Data systems for improvement of reindeer production

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Expended abstract: The use of the additional marking system in reindeer husbandry as described by Lenvik (1987) and the collar system for the identification of the dams of the calves (Petersson 1990) are essential for recording production data on the individual level. The combination of the individual and owner code is used as an unique identification for each animal in recording systems.

This paper presents a calf selection program, a recording and a database system developed as a part of a joint Swedish – Norwegian development project where one of the main objectives is to improve identification, handling and production recording systems. The systems are used in a reindeer flock in the south parts of the reindeer area in Sweden. The additional marking system has been used in this flock since 1981 and procedures for identification of the mothers of the calves has been used since 1986.

During the reindeer production year the following parameters are recorded:

July:
- the owner of the particular calf
- the date for observation
- the day no. of the year
- the day no. within each round up session
- the code for weighing equipment
- the identity of the calf
- the weight of the calf
- the sex of the calf
- the birth year of the dam of the calf
- the identity of the dam of the calf

The parameters are recorded in a relation database management system, dbase III (Ashton-Tate, 1984). The field information for the database file, KALVRAPP.DBF, in which the calf registrations are stored is shown in Fig. 1. The output to the reindeer owner from this activity is daily lists, as shown by example in Table 2. In the list, data on the calf, average weight for male and female calf group are given and the calf's mothers summer results from the last three years. The software behind those lists are dbase III programs.

September:
- the same parameters as above for calves not marked during the summer.

September/December/January:
- the weight of the calf
- the weight of the dam

Occasionally, selection of calves for slaughter occurs in September although the main selection activities take place in December and January. For fall and winter selection, a computer selection program for calf slaughter strategies is used where the heaviest calves are kept for breeding. The program has been developed by prof. Ö. Nissen at the Agriculture University in Norway and is incorporated in the MSTAT-package (Nissen, 1984).

The main elements in the selection process are:
Before a handling/selection session starts, each

Structure for database: KALVRAPP.dbf
Number of data records: 6317

Field	Field name	Type	Width	Dec
1	AGARE	Character	4	
2	DAT	Character	6	
3	DAG	Character	3	
4	KDAG	Character	2	
5	KVAG	Character	1	
6	KNR	Character	4	
7	VIKT	Character	2	
8	VIKT1	Character	1	
9	MORAR	Character	2	
10	MORNR	Character	4	

Structure for database: KALVVIKT.dbf
Number of data records: 5572

Field	Field name	Type	Width	Dec
1	AR	Character	2	
2	AGARE	Character	4	
3	KNR	Character	4	
4	VIKT	Numeric	2	
5	SEX	Character	1	
6	SL	Character	1	
7	DAT	Character	6	
8	DNR	Character	1	

Structure for database: VAJVIKT.dbf
Number of data records: 2535

Field	Field name	Type	Width	Dec
1	AGARE	Character	4	
2	PRODAR	Character	2	
3	DAT	Numeric	6	
4	DAG	Numeric	3	
5	KVAG	Numeric	1	
6	VIKT	Numeric	2	
7	MORAR	Character	2	
8	MORNR	Character	4	

Structure for database: MORTOT.dbf
Number of data records: 4280

Field	Field name	Type	Width	Dec
1	AGARE	Character	4	
2	MORNR	Character	4	
3	MORAR	Numeric	2	

Fig. 1. Field information for det database files.

reindeer owner gives the figures, as percentage, for the slaughter outtake he is aiming at. The slaughter percentages (sl%), one for each sex group, are transformed in the program to x-points (=location on the standard normal distribution) corresponding to one of twenty slaughter percentage classes and stored as a vector. Table 1 shows the sl%, the x-points and the probability enclosed by the standard normal curve above each point representing the probability for selection.

The owner and the identity of the calf are entered into the computer and as soon as the live weight of the calf has been recorded the program recommends «life» or «slaughter» for each particular calf. This recommendation is based on the assumption that the calves weights are normaly distributed and that each calf is compared to a threshold weight. The threshold weight is calculated from the mean, which is continously adjusted, plus the product of standard deviation and corresponding x-point.

Table 1. Transformation of slaughter percentage (sl%) to x-points giving the probability (p%) for selection.

sl%	x	p%
97.5–	5.00	0
92.5–97.4	1.64	0.05
87.5–92.4	1.28	0.10
82.5–87.4	1.04	0.15
77.5–82.4	0.84	0.20
72.5–77.4	0.67	0.25
67.5–72.4	0.52	0.30
62.5–67.4	0.39	0.35
57.5–62.4	0.25	0.40
52.5–57.4	0.13	0.45
47.5–52.4	0	0.50
42.5–47.4	–0.13	0.55
37.5–42.4	–0.25	0.60
32.5–37.4	–0.39	0.65
27.5–32.4	–0.52	0.70
22.5–27.4	–0.67	0.75
17.5–22.4	–0.84	0.80
12.5–17.4	–1.04	0.85
7.5–12.4	–1.28	0.90
2.5– 7.4	–1.64	0.95
0 – 2.4	–5.00	1.00

Table 2. Example on daily output during summer handling.

OWNER	FEMALE ID	WEIGHT	DATE	ID	WEIGHT	DATE	ID	WEIGHT	DATE	ID	WEIGHT	DATE	ID	WEIGHT
			1990			1989			1988			1987		
SL18	C	148 76	900714	L115	28	0	K	0 0	0	J	0 0	870720	H207	28
SL18	H	230 62	900714	L117	23	890715	K325	21	0	J	0 0	0	H	0 0
SL18	H	186 60	900714	L119	20	890708	K	70 16	0	J	0 0	0	H	0 0
SL18	C	112 77	900714	L121	28	0	K	0 0	880718	J	374 25	870716	H	101 30
SL18	D	092 0	900714	L122	24	0	K	0 0	0	J	0 0	870724	H	321 0
SL18	C	024 70	900714	L123	27	890706	K	53 25	880717	J	357 25	870724	H	325 0
SL18	H	062 60	900714	L124	26	890720	K	495 17	0	J	0 0	0	H	0 0
SL18	J	060 66	900714	L125	21	890720	K	444 21	0	J	0 0	0	H	0 0
SL18	D	114 78	900714	L126	25	890720	K	450 27	880715	J	268 23	0	H	0 0
SL18		0	900714	L127	30	0	K	0 0	0	J	0 0	0	H	0 0
SL18	X	504 72	900714	L128	25	890708	K	74 22	0	J	0 0	0	H	0 0
SL18	H	138 69	900714	L129	26	0	K	0 0	0	J	0 0	0	H	0 0
SL18	H	400 67	900714	L130	22	890718	K	371 25	0	J	0 0	870716	H	114 23
SL18	C	048 84	900714	L131	30	890714	K	281 25	880704	J	25 25	870710	H	55 21
SL18	X	030 68	900714	L132	22	890711	K	212 19	880709	J	129 20	870709	H	27 20
SL18	G	384 0	900714	L133	25	0	K	0 0	880916	J	407 36	0	H	0 0
SL18	X	540 61	900714	L134	19	890720	K	428 19	880705	J	49 14	870709	H	36 14
SL18	H	358 64	900714	L135	21	0	K	0 0	0	J	0 0	0	H	0 0
SL18	J	266 61	900714	L136	19	0	K	0 0	0	J	0 0	0	H	0 0
SL18	D	194 77	900714	L137	32	890708	K	66 26	0	J	0 0	0	H	0 0
SL18	C	152 0	900714	L138	24	890711	K	186 21	880716	J	321 22	870719	H	180 23
SL18	B	166 71	900714	L139	24	890714	K	268 24	880714	J	230 20	870719	H	165 26
SL18	E	190 68	900714	L140	26	890719	K	419 30	880709	J	104 21	870723	H	260 24
SL18	H	286 61	900714	L141	25	890706	K	26 22	0	J	0 0	0	H	0 0
SL18	G	286 69	900714	L142	26	890712	K	248 21	0	J	0 0	0	H	0 0
SL18	H	304 67	900714	L143	27	890706	K	24 20	0	J	0 0	0	H	0 0
SL18	G	200 0	900714	L144	24	0	K	0 0	0	J	0 0	0	H	0 0
SL18	X	070 64	900714	L145	25	890708	K	62 21	880716	J	327 26	0	H	0 0
SL18	J	260 60	900714	L146	24	0	K	0 0	0	J	0 0	0	H	0 0
SL18	F	198 0	900714	L147	24	890706	K	32 23	880715	J	301 21	0	H	0 0
SL18	X	018 68	900714	L148	25	890708	K	67 26	880711	J	142 21	870711	H	85 23
SL18	H	176 60	900714	L150	21	890720	K	453 22	0	J	0 0	0	H	0 0
SL18	H	294 62	900714	L152	21	890720	K	459 16	0	J	0 0	0	H	0 0
SL18	X	210 67	900714	L154	26	890708	K	87 27	880704	J	39 22	870724	H	273 0
SL18	G	286 69	900714	L156	22	890712	K	248 21	0	J	0 0	0	H	0 0
SL18	B	080 79	900714	L158	20	890710	K	154 19	880704	J	15 15	0	H	0 0
SL18	X	138 70	900714	L160	27	890708	K	79 25	880714	J	271 23	870724	H	323 0
SL18	D	240 0	900714	L162	26	890715	K	294 21	880714	J	251 19	870723	H	258 18

AVERAGE WEIGHTS AND S. D.

MALE		FEMALE	
WEIGHT	NUMBER	WEIGHT	NUMBER
25.6 (3.4)	17	23.5 (2.5)	21

An example;
A female calf's weight is recorded as 42 kg and the sl% for females calves as defined by the calf owner, is 60. The x-point is the 0.25 (Table 1) and the probability for selection is 0.4. During the handling session the average weight for female calves is calculated to 40 kg and the standard deviation is 4 kg. The threshold weight is the computed as 40+4*0.25=41.00. In this case then recommendation will be to keep this calf for breeding purposes.

Petersson & Danell (1990b) calculated standard deviations, as shown in Table 3, from around 10.000 observations of adjusted calves weights on data collected 1986–1989. As shown the deviation increases with the age of the calves.

Fig. 2 shows a diagram constructed for 5 different standard deviations; 3-, 4-, 5-, 6- and 7 kg.

An example;
Sl%=35, mean=41 and s.d.=3. From the curve for 3 s.d. and sl%=35 the threshold weight is derived as 41–2=39 kg. That is, all animals weighing more 39 kg are selected. As can be seen from the figure, the size of the standard deviation becomes more important when the fraction slaughtered is either big or small.

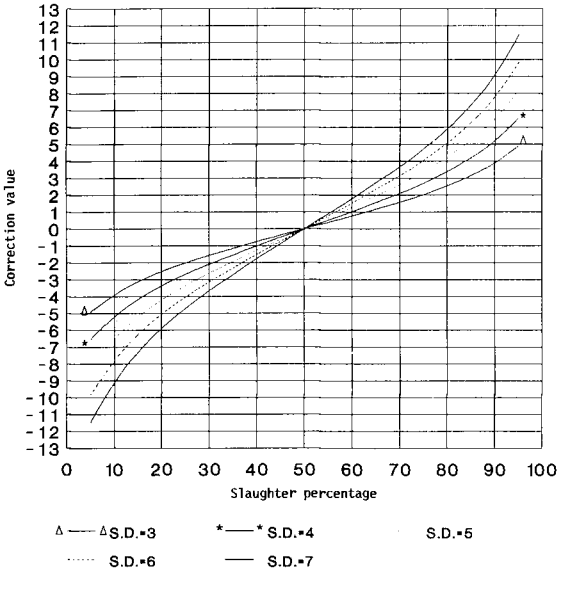

Fig. 2. Threshold weight for 5 different values of standard deviation. Threshold weight = average weight + correction value.

Table 3. Estimated weights and standard deviations for four dates on data collected 1986–1989 (Petersson, 1990).

	Male calves		Female calves	
Date	X	S.D	X	S.D
20/7	24.38	3.12	23.00	2.80
20/9	42.60	4.53	38.95	4.28
20/12	45.41	4.73	41.90	4.13
20/1	44.05	7.59	40.80	7.47

The weighing/selection program generates a file of production data as shown in Table 4a. Example of the daily output to the individual herder is shown in Table 4b.

After the weighing season the data files from the selection system are transformed to a dbase III file, KALVVIKT.DBF (Fig. 1) and each owner is given a complete list of all his yearlings. Missed calves are specialy indexed. This list is used in other districts outside the owners district and retreived «lost» calved are noted.

During December and January each female's weight is recorded and stored into the computer as a database file, VAJVIKT.DBF, as shown in Fig. 1.

A herd database:
All recordings during the reindeer production year are stored in four different database files which are merged into a database system. The main use of the system has so far been to produce life time production records for the individual female reindeer to be used by the owner as an information in the selection work.

Fig. 3 shows an example of a female life time record that is displayed to the owner during handling of the animals.

Future use of production data:
The information in the database system enables several new areas to be investigated in the field of reindeer researching. For example:

1) Studies of causes of variation in production traits important for choice of selection strategies.
2) Analysis of females life time production ability.
3) Analysis of losses.

Table 4a. Example of output from the calf selection program.

0	2	DISTRICT
1	3	OWNER CODE
2	4	INDIVID NR.
3	3	DAY NO.
4	3	WEIGHT (hg)
5	1	SEX 1=MALE 2=FEMALE
6	1	CHOICE 1=KEEP 2=SLAUGHTER
7	2	BIRTH YEAR FOR FEMALE
8	4	ID OF FEMALE
9	3	G/DAG
10	3	WEIGHT GAIN

SETT NR	0 0	0 1	0 2	0 3	0 4	0 5	0 6	0 7	0 8	0 9	1 0
1		18	1	350	540	1	1	84	E164	176	290
2		18	2	350	430	2	1	80	X214	134	220
3		18	3	350	450	1	2	84	E300	140	230
4		18	4	350	370	2	2	87	H314	121	200
5		18	5	350	500	1	1	84	E170	152	250
6		18	6	350	440	2	1	80	X500	128	210
7		18	7								
8		18	8	350	550	2	1	85	F225	189	310
9		18	9								
10		18	10	350	420	2	2	87	H158	140	230
11		18	11	350	480	1	2	80	X244	164	270
12		18	12								
13		18	13								
14		18	14	350	380	2	2	85	F278	134	220
15		18	15	350	360	1	1	87	H228	121	200
16		18	16	350	420	2	1	86	G016	140	230
17		18	17								
18		18	18								
19		18	19	350	410	1	2	87	H142	152	250

Table 4b. Example of production statistic from the calf selection program. The statistic is daily given to the reindeer owner.

	Numbers			Percentages		Average weight		
Sex	Total	Selected	Slaughtered	Selected	Slaughtered	Total	Selected	Slaughtered
Female	90	39	51	43	57	40.72	43.97	38.24
Male	76	15	61	20	80	44.22	50.87	42.59

FILE SEARCH FOR OWNER = SL18

Input ID of female (4 pos) > B072

Owner	ID Female	Birth Year	Weight as yearl.	Dam
SL18	B072	1981	Not rec.	Not rec.

Female weight

Date	Owner	ID	Weight
871215	SL18	B072	66.0
881212	SL18	B072	68.0
891217	SL18	B072	66.0

Female life-time production

Prod.year	Dam ID	Calf ID	Sex	Activity	Weight	Date
1987	B072	H168	Female	Marking	26	870719
1987	B072	H168	Female	Life	46	871208
*						
1988	B072	J218	Female	Marking	21	880714
1988	B072	J218	Female	Slaughter	41	881212
*						
1989	B072	K418	Female	Marking	27	890720
1989	B072	K418	Female	Marking	44	891217
*						
1990	B072	L068	Female	Marking	23	900709
*						

Owner	ID Female	Birth year	Weight as yearl.	Dam
SL18	H168	1987	26 46	B072

Female weight

Date	Owner	ID	Weight
881212	SL18	H168	63.0
891211	SL18	H168	62.0

Female life-time production

Prod.year	Dam ID	Calf ID	Sex	Activity	Weight	Date
1989	H168	K438	Female	Marking	21	890720
1989	H168	K438	Female	Slaughter	35	891211
*						
1990	H168	L075	Male	Marking	22	900709
*						

Fig. 3. Example of a life-time production record for a female reindeer.

Conclusions:

The data systems described has mainly been developed for the recording of research data. Work has to be done before the systems could be used in routine operations run by the reindeer owners themselves.

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