Calving Traits							Direct Calving Traits							
				Old New		Rel	NRRc	FSTCc	CTFS	AFS	MCE	DCA	Rel	CE-FC	CE-LC	CS-FC	CS-LC	CE	CA	Rel	CE-FC	CE-LC	CS-FC	CS-LC	
				DF	DF																				
1	HOCANM100745543	DUDOC MR BURNS	2002	2350	68	97	56	98	96	99	99	73	92	55	90	91	94	99	82	96	74	95	98	97	100
2	HOUSAM122358313	O-BEE MANFRED JUSTICE-ET	1998	2320	69	107	65	106	106	108	95	96	103	68	106	108	99	99	97	114	92	114	111	111	116
3	HOCANM10705608	BRAEDALE GOLDWYN	2000	2271	64	94	82	95	95	98	101	87	100	71	101	100	101	96	89	105	99	104	102	106	107
4	HOUSAM123066734	HARTLINE TITANIC-ET	1998	2217	65	97	97	99	97	94	100	85	101	98	96	98	104	103	90	105	99	105	103	105	96
5	HOCANM7317441	WALLACEVIEW ALADDIN	2001	2208	64	90	70	89	91	100	102	93	99	68	108	108	96	92	84	98	85	98	103	95	91
6	HOUSAM131866683	HORSTYLE MAXWELL-ET	2001	2137	67	91	69	94	89	89	105	85	89	65	97	102	85	87	85	99	85	100	99	93	98
7	HOCANM8641364	BRAEDALE PAGEWIRE	2002	1978	65	100	76	100	100	99	104	83	100	79	96	94	104	103	74	92	91	94	88	93	92
8	HOUSAM133573930	MORNINGVIEW ASHLAR-ET	2002	1944	68	103	53	104	102	99	98	93	99	71	99	98	93	99	93	105	68	105	103	105	107
9	HOUSAM17131025	WELCOME GARTER-ET	1996	1910	67	99	85	103	97	90	102	93	105	82	106	104	102	106	84	97	95	98	98	92	102
10	HOCANM10785322	FORTALE LOMAX	2001	1905	67	100	74	100	99	100	105	86	96	71	99	98	93	99	88	104	98	105	101	100	106
11	HOUSAM60540099	REGANCREST DOLMAN-ET	2001	1900	69	103	67	102	101	99	107	88	95	64	102	103	93	90	80	92	98	91	94	98	99
12	HOCANM9324236	KARONA BONAIR	2003	1890	68	97	57	99	94	97	106	95	97	65	107	107	86	98	82	96	87	95	101	94	106
13	HOUSAM128226159	BRIGEEN GIVENCHY-ET	1999	1885	69	100	76	103	97	92	103	83	100	66	99	93	101	106	89	102	99	104	103	96	91
14	HOCANM9294161	CLAYNOOK VICTORY	2001	1865	69	100	76	101	98	94	106	83	93	71	96	92	92	97	86	102	95	104	102	93	98
15	HOUSAM129952732	RICECREST EMMETT-ET	2000	1863	64	97	72	99	96	93	100	91	98	61	105	106	96	90	89	104	84	105	98	101	106
16	HOUSAM207485404	REGANCREST-JB MONTY-ET	2001	1805	69	100	70	100	98	99	105	90	100	64	106	104	95	98	91	105	79	106	105	101	103
17	HOUSAM17013604	FUSTEAD EMORY BLITZ-ET	1996	1801	68	98	96	103	93	87	106	91	106	96	103	98	109	103	82	95	99	94	96	100	107
18	HOCANM9313510	PENNVIEW INTRUDER	2001	1798	63	86	71	87	83	94	113	81	94	66	94	94	93	99	83	98	86	99	96	98	101
19	HOUSAM129922003	TO-MAR D-FORTUNE-ET	2000	1786	63	99	65	95	101	107	100	85	100	57	102	100	100	99	86	101	97	100	99	104	103
20	HOCANM8432082	STAN HOPE SOVEREIGN	2002	1759	67	99	80	99	98	101	103	72	91	84	90	89	94	96	61	79	97	82	79	79	79
21	HOCANM101457717	FIRSTSTAR DAIRY MAN	2003	1740	67	99	53	99	97	98	105	80	95	61	93	93	98	99	80	99	88	100	97	96	97
22	HOUSAM132245342	HIDDEN-VIEW BARNES	2001	1732	65	90	66	90	90	99	102	86	85	66	96	99	83	81	89	105	84	106	106	100	101
23	HOCANM6790237	BRAEDALE GOODLUCK-ET	1997	1729	67	103	92	105	100	96	106	90	100	92	101	100	97	103	85	98	97	98	100	95	101
24	HOCANM100341734	LA PRESENTATION DANOIS	2002	1724	64	95	67	96	95	101	94	95	99	69	104	105	96	96	92	108	86	109	106	102	101
25	HOCANM7220817	BOFRAN LUCKY STAR	2000	1719	66	99	74	98	100	98	104	91	104	65	106	104	105	99	89	103	98	102	103	105	100
26	HOCANM100745737	LEHOUX LAREZ	2002	1714	69	104	62	104	102	100	103	89	99	65	101	100	99	97	86	97	82	98	97	95	98
27	HOUSAM133277517	COOK-FARM FEISTY-ET	2002	1708	66	97	64	94	97	104	105	96	99	65	108	108	96	92	93	107	83	108	107	103	106
28	HOCANM10751490	STANBRO MONEY	2000	1696	58	85	72	85	84	97	106	90	94	65	100	104	90	94	88	102	95	102	102	102	102
29	HOUSAM60745351	LANG-ENGLAND HARRISON-ET	2002	1692	68	97	75	96	96	99	106	94	98	78	106	105	95	91	90	103	91	104	104	100	103
30	HOCANM7353794	COMESTAR LUTICA	2002	1688	64	93	64	88	93	105	114	87	98	64	98	96	98	100	91	100	79	101	100	95	102
31	HOCANM100385030	WAUREGAN-I MAESTRO	2002	1678	64	95	55	97	96	92	101	93	107	58	107	104	107	103	88	103	79	103	103	99	103
32	HOCANM8324379	GEPAQUETTE SAM	2001	1675	67	101	63	101	102	104	92	94	99	64	104	108	94	95	87	102	81	102	103	100	100
33	HOCANM9434213	GINARY TANDEM	2002	1672	69	102	65	101	102	102	103	94	103	69	106	102	101	101	93	109	86	109	112	103	104
34	HOUSAM132126528	JEFFREY-WAY TOPNOTCH-ET	2001	1651	70	101	71	103	100	96	98	93	94	71	105	105	91	86	80	101	86	102	96	99	99
35	HOUSAM61076923	REGANCREST-MWS MAGNA-ET	2002	1630	65	98	57	98	99	99	103	90	109	63	106	101	110	107	95	111	84	112	110	104	103
36	HOUSAM133588633	MR MINISTER	2002	1626	64	97	59	96	97	99	101	92	101	64	106	104	99	97	87	103	87	103	102	104	101
37	HOCANM8533970	CEDARWAL SUPERIOR	2001	1615	65	100	67	103	99	93	96	89	104	68	102	100	105	103	92	106	83	106	106	106	104
38	HOCANM8209795	GILLETTE CUTLER	2001	1602	63	99	75	97	99	99	108	87	104	67	101	99	107	103	83	96	95	96	99	96	100
39	HOFRAM2941263960	PABST	1999	1599	71	101	78	102	98	100	104	91	104	68	104	104	105	99	90	102	82	102	104	102	101
40	HOUSAM129348607	NEU-WAY ALBERT-ET	2000	1598	67	104	77	103	104	102	102	90	104	66	106	105	104	99	94	106	81	106	107	100	106
41	HOUSAM60540176	REGANCREST DESIGN-ET	2001	1598	65	100	71	100	102	96	104	83	102	64	100	98	104	101	83	95	86	96	93	96	93
42	HOCANM6812634	COMESTAR EXPORT	1997	1595	67	104	94	103	106	101	99	94	109	94	106	104	106	112	86	100	98	101	100	95	97
43	HOUSAM60919227	FAR-O-LA DJ BLITZ DOMINANT	2002	1588	66	95	60	95	92	96	113	89	100	59	100	95	102	101	82	95	82	95	93	99	100
44	HOUSAM60745370	LANG-ENGLAND CAPRI-ET	2002	1586	72	104	68	105	102	99	101	91	96	69	103	102	93	92	93	108	83	108	109	103	106
45	HOCANM8209524	GILLETTE BRILEA F B I	2000	1577	67	96	78	94	94	100	111	89	103	72	103	101	102	104	89	100	99	101	102	95	103
46	HOCANM8298524	MADMANN DIAMOND	2002	1570	65	93	52	97	90	92	98	70	91	58	87	84	95	100	87	100	67	100	99	102	107
47	HOUSAM60700461	HENKESEEN HYATT-ET	2002	1568	65	91	63	94	90	91	104	82	95	67	95	93	97	96	85	102	83	101	99	106	109
48	HOCANM9409361	DUPASQUIER CARISMA	2001	1559	65	100	75	98	100	105	99	85	97	75	99	101	96	98	83	93	95	91	100	94	97
49	HOUSAM123645630	HIDDEN-VIEW BEST	1998	1558	63	99	80	96	99	101	112	90	101	84	98	100	100	103	85	101	94	100	98	108	107
50	HOUSAM132126470	JEFFREY-WAY TOPLEVEL-ET	2001	1557	59	90	71	91	92	97	99	91	92	71	103	107	86	86	90	105	86	106	107	101	102

Bull ID	Name	Year	LPI	Female Fertility Traits							Maternal Calving Traits						Direct Calving Traits							
				Old DF	New DF	Rel	NRRc	FSTCc	CTFS	AFS	MCE	DCA	Rel	CE-FC	CE-LC	CS-FC	CS-LC	CE	CA	Rel	CE-FC	CE-LC	CS-FC	CS-LC
51	HOCANM9428125	2002	1556	65	98	64	95	97	103	116	95	107	68	106	103	107	106	76	97	87	97	92	100	106
52	HOCANM6820564	1997	1548	65	98	97	98	99	98	103	89	98	98	99	94	102	96	85	96	99	98	99	89	96
53	HOUSAM60549654	2001	1548	65	95	59	93	97	102	107	93	102	60	104	104	101	97	87	98	83	98	97	100	100
54	HOUSAM131849954	2001	1547	66	98	74	98	100	99	102	91	105	71	105	97	108	102	89	103	85	104	101	101	106
55	HOCANM8346570	2001	1526	63	97	77	98	98	95	98	93	105	74	104	100	103	107	87	100	93	99	99	102	103
56	HOCANM8533983	2001	1526	60	90	70	90	90	100	101	90	98	71	101	101	96	97	78	98	86	98	95	100	102
57	HOUSAM126366093	1999	1506	71	105	64	105	103	102	105	89	97	74	102	105	95	92	87	101	96	101	103	102	99
58	HOCANM100601995	2002	1497	64	97	54	95	99	103	105	88	107	58	104	99	109	107	88	103	82	103	103	101	101
59	HOCANM7353763	2002	1494	69	105	70	105	108	101	94	95	108	70	109	110	105	104	88	106	85	107	101	106	110
60	HOUSAM132118158	2001	1494	61	86	63	86	83	101	108	85	96	57	99	99	96	96	90	104	74	105	101	104	104
61	HOCANM9243546	2000	1493	62	96	79	96	97	94	109	87	97	72	98	95	99	97	87	100	99	102	101	92	96
62	HOUSAM2261765	1994	1490	69	105	85	109	104	91	99	81	98	74	96	95	100	100	83	94	87	94	100	93	90
63	HOCANM9274858	2000	1490	65	97	76	100	97	95	95	90	107	68	104	106	106	106	92	108	85	109	102	109	110
64	HOCANM9286832	2002	1487	63	98	69	95	98	103	106	85	99	69	98	95	99	104	87	104	87	104	105	100	104
65	HOITAMBS17670H	1993	1484	68	103	73	101	101	99	110	91	108	66	105	104	110	103	92	106	78	105	106	107	110
66	HOCANM10728920	2000	1482	63	97	79	95	95	107	103	89	102	72	102	104	101	101	84	100	99	100	98	102	104
67	HOCANM10788197	2000	1478	62	94	77	94	94	100	98	90	102	71	102	100	103	100	92	105	96	104	104	106	103
68	HOCANM101012403	2001	1475	62	92	63	92	91	100	106	74	91	65	92	90	93	95	84	99	80	100	100	97	98
69	HOUSAM207124561	1999	1466	67	93	76	94	94	92	106	83	95	65	99	97	98	91	77	89	99	90	94	87	93
70	HOUSAM130997757	2000	1455	63	96	77	98	96	98	96	91	102	69	102	101	104	99	94	109	85	109	108	108	108
71	HOUSAM131621936	2001	1448	67	103	63	102	104	100	103	93	105	68	105	104	105	99	77	91	91	90	90	99	102
72	HOCANM7150840	1999	1445	69	107	77	106	105	105	100	93	108	67	107	104	105	108	92	109	89	108	107	108	108
73	HOCANM8209614	2000	1444	65	97	77	100	97	96	96	91	100	72	102	102	98	101	92	104	86	104	103	101	107
74	HOCANM8264964	2001	1444	65	99	66	98	98	102	102	88	99	60	101	99	98	98	88	98	86	100	100	91	89
75	HOCANM101034031	2002	1442	68	103	65	107	100	95	96	88	102	68	102	99	102	103	89	104	86	105	105	101	102
76	HOCANM8556185	2001	1439	62	98	73	99	99	97	102	92	105	71	104	103	102	107	86	106	83	107	100	104	101
77	HOCANM1264083	2001	1439	66	97	70	99	97	98	95	92	101	71	105	98	100	99	81	100	86	101	97	101	96
78	HOCANM7175713	1998	1438	69	101	85	104	101	91	95	91	101	86	102	103	101	96	93	109	96	111	107	103	100
79	HOCANM8150222	1999	1434	74	109	88	110	108	99	103	93	106	89	105	97	106	107	88	102	98	103	104	94	100
80	HOCANM7229251	1999	1434	69	103	82	104	102	98	103	90	101	80	106	99	102	96	92	107	98	108	106	99	102
81	HOUSAM60119746	2000	1433	71	112	75	110	111	106	104	93	109	68	111	113	104	102	92	113	82	114	105	110	110
82	HOCANM9462255	2002	1431	67	100	59	101	100	98	100	91	104	62	103	101	103	106	87	101	83	102	101	95	98
83	HOCANM8190185	2000	1419	61	93	60	92	93	103	100	88	100	53	100	99	98	104	86	103	65	101	102	108	103
84	HOUSAM60178857	2000	1416	64	100	79	99	101	97	108	93	105	73	105	103	104	93	107	95	108	104	105	101	
85	HOCANM8212265	2000	1414	64	91	73	90	92	100	105	89	101	66	103	102	101	98	93	110	87	110	103	112	113
86	HOUSAM51765869	2002	1414	69	95	66	94	93	102	105	90	88	64	100	102	82	86	91	104	87	105	103	98	102
87	HOCANM9255051	2000	1413	65	100	79	98	100	105	104	84	101	71	99	98	99	108	81	99	86	99	95	100	102
88	HOUSAM130762315	2000	1411	68	105	70	104	106	103	99	96	116	63	116	112	114	109	88	105	77	104	104	107	111
89	HOUSAM17188116	1996	1408	62	93	88	91	94	104	103	82	94	87	98	100	93	93	88	100	95	101	102	97	94
90	HOCANM6906781	1997	1408	63	96	75	97	95	98	101	81	97	69	96	94	97	102	76	94	93	92	92	100	107
91	HOITAM9M1001C046	1998	1405	68	104	75	103	104	106	92	89	104	70	99	98	103	112	94	110	70	110	109	106	107
92	HOUSAM207123681	1999	1404	71	110	81	106	110	112	106	87	102	72	103	98	101	105	94	108	80	108	106	105	106
93	HOCANM10608609	1999	1402	65	98	80	95	98	105	107	81	94	69	95	93	98	94	89	103	99	103	103	104	100
94	HOUSAM133092796	2002	1401	66	99	63	98	98	99	102	94	103	63	106	104	100	101	90	101	80	101	102	98	100
95	HOCANM10649801	1999	1400	70	103	82	105	100	97	103	78	94	81	94	94	97	96	87	101	97	101	103	102	96
96	HOUSAM122554867	1998	1397	66	100	93	98	96	108	107	82	91	96	95	98	80	107	82	98	99	97	98	101	105
97	HOUSAM133870073	2002	1394	65	96	58	95	95	103	99	90	99	64	101	99	97	99	85	103	85	104	99	99	100
98	HOCANM7357202	2002	1392	62	90	53	91	91	97	98	85	96	63	98	98	96	95	86	104	87	105	105	96	97
99	HOCANM10705606	2000	1390	54	84	82	85	85	97	97	87	95	75	98	97	93	98	85	100	88	100	95	103	103
100	HOCANM9106826	2000	1389	71	106	80	105	107	102	101	82	100	72	99	99	104	97	83	99	85	99	98	100	100

Appendix. Table B. Top LPI list with details of reproductive indices and traits (Ayrshire)

Bull ID	Name	Year	LPI	Female Fertility Traits								Maternal Calving Traits						Direct Calving Traits							
				Old	New	Rel	NRRc	FSTCc	CTFS	AFS	MCE	DCA	Rel	CE-FC	CE-LC	CS-FC	CS-LC	CE	CA	Rel	CE-FC	CE-LC	CS-FC	CS-LC	
				DF	DF																				
1	AYSWEM91011	B JURIST	1996	2710	63	102	73	101	98	96	113	97	101	69	101	108	107	90	96	104	86	102	100	116	97
2	AYSWEM93907	T-BRUNO	1990	2667	65	105	78	103	99	102	115	98	101	70	99	104	108	94	97	111	85	105	105	128	115
3	AYCANM100317070	DUO STAR NORMANDIN	2002	2518	64	105	41	105	102	98	105								97	109	83	106	106	115	109
4	AYCANM100764632	DE LA TOUR HAMILTON	2002	2069	67	111	56	108	108	105	111	98	105	60	102	102	108	102	97	106	82	103	107	113	108
5	AYCANM8401621	DES CHAMOIS POKER -ET	2002	1981	60	95	62	95	96	96	102	93	94	65	95	96	96	93	95	100	84	101	97	100	101
6	AYCANM100494634	TURCOVAL TUDOR	2002	1856	61	101	42	99	99	100	110	98	108	48	108	110	109	98	97	107	81	107	105	107	95
7	AYCANM10315763	VISSERDALE ETRO -ET	2000	1828	63	103	70	100	103	104	105	97	101	60	99	103	100	101	91	98	87	97	92	100	117
8	AYCANM10002432	KILDARE JERRY ET	1996	1782	63	100	91	104	99	95	94	97	101	90	102	102	96	102	98	106	97	108	105	97	92
9	AYSWEM83882	TORPANE	1989	1711	65	110	70	109	103	103	114	98	104	56	107	104	104	98	95	103	35	106	101	103	63
10	AYCANM8701313	BLACKADDAR KARAMILK	2002	1695	60	97	47	94	96	103	105	91	96	50	93	96	99	97	97	102	80	102	104	100	102
11	AYCANM8389304	LAGACE MODEM -ET	2001	1667	59	88	58	90	86	92	104	86	89	55	90	90	95	89	92	91	79	93	94	89	86
12	AYCANM10030354	KILDARE TORNADE S ET	1998	1561	65	108	74	108	105	104	102	97	104	64	106	104	102	100	97	107	85	109	108	102	79
13	AYSWEM84652	DROPSTAD	1986	1468	72	118	79	114	115	109	113	97	108	68	110	100	112	101	95	98	68	96	98	102	111
14	AYCANM10318219	OAKBURN GRANGE -ET	2001	1433	61	95	59	96	95	97	97	99	105	57	109	108	102	98	96	107	78	108	102	106	105
15	AYCANM101049447	KELLCREST HAPPINESS -ET	2002	1383	62	100	49	99	101	100	105	93	97	57	98	98	97	97	84	91	85	92	88	93	93
16	AYCANM10312953	MARDEL MUSTAFA -ET S	2000	1330	67	113	75	106	113	112	116	96	106	67	101	101	113	101	94	98	80	97	98	100	108
17	AYCANM10021166	MASSE PERCEVAL ET	1997	1327	66	102	86	102	101	95	102	94	94	82	97	99	93	94	93	98	93	100	96	95	96
18	AYCANM10311365	VISSERDALE DILLIGENT -ET S	2000	1327	64	100	78	97	100	106	110	94	97	63	98	96	99	96	92	95	95	94	98	99	106
19	AYCANM10317156	MARGOT COLARGOL	2001	1313	65	102	65	103	103	97	98	92	96	59	97	94	99	95	94	99	77	99	97	102	106
20	AYCANM10019875	TERRACE BANK EASTERN ET	1997	1294	64	103	78	104	104	97	94	97	100	66	105	104	93	98	96	103	85	103	104	101	101
21	AYCANM10316550	LAGACE KARUSO	2001	1290	63	102	54	100	102	104	106								84	88	72	88	91	90	97
22	AYCANM10301616	NORTH PINE AIKON	1999	1264	68	104	68	105	102	104	97								95	107	76	106	107	107	105
23	AYCANM811799	WOODLAND VIEW PARDNER ET	1994	1263	60	97	96	97	98	95	104	91	91	95	93	93	96	90	86	90	98	91	90	92	93
24	AYUSAM144136	ARDROSSAN EV KATES TRIDENT	1988	1259	60	95	93	95	94	97	106	97	101	88	102	102	102	97	91	93	94	91	98	99	99
25	AYCANM10303543	CLAUDALE JACKPOT	1999	1252	63	99	70	96	96	109	105	95	95	55	98	99	95	93	99	107	74	107	111	102	104
26	AYCANM10012178	FERVAL DUO ET	1997	1247	64	100	72	98	97	105	106								82	97	56	98	92	100	99
27	AYCANM101034028	KILDARE JEROME -ET	2002	1242	62	103	47	102	102	100	102								98	104	82	105	108	97	92
28	AYCANM811990	STRATHBURN STARDOM	1994	1219	60	97	71	98	98	98	99	94	102	58	103	99	98	105	93	97	74	94	99	107	99
29	AYUSAM100203204	GALNEY-EPC RIPKEN RAVEN	2001	1203	61	97	61	98	96	96	104	96	101	57	101	99	98	104	95	105	78	105	101	106	100
30	AYUSAM100194674	DON-SHER HECTOR	2001	1188	60	100	65	98	99	102	107	98	105	61	104	100	106	104	97	101	86	101	103	101	94
31	AYCANM100311085	DE LA CAVEE TEST -ET	2002	1188	60	98	49	97	98	100	105								99	106	75	105	107	102	103
32	AYCANM10014960	KELLCREST PASSION ET	1996	1187	58	93	86	95	92	95	98	91	93	81	95	98	93	95	92	96	91	98	93	96	100
33	AYCANM8405490	LA SAPINIERE CACYLITE -ET	2001	1187	57	89	65	86	91	106	105	93	91	61	96	101	88	90	89	96	88	97	97	93	97
34	AYCANM10311833	KILDARE DROPSTAR -ET S	2000	1181	70	113	71	112	110	105	104	95	101	62	103	94	103	100	94	96	81	96	95	96	102
35	AYCANM10317831	KILDARE VINCE -ET	2001	1164	60	100	61	101	101	94	100	91	94	61	95	92	100	94	95	101	77	101	103	101	98
36	AYCANM8389303	LAGACE MOBIL -ET	2001	1138	60	97	64	99	98	98	96	97	102	60	103	101	103	100	98	104	76	103	107	102	102
37	AYCANM10029773	BIRGHDALE COPPER	1998	1131	62	99	81	98	99	102	102	98	96	78	101	101	96	93	93	95	96	95	98	95	98
38	AYCANM10304525	KILDARE REEBUCK	1999	1113	64	102	68	100	100	103	105								91	88	93	91	92	82	86
39	AYCANM10304939	SHADY WALNUT CONN	1999	1106	65	101	75	100	101	101	103	95	99	66	103	99	99	98	93	96	96	95	100	97	105
40	AYCANM8460354	VISSERDALE SECURITY	2002	1106	59	96	48	94	97	103	102								99	112	77	111	113	106	103
41	AYSWEM86153	INGVASTA	1989	1105	68	109	67	106	105	114	104														
42	AYCANM10000721	MARDEL VOLAGE ET	1996	1104	58	96	88	95	98	102	99	96	100	82	102	100	99	100	98	109	93	108	106	108	107
43	AYCANM10301699	SOUS L'OMBRE ALTERNO	1998	1087	63	99	73	101	102	95	92	96	99	59	102	99	98	98	95	101	77	101	106	99	98
44	AYCANM10001147	MARGOT LORENZO	1996	1055	58	96	89	97	96	98	96	94	101	85	97	98	99	108	97	103	95	103	103	101	102
45	AYCANM10311388	LA SAPINIERE DINOMIRE	2000	1031	58	96	73	92	99	107	105	90	96	64	94	93	97	101	96	102	79	102	103	97	101
46	AYCANM10028635	LOMBARD DALE PATRICK VINTAGE	1997	1012	62	100	73	100	102	99	99	97	102	60	101	104	101	99	97	103	64	102	103	102	100
47	AYCANM10313701	LARCH GROVE MISCHIEF	2000	1010	62	105	71	103	109	101	102	99	110	63	108	106	110	106	98	104	86	105	104	98	100
48	AYCANM8480934	YELLOW BRIAR JOURNALIST	2001	1009	59	88	65	88	87	92	105	92	95	66	98	96	100	91	98	103	83	105	100	99	103
49	AYCANM10304708	ROI RUGBY	1999	1004	64	102	73	100	98	106	108	94	103	62	102	101	103	102	92	95	80	93	100	97	100
50	AYCANM10310847	MARGOT CALIMERO	2000	989	64	102	72	102	101	96	107	96	100	60	101	99	101	96	91	96	96	94	97	101	105

Proofs highlighted in yellow will not meet currently proposed minimum publication criteria

Appendix. Table C. Top LPI list with details of reproductive indices and traits (Jersey)

Bull ID	Name	Year	LPI	Female Fertility Traits							Maternal Calving Traits							Direct Calving Traits							
				Old DF	New DF	Rel	NRRc	FSTCc	CTFS	AFS	MCE	DCA	Rel	CE-FC	CE-LC	CS-FC	CS-LC	CE	CA	Rel	CE-FC	CE-LC	CS-FC	CS-LC	
1	JECANM9240969	HOLLYLANE LILIBET'S LEGACY	2001	1831	75	106	64	106	105	99	104	97	101	59	103	101	99	101	93	99	81	101	94	99	94
2	JECANM10211025	PINE HAVEN SENIOR	2000	1728	75	106	65	103	105	108	106	97	98	58	101	102	99	95	96	100	90	102	100	97	91
3	JECANM10203359	GIPRAT BELLE'S CONNECTION -ET	1998	1423	71	103	65	99	102	108	107	93	98	56	91	99	99	104	96	96	79	94	98	99	107
4	JECANM139476	ROCK ELLA PARAMOUNT ET	1995	1391	73	101	86	100	101	101	107	96	99	80	98	101	97	102	96	97	91	98	99	96	101
5	JEUSAM665951	GOLDEN BOY OF FERREIRA	1997	1376	71	96	49	95	98	99	106								97	102	83	100	105	103	95
6	JECANM10201207	SHF CENTURION SULTAN	1998	1302	68	93	79	94	91	96	103	98	101	78	104	100	100	100	96	98	97	101	101	94	88
7	JEUSAM110106571	WINDY WILLOW MONTANA JACE	1996	1288	68	100	64	99	101	101	101	97	105	60	102	102	107	102	95	101	85	100	95	104	108
8	JEUSAM112155106	REFUGE PERIMETER SHOOTER-ET	2001	1279	68	94	53	94	95	97	103								93	101	68	101	104	99	95
9	JECANM139475	ROCK ELLA PERIMETER ET	1995	1218	71	101	95	97	102	105	106	97	100	91	102	101	102	97	95	95	97	97	101	92	91
10	JECANM10008436	GIPRAT BELLES JADE ET	1996	1133	72	106	85	103	105	104	106	98	103	79	106	106	100	100	97	98	92	96	96	104	110
11	JEUSAM655767	SOONER CENTURION ET	1991	1131	70	101	86	99	101	104	105	94	104	81	98	101	103	108	97	100	93	101	105	94	103
12	JEUSAM661400	MOLLY BROOK BERRETTA FLYER-ET	1994	1104	71	99	48	99	101	96	104								92	91	63	92	94	94	101
13	JEUSAM651835	MASON BOOMER SOONER BERRETTA	1989	1069	72	100	87	97	102	102	108	97	98	82	97	103	98	99	96	88	88	90	100	85	97
14	JEUSAM111650176	CROCKETT FARMS GOLDEN HERBY-ET	2000	1013	73	102	61	103	98	96	109								96	106	79	107	100	98	116
15	JECANM8422994	BRIDON REMAKE COMERICA -ET	2001	1011	73	100	63	102	99	98	98	81	85	63	85	90	89	89	97	98	83	98	103	98	98
16	JEUSAM658836	LESTER SAMBO	1992	970	74	102	88	104	101	93	106	94	99	80	98	95	100	100	98	99	92	100	103	95	104
17	JECANM8804402	RJF BIG SHOW	2002	945	72	100	38	102	99	96	101								96	103	79	103	104	100	103
18	JEUSAM658741	ROCK MAPLE BROOK MONTANA ET	1992	928	68	99	85	95	99	106	105	98	103	74	102	98	102	106	93	101	87	100	95	104	102
19	JEUSAM665185	BW PARADE-ET	1996	923	73	105	50	104	103	103	102								98	104	68	102	102	106	105
20	JECANM10018825	MOLLY BROOK BERRETTA FAIR ET	1994	906	72	96	49	95	96	98	104								92	90	55	90	98	94	100
21	JEDNKM45310	FYN INDEX	1982	900																					
22	JEUSAM653585	DUNCAN CHIEF	1989	892	70	94	72	95	92	99	105	97	95	58	95	99	99	92	97	107	63	103	106	112	101
23	JEUSAM112646208	WF/L&M HALLMARK FIELD-ET	2002	867	68	98	40	97	99	103	97								98	106	78	106	107	102	96
24	JEUSAM113076851	VINDICATION	2002	866	72	102	47	104	103	99	95								96	105	84	104	104	103	107
25	JEUSAM654500	WF/L&M DUNCAN BARBER ET	1990	853	71	100	84	98	101	103	100	96	102	75	104	103	101	99	96	99	82	96	103	105	96
26	JEUSAM661148	SCHULTZ BROOK HALLMARK	1994	805	62	90	84	89	90	101	99	97	108	75	104	97	109	108	97	101	90	102	100	99	97
27	JECANM10010426	PIEDMONT BARBER DESIGN	1996	792	68	97	54	97	98	101	99														
28	JEUSAM660532	BARBS MBSB DECLO	1994	791	70	103	73	100	107	100	106	98	103	67	106	109	101	98	97	101	75	101	105	99	101
29	JECANM139233	ROCK ELLA REMAKE ET	1993	788	72	101	93	102	99	101	100	93	92	87	94	95	96	90	95	97	95	97	102	95	99
30	JEUSAM111521944	BLACKYS BIG TIME-ET	2000	783	71	106	58	107	106	99	97								98	102	77	102	101	103	98
31	JECANM10200231	NORVAL ACRES PLAUDIT	1998	743	76	105	76	107	102	94	104	92	95	64	97	95	98	95	96	101	89	99	103	102	108
32	JECANM139456	VALLEYSTREAM BONUS ET	1995	733	72	104	71	107	104	95	96	97	105	57	103	104	101	108	97	95	58	95	96	99	99
33	JECANM10013509	MORDALE TOPSY'S GENERAL ET	1996	728	76	107	82	109	105	97	97	93	99	71	97	98	97	104	97	106	87	107	104	102	103
34	JECANM10028633	MOLLY BROOK FUSION ET	1997	727	67	96	90	93	97	102	109	95	106	89	98	97	108	107	95	97	97	100	100	92	97
35	JEAUSM493178	FLEURIEU NANGKITA	2001	687	71	102	42	101	102	100	103														
36	JECANM10213172	MORDALE REN RAPTOR -ET	2000	622	75	109	51	110	108	103	97								93	102	62	101	94	104	106
37	JEUSAM662338	MOLLY BROOK GLNWOOD FREEDOM ET	1994	617	66	90	49	89	92	100	102								95	99	55	98	101	100	105
38	JECANM139414	VALLEYSTREAM BERRETTA BLAZE ET	1994	600	73	107	83	101	109	107	110	96	102	69	100	103	102	100	97	97	75	98	100	96	96
39	JEUSAM111857117	CROCKETT FARMS GOLDEN NICK-ET	2000	594	68	91	70	92	93	94	101	95	99	63	99	94	103	98	97	99	80	99	102	98	99
40	JEUSAM663209	H&B ALF PARAGON ET	1995	571	70	98	75	99	99	99	101	96	108	66	107	96	107	109	96	106	84	105	99	109	101
41	JECANM10005582	VALLEYSTREAM JULIAN	1997	567	69	99	82	97	98	103	103	96	98	76	98	100	99	98	98	106	93	106	105	104	96
42	JECANM10200167	PRICELAND BANFF-ET	1998	561	70	109	71	105	108	109	104	96	105	55	96	99	106	109	95	101	71	101	109	97	100
43	JEUSAM665017	BELLE ONLINE ET	1996	555	68	105	76	102	107	102	104	99	105	65	107	109	100	103	97	104	82	105	99	99	101
44	JECANM139417	BOVI-LACT BELLE'S PRIZE ET	1994	538	72	104	81	105	102	100	97	92	91	70	89	95	93	96	94	99	81	100	90	102	100
45	JECANM10203360	GIPRAT BELLE'S CHAIRMAN -ET	1998	533	69	99	82	98	99	104	103	97	102	74	101	103	100	104	96	100	91	100	100	101	104
46	JEUSAM660592	BB BRETTA	1993	524	70	94	43	94	96	98	100														
47	JECANM139361	GLENHOLME COUNCILLER	1994	522	69	99	93	97	99	104	100	95	95	88	99	99	95	96	95	98	96	98	97	100	95
48	JECANM138174	VALLEYSTREAM GEMINI GENERAL ET	1986	508	73	107	85	110	107	91	100	94	97	75	96	95	97	102	97	100	85	100	99	102	100
49	JECANM10214507	LENCREST TOWNSHIP -ET	2001	501	75	108	63	106	108	105	102	99	106	60	108	108	102	104	97	103	80	103	102	102	102
50	JECANM10023782	WILLOA LASER	1998	499	71	99	80	101	95	95	102	93	91	75	95	93	93	92	96	100	94	101	102	100	90

Proofs highlighted in yellow will not meet currently proposed minimum publication criteria

Appendix. Table D. Top LPI list with details of reproductive indices and traits (Brown Swiss)

Bull ID	Name	Year	LPI	Female Fertility Traits							Maternal Calving Traits						Direct Calving Traits								
				Old DF	New DF	Rel	NRRc	FSTCc	CTFS	AFS	MCE	DCA	Rel	CE-FC	CE-LC	CS-FC	CS-LC	CE	CA	Rel	CE-FC	CE-LC	CS-FC	CS-LC	
1	BSCANM39421	BLESSING PROPHET RANSOM	1996	1438	70	101	47	99	100	105	105		104	38	104	97	97	109		101	54	101	102	99	99
2	BSCANM40724	SUN-MADE GAR BRO PRONTO ET	1995	1432	69	98	40	97	100	104	98		102	31	98	94	103	105		98	48	97	98	100	100
3	BSUSAM190202	R HART CHRISTIANS ACE ET	1994	1138	63	88	52	89	87	103	98		101	44	103	102	104	95		106	55	107	103	103	94
4	BSCANM38796	R HART CARTOON ET	1996	1125	67	102	87	102	100	104	99		104	83	107	106	99	102		103	93	103	104	101	99
5	BSUSAM191928	QUINCY EVEN SPECIAL ET *TW	1996	1094	67	97	31	100	98	94	92		99	25	99	96	100	101		101	60	101	101	100	101
6	BSUSAM191952	HILLTOP ACRES PT DALTON TWIN	1996	983	67	102	41	102	99	101	103		100	31	101	96	100	101		99	68	101	97	98	97
7	BSCANM8444714	SWISS DREAM COLBY FORTUNE	2002	963	66	99	32	98	96	95	110		97	30	98	99	99	96		101	71	102	101	100	98
8	BSCANM34148	FOREST LAWN PAT JOYTREK ET	1991	927	76	112	76	110	110	106	104		102	61	99	107	99	103		101	77	102	99	96	102
9	BSCANM10034127	GUBELMAN DENMARK DANIEL	2000	869	63	96	62	96	94	102	105		95	51	96	94	95	100		98	84	98	100	98	97
10	BSUSAM192278	R HART EC EAGLE ET	1997	869	66	99	34	101	95	104	100		96	28	104	104	93	93		100	56	100	101	100	98
11	BSCANM40590	HARTS ELM PARK ESKIMO ET	1998	833	70	102	62	100	102	106	103		105	51	97	105	108	103		91	83	90	95	97	99
12	BSCANM41255	R HART CJ JEMSTONE ET	1994	818	68	100	72	103	97	97	99		102	58	99	100	99	106		97	66	97	97	98	97
13	BSCANM39420	R HART TC DENMARK ET	1992	799	60	96	86	94	94	110	105		102	75	104	106	104	96		99	83	100	99	98	96
14	BSCANM39563	R HART BC COLLECTION	1992	790	64	99	71	98	102	95	101		92	59	91	94	99	93		94	74	93	95	99	99
15	BSCANM38199	VICTORY ACRES SIMON EXTRA	1988	762	68	99	50	99	103	100	96		110	35	104	100	108	110		95	38	96	98	97	99
16	BSCANM39846	R HART CHRISTIANS PRIDE ET	1995	741	66	101	42	102	100	100	97		102	32	101	101	104	99		99	51	99	98	101	99
17	BSCANM40815	GEARING'S PATRICK CAMELOT	1991	705	72	108	42	105	106	110	104		103	30	94	99	107	104		107	40	108	101	101	104
18	BSCANM38976	WESTLEY MATT GORDON	1990	667	67	96	63	94	96	90	121		92	46	90	87	96	100		95	56	96	95	98	99
19	BSCANM35588	R HART SIMON ENSIGN ET	1987	653	68	90	63	89	91	106	99		101	49	95	93	102	107		94	66	94	97	97	99
20	BSUSAM194934	KULP GEN BANKER DAVID ET	2000	648	68	103	49	102	104	97	104		104	44	102	99	105	102		104	67	104	101	104	97
21	BSCANM37538	VICTORY ACRES PROPHET SAM	1994	638	69	102	63	103	103	93	100		97	48	99	98	95	99		100	59	100	98	101	99
22	BSCANM38810	BLESSING AYTOLA BANKER	1994	634	66	97	66	97	98	96	104		109	55	107	101	107	108		103	76	104	100	103	94
23	BSUSAM190913	HILLTOP ACRES PR DOMINATE ET	1995	616	66	100	43	102	97	98	100		102	35	100	101	107	97		99	57	100	101	97	99
24	BSCANM36422	TOP ACRES DOTSON PROPHET ET	1989	592	70	105	83	105	104	104	101		102	70	105	102	97	102		100	78	101	100	100	100
25	BSCANM39993	R HART PROTEIN EXCITE ET	1996	592	65	101	37	100	98	103	104		97	30	104	105	94	94		98	50	98	100	99	97
26	BSCANM40646	LYNDALE EMORY EMERALD ET	1990	566	74	112	74	114	110	96	95		102	60	104	101	100	102		98	73	98	97	101	101
27	BSCANM39468	MISA JETWAY MASCOT ET	1995	564	69	94	60	94	92	102	103		97	53	98	98	97	98		95	71	94	96	100	99
28	BSUSAM176173	TOP ACRES ELEGANT SIMON	1971	554	-9	90	55	93	86	99	100		97	47	97	82	96	108		95	50	95	97	97	100
29	BSCANM38797	LOST ELM PORTFOLIO ET	1996	552	70	106	73	104	105	101	109		102	62	107	105	100	97		97	76	97	99	98	98
30	BSCANM39551	R HART CHRISTIANS CHAMP TWIN	1996	467	66	98	28	97	97	106	101		101	25	103	104	101	97		103	35	103	104	101	99

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Appendix. Table E. Top LPI list with details of reproductive indices and traits (Guernsey)

Bull ID	Name	Year	LPI	Female Fertility Traits							Maternal Calving Traits						Direct Calving Traits								
				Old DF	New DF	Rel	NRRc	FSTCc	CTFS	AFS	MCE	DCA	Rel	CE-FC	CE-LC	CS-FC	CS-LC	CE	CA	Rel	CE-FC	CE-LC	CS-FC	CS-LC	
1	GUCANM10027474	ROZELYN ENHANCER JORDAN ET	1996	1220	65	106	42	107	103	102	94		105	31	99	103	100	107		99	47	100	102	97	99
2	GUCANM20223	EBY MANOR BUTTERMOST WARDEN	1993	1173	70	109	66	109	107	97	101		102	51	93	103	101	104		94	63	94	108	92	93
3	GUCANM10032765	KNAPPS ENHANCER KRUNCH-ET	1998	1155	60	105	49	104	107	95	104		95	36	89	96	98	99		105	57	105	106	102	100
4	GUCANM10031198	KNAPPS MR AMERICA	1997	1083	61	106	30	104	107	98	107		102	23	97	99	102	103		103	60	103	106	98	98
5	GUUSAM604312	PINE RIDGE DOUBLE L-ET	2000	849	62	97	44	96	96	101	104		102	41	101	98	101	102		98	67	97	95	102	99
6	GUCANM10006170	LAND OF LIVING P GARRETT ET	1995	756	65	99	56	104	90	101	94		99	43	100	93	90	107		85	57	84	103	88	103
7	GUCANM19892	DUTCH MILL TELESTARS FAYETTE	1977	719	59	89	64	88	94	99	101		92	56	90	91	93	98		98	54	101	100	94	102
8	GUCANM10034580	MYOWN MAGIC POKER	1995	705	60	96	44	98	100	93	98		98	35	96	103	97	100		105	59	104	102	105	100
9	GUUSAM604520	COULEE CREST R O SILVERADO-ET	2001	656	62	93	33	95	93	93	102		90	33	97	93	96	90		103	53	102	92	108	105
10	GUUSAM603672	FOUR WINDS DYNASTY	1998	618	64	108	39	109	108	95	98		96	33	101	102	101	92		102	58	102	103	102	98
11	GUCANM20213	BIG SPRING ROGER	1993	601	66	98	74	98	95	104	99		101	63	103	106	97	101		106	80	102	102	109	97
12	GUUSAM598587	WILLOWS ADMIRAL JASPER	1985	579	64	100	47	100	98	97	108		103	41	111	107	100	99		117	44	111	103	123	97
13	GUCANM20074	BIG SPRING FAY'S DIPLOMAT	1988	520	61	95	76	93	97	104	101		98	56	86	103	94	105		89	48	89	106	90	91
14	GUUSAM600974	ROZELYN PAT MAR P GOLIATH ET	1989	487	65	102	63	101	104	105	94		107	47	106	109	99	106		101	49	102	101	98	104
15	GUCANM20202	SPRING WALK STREAKS VICTOR	1992	487	59	100	70	101	98	99	102		102	57	101	104	103	100		100	64	101	102	98	101
16	GUUSAM591895	SCHWINGHAMER FARM CAPTAIN	1976	452		98	9	100	91	106	101		92	7	80	108	86	103		98	2	99	102	96	99
17	GUUSAM602121	TROTACRE MERCURY LORAL ET	1992	443	63	102	46	100	105	99	101		102	38	104	95	103	101		100	62	99	89	108	99
18	GUUSAM595722	BETTWARDS TELESTAR VICTORY	1977	418	63	101	47	107	95	98	90		103	44	96	112	93	108		102	43	105	104	94	103
19	GUUSAM603607	OCS DAIRY OPALS TROMBONE	1998	397	62	104	41	103	103	101	103		106	30	98	97	107	105		94	63	95	93	97	96
20	GUCANM20156	LAESCHLAND VOLCANO OLIVER-ET	1990	365		79	19	84	75	92	112		81	15	97	96	92	79		122	6	126	82	113	124
21	GUUSAM598626	ARROW HEAD TF LINKON	1985	355		85	22	91	88	97	86		99	19	111	102	106	90		97	14	98	101	96	99
22	GUCANM20238	MAPLEHURST B JASPER	1994	293	65	106	68	104	100	108	107		105	51	107	101	105	101		98	35	100	96	98	92
23	GUCANM20221	BROWN EDEN TRADITION	1992	278	59	97	59	94	102	102	102		102	50	102	99	100	102		97	73	96	104	99	98
24	GUCANM20232	PINE RIDGE PERFECTOS LEE ET	1993	274	61	99	38	97	99	102	110		103	28	99	98	101	105		98	36	98	104	98	97
25	GUCANM20259	MARSHDENE NOBILITY	1996	260	61	93	58	89	97	108	103		104	45	100	97	111	99		101	56	100	106	98	98
26	GUCANM20230	FOUR WINDS MAGICMAN ET	1993	245	62	92	74	98	95	87	90		90	65	98	91	95	92		103	82	101	101	104	98
27	GUCANM10001268	KNAPPS GOLIATH ABRAHAM ET	1995	231	65	102	55	100	102	106	99		100	39	103	98	102	98		105	30	105	100	102	108
28	GUUSAM596990	LINCREST TELESTAR BUTTERMOST	1980	190		106	32	107	104	98	96		95	33	84	102	90	104		101	30	103	100	96	105
29	GUUSAM602300	TAMARACKS PERFECTOS VALIANT ET	1993	168	66	107	28	106	100	106	108		103	22	100	92	107	102		105	40	105	101	102	105
30	GUCANM20083	LEVEL GOLD TRAVELLER-ET	1987	167	60	94	38	93	94	101	106		99	28	95	105	103	96		98	21	99	103	96	99

Proofs highlighted in yellow will not meet currently proposed minimum publication criteria

Appendix. Table F. Top LPI list with details of reproductive indices and traits (Milking Shorthorn)

Bull ID	Name	Year	LPI	Female Fertility Traits							Maternal Calving Traits						Direct Calving Traits								
				Old DF	New DF	Rel	NRRc	FSTCc	CTFS	AFS	MCE	DCA	Rel	CE-FC	CE-LC	CS-FC	CS-LC	CE	CA	Rel	CE-FC	CE-LC	CS-FC	CS-LC	
1	MSCANMAR3366	WILDWOOD D G LADY'S LANCE	1992	1741	73	76	29	84	93	100	93		103	16	99	101	111	98		111	18	109	112	118	103
2	MSCANMAR3640	NORDICA T V C ANTHONY	1994	968	75	98	33	113	95	98	86		94	22	99	101	98	94		98	22	97	102	97	101
3	MSCANMAR5413	BAR-D CINDY'S CLAY	1995	723	73	94	51	99	95	97	98		103	27	104	103	111	93		95	42	95	102	91	99
4	MSCANM461767	K SCHIE	1972	684	73	130	48	127	111	105	92		101	29	107	103	96	95		90	24	87	109	99	99
5	MSCANMAR3365	INNISFAIL PRIME TIME	1990	598	70	103	33	101	107	103	95		99	24	102	99	92	102		101	18	101	102	98	101
6	MSCANM*6501	MERICREST NOW YOU SEE	1994	565	67	97	44	92	96	108	104		102	27	103	105	99	96		102	40	101	102	100	100
7	MSCANM465763	PRAIRIE-PINE WR'S LADYSMAN	1993	501	71	108	55	107	100	99	101		92	33	88	90	98	109		104	41	104	102	102	106
8	MSCANM*3575	WILDWOOD NELL'S PRESTIGE	1993	343	73	101	43	105	105	96	93		105	20	102	104	105	98		96	22	97	102	92	90
9	MSCANMAR4610	KINGSDALE LIBBY'S REBEL	1994	325	71	102	39	104	103	103	93		90	22	88	96	95	104		100	30	100	97	100	102
10	MSCANM461766	KORNCREST PACESETTER	1974	229	72	115	32	112	92	99	112		91	20	90	96	97	102		103	11	103	97	101	105
11	MSCANM462247	MERIVILLE PRINCE EDWARD	1991	193	71	100	71	101	102	97	98		99	46	99	98	99	101		98	56	97	96	103	103
12	MSCANM458187	KINGSDALE PERI'S CHAMP	1986	184	72	112	27	118	93	102	97		90	15	93	96	93	101		101	14	101	96	99	102
13	MSCANM467546	MERICREST OUTLAW	1995	109	68	104	64	99	96	99	110		102	44	101	100	100	102		97	60	97	95	103	104
14	MSCANM10036276	VINRA PEERLESS FROLIC	2000	95	71	99	27	105	98	101	92		91	14	97	97	95	97		100	41	100	98	102	102
15	MSCANM458144	KRAUSE'S MAXINE'S MIKE	1984	83	74	119	43	120	111	91	98		95	31	101	98	98	96		95	21	94	102	99	100
16	MSCANM460756	MERIVILLE KING ARTHUR	1987	83	72	102	35	95	107	102	102		102	20	102	100	101	100		98	24	98	97	105	104
17	MSCANM462081	MERIVILLE PEERLESS	1988	73	69	98	62	102	95	97	101		101	42	101	101	94	103		98	48	98	97	105	104
18	MSCANM10036086	GLENBROOK STORM RULER	2000	54	71	105	22	93	110	109	102		114	11	111	114	100	95		113	19	113	113	107	93
19	MSCANM458851	KRAUSE'S ROXIE RODD	1986	-129	71	100	43	89	107	105	105		107	32	103	106	100	101		105	38	105	100	101	107
20	MSCANM461861	WILDWOOD DUSTY K-SCHIE-ET	1989	-244	70	116	31	117	99	100	100		94	18	96	96	96	101		95	22	94	102	99	100

Proofs highlighted in yellow will not meet currently proposed minimum publication criteria

Appendix. Table G. Top LPI list with details of reproductive indices and traits (Canadienne)

Bull ID	Name	Year	LPI	Female Fertility Traits							Maternal Calving Traits						Direct Calving Traits								
				Old DF	New DF	Rel	NRRc	FSTCc	CTFS	AFS	MCE	DCA	Rel	CE-FC	CE-LC	CS-FC	CS-LC	CE	CA	Rel	CE-FC	CE-LC	CS-FC	CS-LC	
1	CNCANM63872	ERABLES DANCER EXPO 3X ET 50.0	1988	1475	66	100	71	99	98	113	99		98	52	99	108	94	100		99	67	99	98	101	97
2	CNCANM64691	MONBRIANT KARATE ENERGIKA ET	1991	836	71	100	80	100	98	99	98		102	66	99	101	108	98		105	80	103	104	108	104
3	CNCANM65303	MON PARADIS PREST MISTER ET	1993	791	68	97	78	95	95	101	111		91	56	100	96	95	93		99	76	98	104	98	104
4	CNCANM65463	AMANDES PRESTIGE EPI	1995	668	71	106	49	104	108	101	104		104	36	100	102	105	101		93	53	92	102	93	104
5	CNCANM65558	MON PARADIS TRAD KID ET	1994	478	67	98	78	99	99	96	98		98	66	99	95	98	100		101	78	100	101	101	104
6	CNCANM66251	NONCENTS RUBIS OSCAR	1998	465	68	94	27	91	91	117	108		101	24	89	94	101	107		101	53	100	101	101	102
7	CNCANM61858	MONTAGNE PERFORMER BRIO 1S50.0	1984	313	69	98	46	100	94	99	99		86	28	95	108	72	101		92	10	92	106	90	85
8	CNCANM58552	BORD DE L'EAU TOINON KING K21	1978	274	71	103	47	100	109	107	104		95	35	101	95	93	99		105	30	110	95	101	85
9	CNCANM63742	FERNANDALE URUS PREST 10X 75.0	1988	134	70	97	50	97	98	98	100		100	33	109	101	100	96		101	35	101	104	98	105
10	CNCANM66201	MONTREAL	1996	-160	70	101	32	100	104	103	99		98	31	100	98	100	98		105	44	107	99	105	96
11	CNCANM64089	LOUVICOURT AJAX ET 75.0	1988	-218		89	24	92	90	108	78		97	18	129	81	88	96		107	11	107	103	107	108
12	CNCANM58573	BRITANNIA MARCO KARATE 25K	1978	-219	68	84	49	87	81	85	102		103	39	97	90	107	103		111	39	111	97	115	106
13	CNCANM65996	BRUNET TRADITION GOUVERNEUR	1997	-232	66	95	71	97	93	98	96		109	59	105	101	106	105		101	76	101	101	101	104
14	CNCANM64969	PAGES BRIO BRAHMA 13B 75.0	1992	-274	69	100	54	100	100	97	103		97	32	100	104	90	101		95	16	94	105	94	95
15	CNCANM51780	DESCHAMBAULT FRANCIS RUBIS 8C	1971	-313	70	94	30	86	86	143	123		83	22	78	89	72	110		96	25	97	99	92	98
16	CNCANM63871	STBVQ DANCER PRIMO 26X ET 50.0	1988	-326		93	24	91	90	116	103		107	16	91	111	106	106		54	4	50	77	73	60
17	CNCANM61097	CLERJOYE ISAK UNIC 83N	1981	-330									117	5	98	105	103	118		147	0	150	141	128	107
18	CNCANM63262	VALBOURG KARATE FIER 3W	1987	-429									117	14	106	95	115	110		107	11	107	103	107	108
19	CNCANM62031	FERNANDALE TRESOR TRADITION15T	1985	-486	68	95	75	95	101	97	96		100	58	108	100	104	94		97	50	99	98	92	102
20	CNCANM62714	PAGES MARSOUIN URUS 11U	1986	-521		88	31	88	87	91	113		79	21	117	75	78	88		104	15	106	103	96	102

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