Note on economic value of Young Stock Survival

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Summary

Young Stock Survival (YSS) has been included in the economic model that was used for assessment of economic value of the traits included in the present NTM-index. The major part of the assumptions has remained unchanged in order to make the result for YSS comparable with the value of the other traits. The proposal for weights of YSS in NTM presented at the NAV-workshop in January 2015 was based on DNK assumptions only. In this revision Swedish and Finnish assumptions are included.

The results presented are all expressed as value of improving survival by one percent unit per cow per year. The values (x 100) are not exactly the same at the value of one calf because usually the number calves born per cow per year is slightly larger than 1.0.

The results from the early period are to some degree comparable with the values of improving stillbirth rate. As expected, the results for the early period are slightly higher than the value of stillbirth rate. The value of the second period is of cause higher due to added costs.

FIN heifer value (HP1 and HP2) is larger than in DNK and SWE for HOL. That is due to a higher value of pregnant heifers in FIN. Another remarkable country difference is the lower value of bull calf survival in DNK. That is because the economic assumptions make beef production more profitable in SWE and FIN than in DNK. In the original NTM report value of growth rate was also highest in SWE and FIN. In evaluation of survival of bull calves this difference will be expressed heavily. The difference in age at death will enhance these differences.

When the values are converted to value of an index unit it turn out that value of the YSS is relatively high for RDC compared to HOL and JER. That is partly due to larger genetic variation for survival traits in RDC and partly due to the effect of higher economic value of growth traits in RDC.

The correlation between YSS index and the other NTM-traits are generally close to zero. The most positive correlations are observed for Other Diseases and Longevity (0.1 – 0.2).

Including YSS in the NTM have only small effect in HOL and JER. The effect is larger in RDC because the weight is larger.

The economic model

Young Stock Survival (YSS) has been included in the economic model (developed in 2008) that was used for assessment of economic value of the traits included in the present NTM-index. The major part of the assumptions has remained unchanged. Below, only the additional assumptions introduced for evaluation of YSS is described.

The definition of the traits included in the YSS index was described in the report "NAV evaluation for calf survival". They are:

- HP1: Heifer survival in the period 2-30 days
- HP2: Heifer survival in the period 31-458 days (15 month)
- BP1: Bull Calf survival in the period 2-30 days
- BP2: Bull calf survival in the period 31-184 days (6 month)

The proposal for weights of YSS in NTM presented at the NAV-workshop in January 2015 were based on DNK assumptions only. In this revision Swedish and Finnish assumptions are included.

Biological assumptions

For calculation of economic value of YSS the most important biological assumptions are the survival rates (or mortality) and the average age at death. Table 1 show the average mortality for calves born 2008-2012 and table 2 show the average age of dead calves.

In general HOL has slightly lower mortality than RDC. The highest mortality is observed in for JER. For bull calves in period 1 (BP1) the mortality is extremely high in JER. Another important observation is that mortality is lower in FIN than in DNK and SWE. That has consequences for the evaluation model (see "NAV evaluation for calf survival ").

The result for JER might be influence by the fact that a large number of JER bull calves are killed right after birth. Calves killed within the first 7 days are not included in these analyses. The high mortality for JER might be because some are calves killed later than 7 days after birth.

Table 1. Mortality of young stock – calves born 2008 - 2012

	HP1	HP2	BP1	BP2
		RDC		
DNK	**3.7%**	**4.6%**	**4.3%**	**6.5%**
FIN	**1.9%**	**3.2%**	**3.6%**	**4.8%**
SWE	**2.4%**	**6.0%**	**-**	**-**
		HOL		
DNK	**3.7%**	**3.8%**	**5.0%**	**5.0%**
FIN	**1.5%**	**2.5%**	**3.2%**	**3.2%**
SWE	**2.4%**	**4.9%**	**-**	**-**
		JER		
DNK	**7.4%**	**6.6%**	**12.2%**	**9.1%**
SWE	**3.2%**	**6.8%**	**-**	**-**

I table 2 the average age at death is shown. In general, the calves that die in period 1 (1-30 days after birth) are on average 12-14 days old. The heifers that die in period 2 (31-458 days) are youngest in FIN and oldest in SWE. Also the FIN bull calves that die in period 2 (31-184 days) are younger. The results in table 2 will have an effect on the feed costs. Higher average age at death will give higher feed cost and therefore a higher value of improving YSS.

Table 2. Average age (days) of dead calves – calves born 2008-2012

	HP1	HP2	BP1	BP2
		RDC		
DNK	13.3	139.7	13.0	98.2
FIN	13.5	125.0	15.3	84.6
SWE	13.6	165.6	-	-
		HOL		
DNK	12.0	156.7	11.8	92.1
FIN	13.4	132.2	15.1	75.2
SWE	12.2	179.4	-	-
		JER		
DNK	12.3	148.4	13.0	88.5
SWE	10.7	191.4	-	-

Revised economic assumptions

I table 3 the most important economic assumption are listed.

The cost related to calves that die in period 1 (2-30 days) are assumed to be the same as for still-born calves. However, there are added extra costs of 5 € in order to take into account that some effort probably have been made to prevent the death. Additionally, the feed costs up to the day of death will introduce extra costs.

For calves in period 2 the cost of destruction of the calf is assumed to be 30% of the cost for a cow. The extra work is assumed be 0.5 hours (1 hour is assumed for a cow), and the extra cost was set to 10 € (cost of the efforts made to prevent death of the calf)

The economic value of a heifer is unchanged and the one used throughout the development of NTM. In the ongoing research in the project “Optimal cow” a value of 1200 € are used for HOL and RDC. For JER the value used in “Optimal cow” is 1066 €. So compared to “Optimal cow” the JER value deviates most.

Table 3. Economic assumptions related to young stock survival (YSS).

	DNK	FIN	SWE
New assumption directly related to YSS			
Calves 1-30 days: Destruction of dead € (same as stillborn)	**5.33**	**0.00**	**10.70**
Calves 1-30 days: Extra work, hours (same as stillborn)	**0.25**	**0.75**	**0.25**
Calves 1-30 days: Extra costs, €	**5.00**	**5.00**	**5.00**
Heifers 31-458 days: Destruction, €	**15.00**	**9.70**	**21.30**
Heifers 31-458 days: Extra work, hours	**0.50**	**0.50**	**0.50**
Heifers 31-458 days: Extra costs, €	**10.00**	**10.00**	**10.00**
Bull calves 31-184 days: Destruction, €	**15.00**	**9.70**	**21.30**
Bull calves 31-184 days: Extra work, hours	**0.50**	**0.50**	**0.50**
Bull calves 31-184 days: Extra costs, €	**10.00**	**10.00**	**10.00**
Important assumptions – kept unchanged			
RDC Heifers at 1st calving, €/ap.	***1160***	***1220***	***1160***
HOL Heifers at 1st calving, €/ap.	***1160***	***1350***	***1160***
JER Heifers at 1st calving, €/ap.	***720***		
Cows, €/kg carcass	***1.86***	***1.64***	***2.30***
Heifers, €/kg carcass	***2.32***	***3.12***	***2.90***
Bull calves, €/kg carcass	***3.12***	***2.89***	***2.70***
Young bulls, €/kg carcass	***2.48***	***3.21***	***3.10***
Some feed cost: Concentrates, €/kg	***0.20***	***0.22***	***0.21***

Assumptions on slaughter values are kept unchanged compared to the previous work with the NTM-model. In the ongoing research in the Danish project “Optimal cow” slightly higher values are used. Slaugther value has varied somewhat over time. Currently it is quite high in Sweden.

Also feeding costs are kept unchanged. However, as mortality and age at death differ between countries there are differences in value of survival.

Results

The main results are shown in table 4. In table 5 results for either 10% higher heifer value or 10% slaughter value is shown.

The results presented are all expressed as value of improving survival by one percent unit per cow per year. The values (x 100) are not exactly the same at the value of one calf because usually the number calves born per cow per year is slightly larger than 1.0.

Table 4. Estimated economic values of Young Stock Survival (€ per cow per year – for an increase of one percent in survival rate)

	DNK	FIN	SWE	Average
		RDC		
HP1: Survival of heifers 2-30 days	3.46	3.52	3.20	**3.40**
HP2: Survival of heifers 31-458 days	4.09	4.08	4.02	**4.06**
BP1: Survival of bull calves 2-30 days	1.35	2.17	2.14	**1.89**
BP1: Survival of bull calves 31-184 days	1.96	3.40	3.50	**2.96**
		HOL		
HP1: Survival of heifers 2-30 days	3.36	4.20	3.19	**3.58**
HP2: Survival of heifers 31-458 days	4.01	4.84	4.01	**4.29**
BP1: Survival of bull calves 2-30 days	1.20	2.15	1.99	**1.78**
BP1: Survival of bull calves 31-184 days	1.73	3.36	3.29	**2.79**
		JER		
HP1: Survival of heifers 2-30 days	1.92			**1.92**
HP2: Survival of heifers 31-458 days	2.38			**2.38**
BP1: Survival of bull calves 2-30 days	0.19			**0.19**
BP1: Survival of bull calves 31-184 days	0.73			**0.73**

Table 5. Estimated economic values of Young Stock Survival – sensitivity to changes in heifer value and beef process (€ per cow per year – for an increase of one percent in survival rate)

	Average Table 4	Heifer value + 10% Average	Beef value + 10% Average
		RDC	
HP1: Survival of heifers 2-30 days	3.40	**3.96**	**3.40**
HP2: Survival of heifers 31-458 days	4.06	**4.64**	**4.07**
BP1: Survival of bull calves 2-30 days	1.89	**1.89**	**2.30**
BP1: Survival of bull calves 31-184 days	2.96	**2.96**	**3.38**
		HOL	
HP1: Survival of heifers 2-30 days	3.58	**4.17**	**3.59**
HP2: Survival of heifers 31-458 days	4.29	**4.88**	**4.29**
BP1: Survival of bull calves 2-30 days	1.78	**1.78**	**2.20**
BP1: Survival of bull calves 31-184 days	2.79	**2.79**	**3.21**
		JER	
HP1: Survival of heifers 2-30 days	1.92	**2.26**	**1.92**
HP2: Survival of heifers 31-458 days	2.38	**2.72**	**2.38**
BP1: Survival of bull calves 2-30 days	0.19	**0.19**	**0.43**
BP1: Survival of bull calves 31-184 days	0.73	**0.73**	**0.96**

The results from the early period are to some degree comparable with the values of improving stillbirth rate. The average value of stillbirth rate for heifers and bull calves is 2.48€ for RDC, 2.51€ for HOL and 0.93€ for JER. As expected, the results in table 4 show average values for the early period that are slightly higher than the value for stillbirth rate.

Country differences:

- FIN heifer value (HP1 and HP2) is larger than in DNK and SWE for HOL. That is due to a higher value of pregnant heifers in FIN
- Another remarkable country difference is the lower value of bull calf survival in DNK. That is because the economic assumptions make beef production more profitable in SWE and FIN than in DNK. In the original NTM report value of growth rate was also highest in SWE and FIN. In evaluation of survival this difference will be expressed heavily. The difference in age at death will enhance these differences.

Preliminary results in the project "Optimal cow"

In the ongoing Danish project "Optimal cow" economic values are calculated for many traits including some survival traits. However, bull calf survival is not included and the survival periods are not defined exactly as in the economic model for NTM. The preliminary results from this project indicate somewhat lower value of improving both stillbirth rate and YSS.

Value of an index unit

Table 6 show the steps in calculation of the value of the young stock survival index and the value of each of the 4 sub indexes.

Table 6. The steps in calculation of the value of the young stock survival index (and sub indexes)

	RDC	HOL	JER
	Standard deviation (= 10 index units) measured in units of survival rates		
HP1: Survival of heifers 2-30 days	0.0107	0.0098	0.0259
HP2: Survival of heifers 31-458 days	0.0192	0.0118	0.0169
BP1: Survival of bull calves 2-30 days	0.0109	0.0097	0.0275
BP1: Survival of bull calves 31-184 days	0.0283	0.0208	0.0188
	Value of 1 survival unit (€) = 100 * value/percent unit (from table 4)		
HP1: Survival of heifers 2-30 days	340.0	358.0	192.0
HP2: Survival of heifers 31-458 days	406.0	429.0	238.0
BP1: Survival of bull calves 2-30 days	189.0	178.0	19.0
BP1: Survival of bull calves 31-184 days	296.0	279.0	73.0
	Value of 1 standard deviation (= 10 index units)		
HP1: Survival of heifers 2-30 days	3.638	3.508	4.973
HP2: Survival of heifers 31-458 days	7.795	5.062	4.022
BP1: Survival of bull calves 2-30 days	2.060	1.727	0.523
BP1: Survival of bull calves 31-184 days	8.377	5.803	1.372
	Value of 1 index unit		
HP1: Survival of heifers 2-30 days	0.3638	0.3508	0.4973
HP2: Survival of heifers 31-458 days	0.7795	0.5062	0.4022
BP1: Survival of bull calves 2-30 days	0.2060	0.1727	0.0523
BP1: Survival of bull calves 31-184 days	0.8377	0.5803	0.1372

Comments to table 6:

- Standard deviation: Per definition the standard deviation is equal to 10 index units
- Value of one survival unit: Table 4 shows the value of 1 percent unit. By multiplying by 100 we get the value of one unit of the survival rate
- Value of one standard deviation: Is obtained by multiplying standard deviation by value.

The total YSS index can be calculated directly in 2 steps by:

- For each animal the breeding value for each of the 4 traits is multiplied by the value. The sum is the YSS breeding value measured in Euro.

- Then the standard deviation is estimated. This equal to the value of 10 index units of the YSS index.

The standard deviation of YSS-breeding value is:
- RDC: 20.29 € – and the value of 1 index unit is 2.029 €
- HOL: 13.98 € – and the value of 1 index unit is 1.398 €
- JER: 9.18 € – and the value of 1 index unit is 0.918 €

The old value of YSS was based on DNK assumptions only. The revision of assumptions and inclusion of SWE and FIN data has increased the value in RDC and HOL.

Comparison with value of other traits in the NTM

I table 7 the economic value of the YSS index is compared to the economic weights of the other traits (results from the Report on Economic Basis for a Nordic Total Merit Index, 2008). Since 2008, the relative weights of the traits in NTM have been slightly modified several times (eg no weight on growth in RDC and JER, larger weight on udder conformation)

The most interesting comparison are with Growth, Birth, Calving and Longevity index as they are influenced by some of the same biological and economic assumptions. The relatively large value of YSS for RDC can be explained partly by higher genetic variation for survival traits in RDC, partly by the effect of higher economic value of growth traits.

The original economic value listed in table 7 has later been modified. In table 8 the current value are shown.
- RDC and JER removed the weight for growth.
- All three breed groups have introduced a large increase on weight for udder conformation.
- RDC and HOL have increased weight for leg conformation
- RDC has increased weight for milkability
- JER has decreased weight for longevity
- For the remaining traits the changes have been minor

Table 7. Original economic values of an index unit (combining results of table 8.1 and 8.2 in NTM-report, 2008) compared with value of the Young Stock Survival Index (YSS)

	RDC	Holstein	Jersey
Yield index	*8.33*	*7.61*	*6.79*
Growth	*0.92*	*0.61*	*0.20*
Fertility	*2.33*	*3.12*	*1.56*
Birth index	*1.25*	*1.52*	*0.48*
Calving index	*1.08*	*1.67*	*0.41*
Udder health	*2.83*	*3.50*	*3.46*
Other Diseases	*1.08*	*1.22*	*0.34*
Body conformation	*0.00*	*0.00*	*0.00*
Feet & legs conformation	*0.58*	*0.76*	*0.41*
Udder conformation	*1.17*	*0.91*	*1.02*
Milking speed	*0.58*	*0.84*	*0.75*
Temperament	*0.25*	*0.30*	*0.20*
Longevity	*0.75*	*1.14*	*0.95*
Claw Heath (added 2011)	*0.31*	*0.41*	*0.29*
Young Stock Survival	**2.03**	**1.40**	**0.92**

Table 8. Current economic value of an index unit (based the economic value of the yield index and the relative weighs)

	RDC	Holstein	Jersey
Yield index	*8.33*	*7.61*	*6.80*
Growth	*0.00*	*0.61*	*0.00*
Fertility	*2.26*	*3.15*	*1.56*
Birth index	*1.21*	*1.52*	*0.47*
Calving index	*1.04*	*1.72*	*0.47*
Udder health	*2.78*	*3.55*	*3.44*
Other Diseases	*1.04*	*1.12*	*0.31*
Body conformation	*0.00*	*0.00*	*0.00*
Feet & legs conformation	*0.78*	*1.22*	*0.31*
Udder conformation	*2.78*	*2.54*	*2.03*
Milking speed	*0.87*	*0.81*	*0.78*
Temperament	*0.26*	*0.30*	*0.23*
Longevity	*0.61*	*1.12*	*0.63*
Claw Heath (added 2011)	*0.43*	*0.81*	*0.39*
Young Stock Survival	**2.03**	**1.40**	**0.92**

Correlations with NTM traits

Table 9 shows the correlations with the NTM traits. These correlations are low and most of them are not statistical different from zero. The tendency is that the most positive correlations are to longevity and health. Including YSS in the NTM have only small effect for HOL and JER. The effect is larger for RDC because the economic value of an index unit and the weight is larger.

Table 9. Correlations between Young Stock Survival index (YSS) and the current NTM-traits. At the bottom correlations between NTM with YSS included and NTM without YSS included. Based on sires born 2006-2008

	RDC	HOL	JER
Yield	**-0.03**	**-0.02**	**-0.07**
Growth	**-0.05**	**0.01**	**0.20**
Fertility	**0.11**	**0.09**	**0.09**
Birth	**0.31**	**0.05**	**0.04**
Calving	**-0.06**	**0.07**	**0.04**
Udder health	**-0.01**	**0.07**	**0.21**
Other diseases	**0.07**	**0.12**	**0.16**
Claw health	**-0.02**	**0.15**	**-0.07**
Longevity	**0.16**	**0.20**	**0.12**
Body conformation	**-0.30**	**-0.19**	**-0.05**
Legs conformation	**0.27**	**0.07**	**-0.05**
Udder conformation	**-0.12**	**-0.03**	**0.03**
Milking speed	**-0.04**	**-0.05**	**-0.06**
Temperament	**-0.09**	**0.08**	**-0.08**
NTM, YSS not included	**0.06**	**0.11**	**0.08**
NTM, YSS included	**0.31**	**0.25**	**0.22**
NTM, with and without YSS	0.97	0.99	0.99
Number of sires	633	948	149

Table 10 show the correlations between NTM and the traits included in the NTM. There are results both for the current NTM and a for NTM where Young Stock Survival is included. The results are based on sires born in 2006 to 2008. The level of the correlations will be different for other samples of sires and especially if a younger sample was chosen. But the difference between the two sets of correlations (NTM with and without Young Stock Survival) seems to be fairly stable.

The largest effect is of cause observed for Young Stock Survival where the correlation increases from 0.06-0.11 to 0.22-0.31. The correlation between NTM and Body Conformation decreases by -0.01, -0.03 and -0.08 in JER, HOL and RDC. For the yield index the correlation will decrease by -0.02 in HOL and JER and -0.04 in RDC.

The effect of including Young Stock Survival is largest in RDC where the weight on Young Stock Survival is relatively large. Beside the effect on correlations to Young Stock Survival, Yield and Body Conformation there is relatively large positive change for Birth and Leg Conformation (+0.07 and +0.06) and relatively large negative change for Udder (-0.04).

Table 10. Correlations between NTM and the subindexes of NTM. Results for current NTM and NTM with Young Stock Survival included. Based on sires born 2006-2008.

	RDC		HOL		JER	
	Current NTM	NTM with YSS included	Current NTM	NTM with YSS included	Current NTM	NTM with YSS included
Yield	**0.67**	**0.63**	**0.52**	**0.50**	**0.60**	**0.58**
Growth	**0.06**	**0.05**	**0.10**	**0.10**	**0.13**	**0.16**
Fertility	**0.14**	**0.16**	**0.38**	**0.38**	**0.31**	**0.32**
Birth	**0.20**	**0.27**	**0.34**	**0.34**	**0.10**	**0.10**
Calving	**0.16**	**0.13**	**0.22**	**0.22**	**0.40**	**0.40**
Udder health	**0.36**	**0.34**	**0.56**	**0.56**	**0.50**	**0.52**
Other diseases	**0.22**	**0.23**	**0.46**	**0.47**	**0.18**	**0.20**
Claw health	**0.18**	**0.16**	**0.35**	**0.36**	**0.09**	**0.08**
Longevity	**0.61**	**0.62**	**0.68**	**0.70**	**0.64**	**0.64**
Body conformation	**0.04**	**-0.04**	**-0.08**	**-0.11**	**0.18**	**0.17**
Legs conformation	**0.22**	**0.28**	**0.21**	**0.21**	**0.18**	**0.17**
Udder conformation	**0.26**	**0.22**	**0.30**	**0.29**	**0.13**	**0.13**
Milking speed	**0.18**	**0.16**	**-0.03**	**-0.04**	**0.15**	**0.14**
Temperament	**0.08**	**0.05**	**0.01**	**0.03**	**0.11**	**0.10**
Young Stock Survival	**0.06**	**0.31**	**0.11**	**0.25**	**0.08**	**0.22**
Current NTM	*1.00*	*0.97*	*1.00*	*0.99*	*1.00*	*0.99*
Number of sires	633		948		149	

Other descriptions of Young Stock Survival

The economic value of young YSS has been described in:

- "Note on economic value of the trait Mortality of young stock". The results were used for motivation when the project were initiated (December 2011)
- "NAV evaluation for calf survival". Final report on development of NAV-evaluation of young stock survival (August 2014)
- "Economic value of Young Stock Survival index". Summary for the NAV-workshop, January 2015

The preliminary results reported in "Note on economic value of the trait Mortality of young stock" was used for calculation of the Young Stock Survival Index (YSS) published first time August 2014. They were also basis for the proposal for weight of YSS in NTM presented at the NAV-workshop in January 2015.