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EXPERIENCES OF BREEDING-EVALUATION FOR DISEASES AND FEMALE FERTILITY TRAITS.

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Introduction

Integration of milk-recording and ai have a long tradition in Sweden. Following the good example from our Norwegian neighbours we have also managed to include information from veterinary treatments of all females in milk-recording. Today 77 % of all dairy cows are milk-recorded and 88 % of all females are inseminated by the farmers'cooperative ai-organisation. It is compulsory for all veterinarians to report treatments made in milk-recorded herds. The information from milk-recording, ai and veterinary treatments are stored on each individuals "account" in a central databank. This information is used for a number of purposes including breeding evaluation of bulls. (see fig. 1).

Breeding evaluation for female fertility.

We have had breeding values for female fertility during a long period of time. The system used until 1989 was based on the thesis by Janson (1980). The trait which was used was number of inseminations per heifer and first calver. It worked very well but we had some educational problems as we didn't manage to keep the averages of the breeding values on a stable level of 100. The reason for this was that we used herd averages and our two main breeds had different levels of fertility. The ranking of bulls within breeds however was correct as a number of tests could verify. In time there grew a demand for including the interval calving -first insemination in the breeding evaluation and of course the BLUP-procedure became available. We also studied the genetic variation of oestrus signs which were recorded in ai. There we found heritabilities of the same level as the other traits in fertility but a smaller genetic standard deviation.

In 1989 we introduced a new system with the following characteristics:

Traits: inseminations per female, days calving-first ins, oestrus signs.

Group of females: heifers, first and second calvers

Model: BLUP, Herd-year, year-month, dam's breed group,sire

Heritabilities: ins per female = 0,03-0,05

days calving-first ins. = 0,03-0,04

oestrus signs = 0,02-0,03

Expression of proof: Relative breeding value,mean=100 based on the three latest batches of tested bulls,standard deviation=6.

For every bull 9 different breeding values are calculated including a total value which is published in bull catalogues etc.

Breeding evaluation for diseases.

Breeding evaluation was possible when we managed to build a practical system to register all veterinary treatments. This is based on an agreement between the Board of Agriculture and the Swedish Association for Livestock Breeding and Production. The individual veterinarian uses a number of different codes in his daily work. In the breeding evaluation we have concentrated on two diseases "mastitis resistance" and "other diseases" which include all diseases except mastitis. In the breeding evaluation we also include fertility treatments and culling reasons from milk-recording.

The breeding evaluation for diseases is based on the following:

Traits: Mastitis resistance:veterinary treatments, cell counts from milk-recording, culling due to mastitis.

Other diseases: veterinary treatments, fertility treatments from ai-recording, culling due to fertility reasons.

Registration period: 10 days before to 150 days after first calving.

Model: BLUP, Herd-year-season, calving month, calving age, dam's breed group, sire.

Heritabilities: clinical mastitis = 0,02

cell-count = 0,08

other diseases = 0,02

Expression of proof: Relative breeding value, mean=100 based on the three latest batches of tested bulls, standard deviation= 5. High breeding values means good disease resistance.

Genetic correlation between clinical and subclinical mastitis = 0,7

The registration period is selected for practical reasons. If we restrict ourselves to 150 days after calving most bulls will have breeding values for diseases estimated at the same time as those for production,fertility and conformation-traits. Lindhe has shown that about 75 % of all veterinary treatments will occur before 150 days after calving so we miss a rather small amount of information. If we would wait longer a number of bulls would be used without knowledge about their breeding-value for diseases.

Correlations between female fertility,diseases and production.

In Sweden many veterinarians have claimed that breeding for higher production means indirectly breeding for higher incidence of diseases. As we now have breeding values for diseases we can verify these ideas which was also shown by Emanuelson et.al.(1988).Based on material for Swedish Red and White and Swedish Friesian bulls Eriksson has estimated genetic correlations between production, conformation, female fertility and diseases.There are unfavourable genetic correlations between milk yield and disease resistance.The correlations are low but significant. There are low, significant favourable correlations between mastitis and conformation. There are slightly higher, significant unfavourable correlations between milk yield and female fertility.

Genetic changes in the Swedish population of ai bulls.

As a by-product from the BLUP- procedure we can estimate the genetic trends in the populations of ai bulls. In the Swedish breeding evaluation system we use a rolling average as a base. The average of the three latest batches of tested bulls equals 100 and every September a new batch of bulls is added to the base and the oldest batch is taken away from the base.

In figure 2 the results from breeding evaluation for mastitis resistance is presented.There is no apparent genetic change in the two breeds but different levels between the breeds.All breeding evaluation is made within breed. This unchanged resistance has been obtained despite the increased production and unfavourable correlation with this trait.

In figure 3 the corresponding results for the trait resistance to "other diseases" are presented. The different breeds do not differ very much in average and there is no trend so far.

We have used quite a few U.S. Holstein sires in Sweden the last decade and some of them now have breeding values for mastitis resistance. Results from this is presented in table 1. There seems to be no important difference between the mastitis level in Sweden and U.S.A. This might be logical since U.S. Holsteins are superior for udder conformation.The problem is that when we import semen mastitis information is not available and that there is a large variation among bulls. In table 2 average breeding values also for groups of sons are presented. The results are in good agreement with those in table 1.

The economic weights for diseases in the total breeding-value for bulls is aimed for some genetic progress in each breed. So far we have managed to balance the unfavourable correlation with milk yield.

In figure 4 the results from progeny testing for female fertility is presented as the average of the bulls' breeding-values. Breeding-evaluation is made within breed and there are differences between the breeds, the breed averages are presented below, in table 3.

Table 3. Breed averages 1991 in fertility, Sw. Red and White och Sw. Friesian.

Breed	Days Calving 1 st ins	Calving interval month	Ins per female	Treated for cysts
Sw. Red x White	82	12,8	1,70	3,4
Sw. Friesian	83	12,6	1,61	1,6

As can be seen in figure 4 there is no genetic trend in the Red and White breed but a negative trend in the Friesian breed Strandberg (1991) have estimated genetic trends in the cow population from an earlier period based on days between calving and conception.In that material there were positive genetic trends, small in the Red and White breed and higher in the Friesian breed.

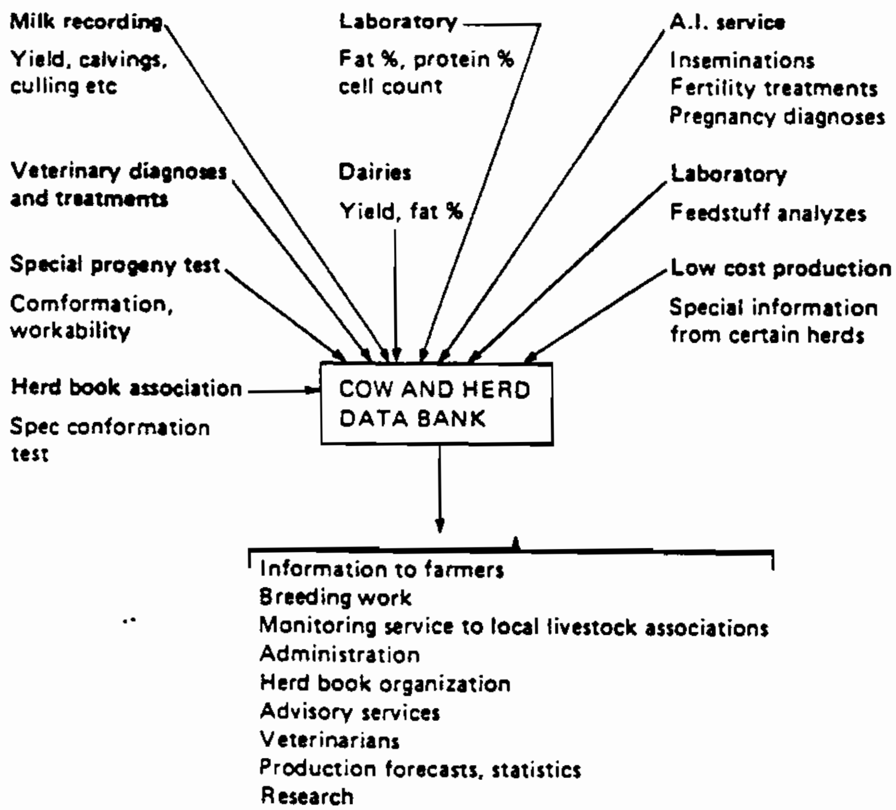
The negative genetic trend now shown among the Friesian bulls is explained by the imports of U.S. Holsteins. In table 4 results from imported bulls are presented.U.S. Holsteins have also during the latest years been dominating as bull-sires which explains the negative genetic trend. When these fertility results were presented for the first time in Sweden their accuracies were discussed and thoroughly analyzed and further tested but no biases have been found. As we can see in figure 5 the results are the same if we look at heifer results only.

It is logical that Holsteins are inferior to Swedish Friesian in fertility partly due to higher production level and the unfavourable correlation with production. Breeding for improved fertility has also been one part of the total breeding programme during many years in all Scandinavian countries. The results in fertility for Holsteins in Denmark are similar to those presented here. In table 5 and 6 average breeding values for groups of sons in female fertility are presented. The variation among bull sires is much larger in the Sw. Friesian breed compared to the Sw. Red and White breed. The genetic decline in the female fertility is of course a problem and is probably going to have greater importance in the future due to further increased production and expected increased prize differentiation of milk according to season. This will mean higher costs for increased calving interval.

Summary.

Breeding for improved female fertility and better disease resistance in dairy cattle during Swedish conditions is presented. Due to coordination of information from milk recording,ai and veterinary treatments this is possible. So far there has been no genetic trends among bulls in disease resistance which means that direct selection for disease resistance has corrected the negative correlated response from selection for increased production. However, a negative genetic trend in female fertility has been observed mainly due to imports of bulls from U.S.A.

Figure 1. Input and output in swedish milkrecording, A.I. and health service



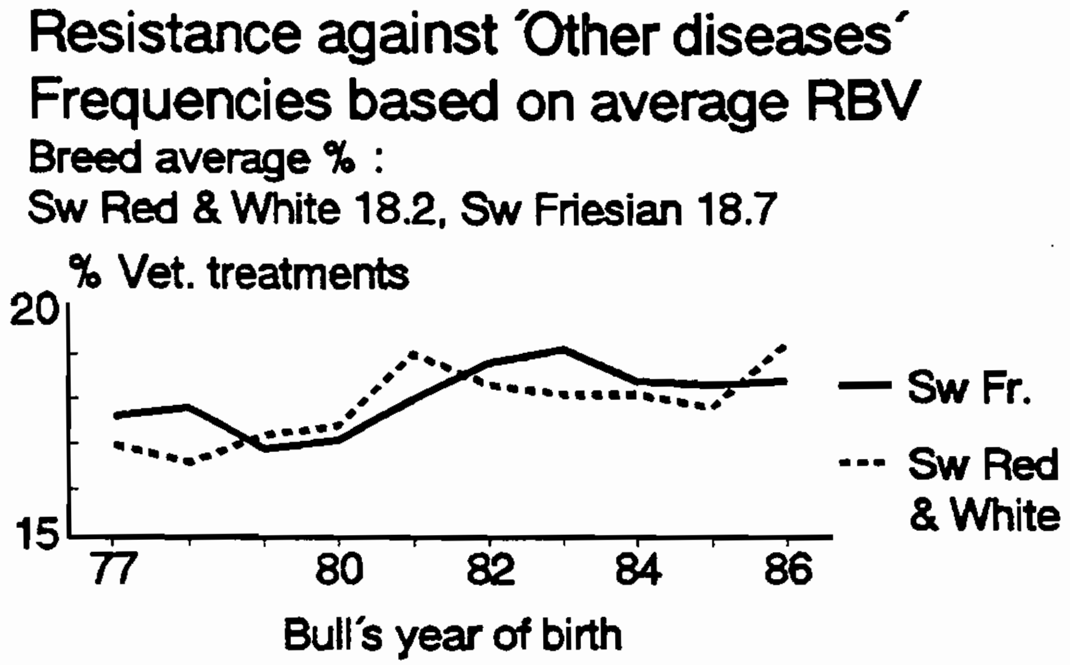


Figure 2. Relative breeding values (RBV) for tested bulls in the trait resistance against "Other diseases". RBV translated to frequencies of vet. treatments.

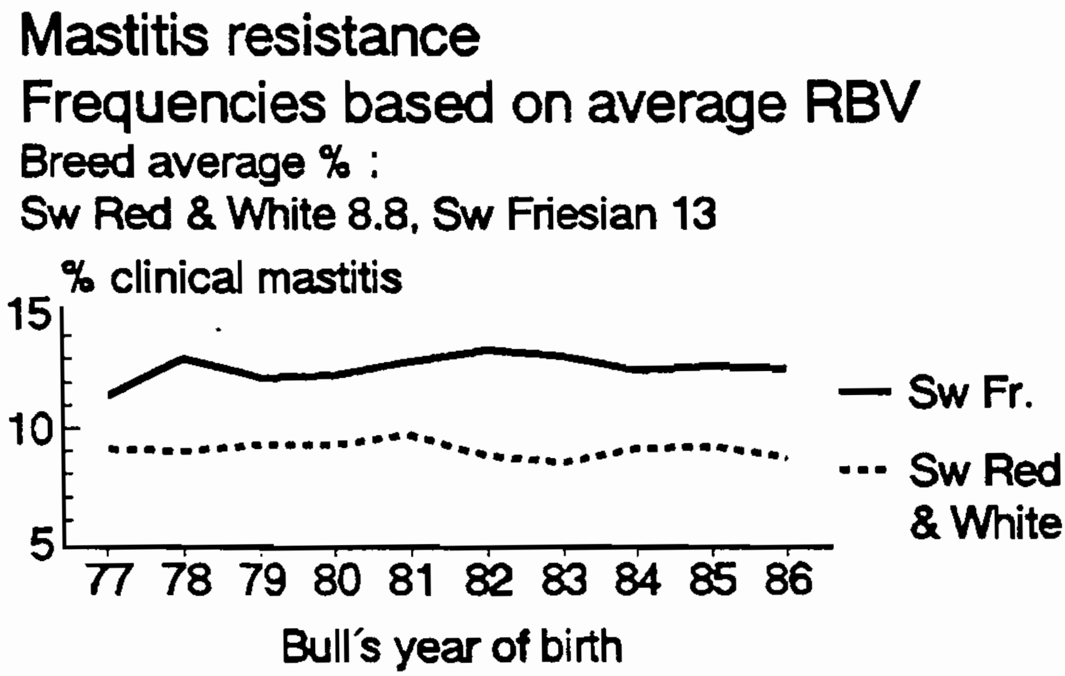


Figure 3. Relative breeding values (RBV) for tested bulls in the trait mastitis resistance. RBV translated to frequencies of clinical mastitis cases.

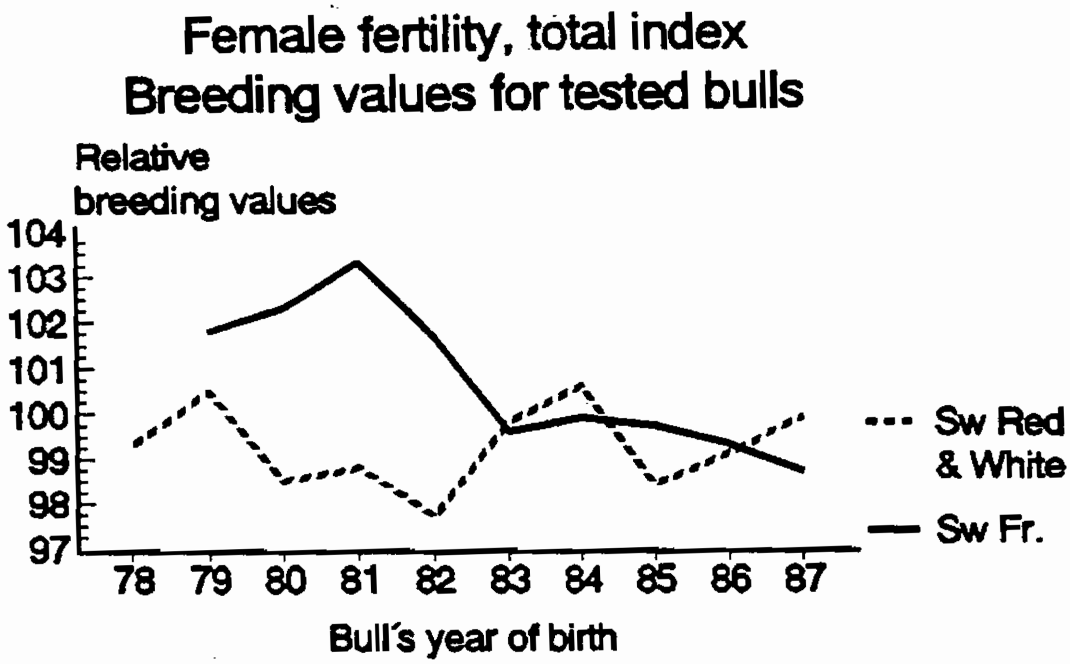


Figure 4. Breeding values for tested bulls for the trait female fertility, total index.

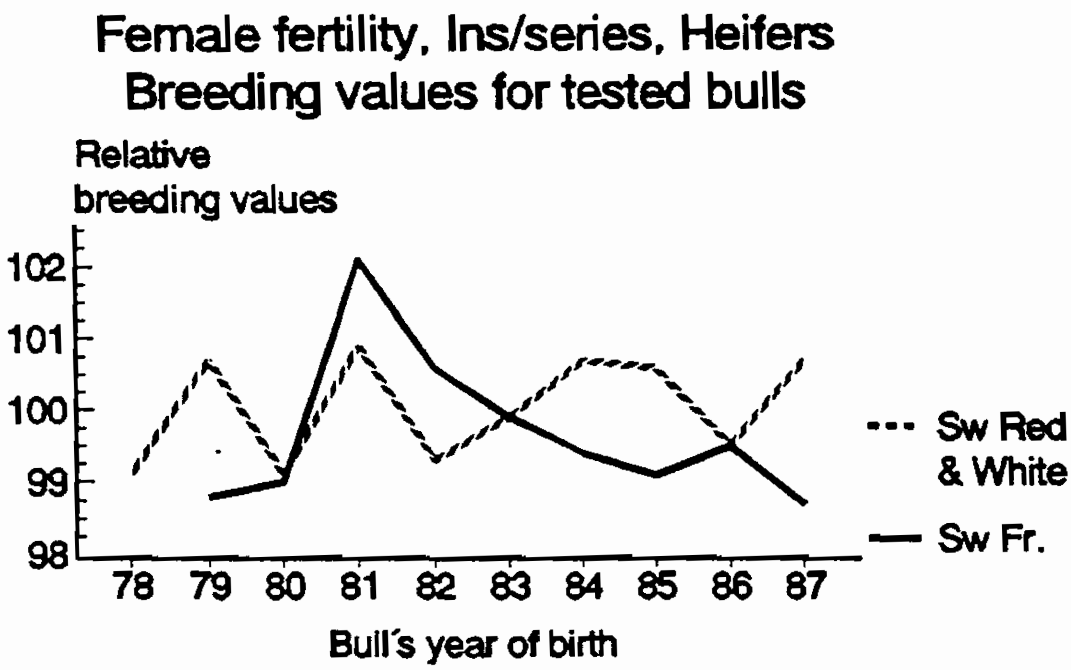


Figure 5. Breeding values for tested bulls, female fertility, heifers.

Table 1. Breeding values for mastitis resistance and other diseases for U.S. Holstein bulls used in Sweden.

Bull	Breeding value for mastitis resistance	Breeding value for other diseases
99040 Apache	97	102
99065 Kingway El. Very	106	97
99066 Arlinda Comander	96	94
99067 Krahns El. Bart	106	86
99068 C-A P. Chief Superstar	99	88
99069 Y-P. El. Ace	99	101
99072 Shardale Arl. Ch. Jemini	100	91
99073 Fultonway Transformer	107	100
99085 Knolltop Reckers Ace	102	101
99086 Sunny-Craft Ch.Spirit	91	84
99104 Moodys Pal Troy	98	82
99105 Cal-Clark B.Chairman	104	95
99106 Sun-Kota G. Genus	96	96
99107 Joyl. Forcaster Starlite	102	98
99108 Buffalo V. Wales	104	101
99109 Sir C.-C Nite Train	99	88
99110 Cres.-mead Ch. Stewart	107	88
99123 Wh.-F. Ned Boy	98	96
99128 Bit-O-Wind Starwar	91	86
99129 Merit Hamlet St. Val	104	90
99130 B-T. Val. Sammy	100	94
99131 Thonyma Secret	99	92
99140 Potts South. Man Twin	95	89
99141 Vigo Val. Elvan .	99	100
99142 P-O. Pappy	93	96
99144 Bear-Path Fant.	99	93
99145 Mawo Maveric Twin	101	94

Table 2. Breeding values for groups of sons, mastitis resistance and other diseases in Sw. Friesian (bull sires with > 15 sons).

Bull sire		Number of sons	Average breeding value in songroups	
			Mastitis resistance	Other diseases
33522	Hakan	15	94,4	101,7
33860	Saxon	26	102,8	105,4
34415	Aldin	18	106,2	102,2
35305	Benno	30	97,8	103,6
35316	Sitan	38	98,8	99,0
35365	Lift	32	101,6	94,5
35584	Slim	25	98,7	96,2
35931	Laser	31	87,8	100,2
36671	Latex	17	101,2	103,5
99040	Apache	39	99,8	101,8
99065	Very	44	103,1	99,6
99067	Bart	16	104,1	94,6
99068	Superstar	15	99,5	95,5
99085	Reckers	23	102,3	101,3
99086	Spirit	18	95,8	95,1
99105	Chairman	25	101,6	99,2

Table 4. Breeding values for female fertility for U.S. Holstein bulls used in Sweden.

Bull	Breeding value female fertility
99040 Apache	98
99065 Kingway El. Very	86
99066 Arlinda Commander	104
99067 Krahns El. Bart	80
99068 C-A P.Chief Superstar	99
99069 Y-P. El. Ace	86
99072 Shardale Arl. Ch. Jemini	95
99073 Fultonway Transformer	96
99085 Knolltop Reckers Ace.	100
99086 Sunny-Craft Ch. Spirit	81
99104 Moodys Pat Troy	93
99105 Cal-Clark B. Chairman	84
99106 Sun-Kota G. Genius	95
99107 Joyl. Forcaster Starlite	101
99109 Sir C-C Nite Train	94
99110 Cres.-mead Ch. Stewart	90
99123 Wh. F Ned Boy	96
99127 Walkway Ch. Mark	86
99128 Bit-O-Wind Starwar	93
99129 Merit Hamlet St. Val.	98
99130 B-T. Val Sammy	100
99131 Thonyma SSecret	96
99140 Potts South. Man. Twin	82
99141 Vigo Val. Elvan	99
99142 P O Pappy	90
99143 Fisher-Place Mandingo	104
99144 Bear Path Fant.	97
99145 Marvo Maveric Twin	95
99159 Lutz-Br. Bell Rex	95

Table 5. Breeding values for groups of sons, female fertility, total index (bull sires with > 10 sons) Sw. Friesian.

Bull sire	Number of sons	Average breeding value of sons
35305 Benno	30	109,2
35309 Svinn	14	105,8
35316 Sitan	38	102,2
35341 Blend	14	104,2
35365 Lift	31	96,7
35584 Slim	25	102,3
35931 Laser	29	99,9
36671 Latex	18	100,5
36691 Lutan	13	95,6
37140 Bråk	12	106,3
37875 Lokal	16	103,1
38105 Leo	19	103,4
73066 Bostorp	12	100,6
99040 Apache (U.S)	37	99,6
99065 Very (U.S)	44	95,2
99067 Bart (U.S)	16	90,1
99068 Superstar (U.S)	15	101,3
99072 Jemini (U.S)	11	97,5
99085 Reckers (U.S)	25	101,6
99086 Spirit (U.S)	18	90,4
99091 Valiant (U.S)	16	102,7
99097 Willow (Denmark)	19	96,7
99105 Chairman (U.S)	31	94,2
99110 Stewart (U.S)	11	94,9
99123 Ned Boy (U.S)	27	98,6

Table 6. Breeding values for groups of sons, female fertility, total index (bull sires with > 14 sons) Swed. Red x White Breed.

Bull sire		Number of sons	Average breeding value of sons
73616	Ölvingstorp	48	100,5
73637	Wahlstad	36	94,2
73932	Leukoi (Finland)	26	96,3
74550	Hagby	18	100,4
74601	Påbonäs	32	97,3
74746	Hanåsa	48	102,5
74820	Gräsgärde	35	101,3
75020	Floda Sund	19	100,4
75067	Salintupa (Finland)	41	102,2
75088	Ökna	18	93,7
75100	Sörberga	24	99,8
75158	Jussila (Finland)	34	96,2
75224	Kvarnåkra	21	98,5
75241	Nuutajärvi (Finland)	57	103,2
75256	Kairinen (Finland)	22	94,5
75310	Hedås	29	103,0
76028	Kungsgården	37	99,7
76098	Nor	27	96,4
76160	Bodan	23	92,1
76261	Andersta	29	96,8
76328	Gafsele	26	104,1
76351	Örarna	29	103,0
76360	Tosarby	51	92,8
83434	Stola	17	98,5
85409	Gamlegård	31	101,9
85439	Grindegård	22	100,5
99032	K. Schie (Norway)	23	97,7
99033	Y. Vangen (Norway)	23	101,7
99057	Jonny (Canada)	14	95,4
99055	Royal (Canada)	21	95,8
99060	Bekkevold (Norway)	37	100,0