Genetic relationship between hunting traits of leashed and non-leashed traits in Norwegian Elkhound

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Abstract 23531

Session 65 «Dog Breeding»

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Disposition

- **About the breed Norwegian Elkhound**
- **About the hunting trials, and questions to be asked**
- **The dataset and pedigree file**
- **The model, including details on fixed effects**
- **Results; Important environmental effects**
- **Results; Heritabilities and genetic correlations**
- **Conclusions**
- **Implications and recommendations**


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Norwegian Elkhound

Two breeds, Norwegian Elkhound Grey, and Norwegian Elkhound Black. Both breeds belonging in the FCI group 5. This study deals with the Norwegian Elkhound Grey (NEG).

One of the national breeds of Norway. The breed has populations outside of Norway, with some genetic influence into the Norwegian gene pool, mainly from the Swedish and the Finnish populations. This has little effect on the inbreeding level, as the base population was exported from Norway only a few generations ago.

The NEG as a breed was created during the early 1800's and appeared for the first time in a Norwegian dog show in 1877. Today approx. 900 pups are registered in Norway annually.

The breed is traditionally used for hunting elk (and bears) in both non-leashed and leashed tracking. The breed was traditionally also a barking watchdog on farms.

The wanted hunting behaviour is to independently track down and hold elk at bay.

Around 60 thousand people in Norway hunt moose every autumn, and approx. 35-40 thousand animals are shot. Gross value of hunting has been estimated to 30 mill. euro per year.

The traditional selection is based on phenotypes

The Norwegian Elk Hound Association is responsible for management and breeding of the two elkhound breeds in Norway

About the hunting trials-1

The breed is used for both leashed and non-leashed tracking of elk.

Trials are held outdoors mainly in one-day events under non-standardized conditions

The trials are both social sport gatherings as well as serving the breeding work with phenotypes

The trials include registration of 5 separate traits (L 1-5) in leashed dogs:

1. **Quality of search for elk** **N= 5394**
2. **Ability to find elk** **N= 4477**
3. **Quality of keeping elk at bay** **N= 4105**
4. **Behaviour in front of or when finding elk** **N= 4031**
5. **Tracking elk** **N=5004**

About the hunting trials-2

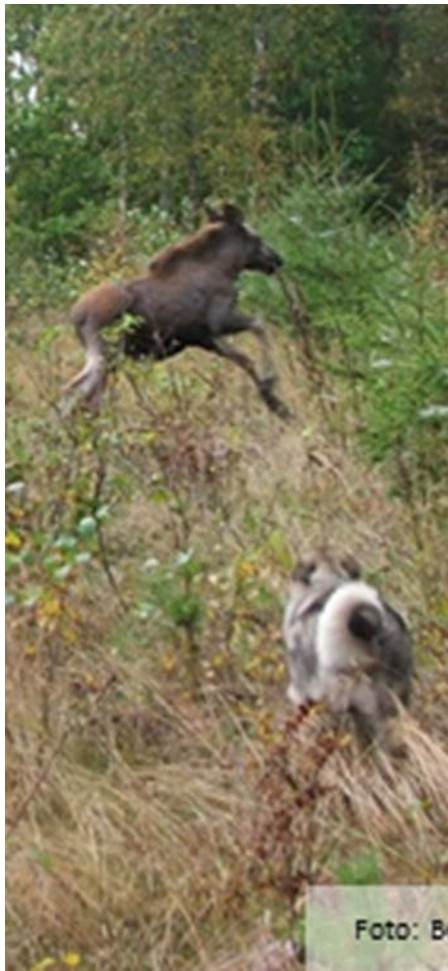
The breed is used for both leashed and non-leashed tracking of elk.

Trials are held outdoors mainly in one-day events under non-standardized conditions

The trials are both social sport gatherings as well as serving the breeding work with phenotypes

The trials include registration of 11 separate traits (NL 1-10) in non-leashed dogs:

1. **Quality of search for elk** **N=5394**
2. **Ability to find elk** **N=4655**
3. **Ability to keep elk at bay** **N=4506**
4. **Quality of keeping elk at bay** **N=4319**
5. **How the dog cling to the elk if the elk runs** **N=4564**
6. **How the dog conducts itself during baying** **N=4322**
7. **Loudness of barking** **N=3835**
8. **Use of barking** **N= 3796**
9. **Willingness to keep concact with leader** **N=4113**
10. **How the dog follows commands from the leader** **N=4091**



Questions to be asked

ARE WE BREEDING IN TWO DIRECTIONS WITHIN THE BREED (leashed vs. non-leashed traits)?

The population is not big enough to split into two different sub-breeds.

Could we select some of the most important traits for breeding value estimation purposes?

Could we develop a joint breeding value for leashed and non-leashed traits?

In order to do so we need to:

Find the correct adjustment factors for the most dominant fixed effects

Estimate heritabilities for the different traits in the two groups of traits

Find genetic correlations between the traits in the two groups

SELECT some of he traits based on heritabilities and genetic correlations

The data set and the pedigree file

5 394 records from 1 991 dogs in leashed hunting trials 1995-2014*

5405 records from 2070 dogs in non-leashed hunting trials 2005-2014**

No dogs have records in both groups of traits

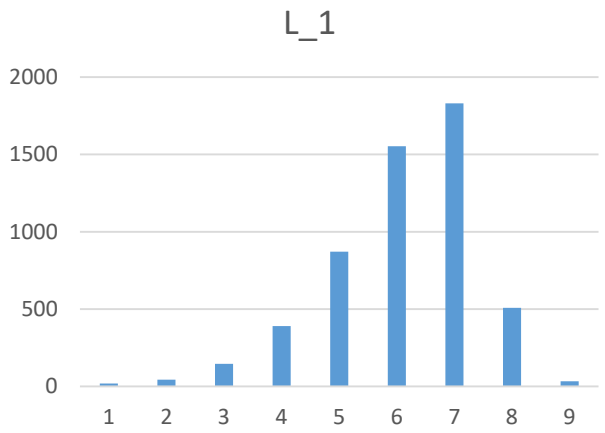
The pedigree file included 8 623 animals going back 10 generations

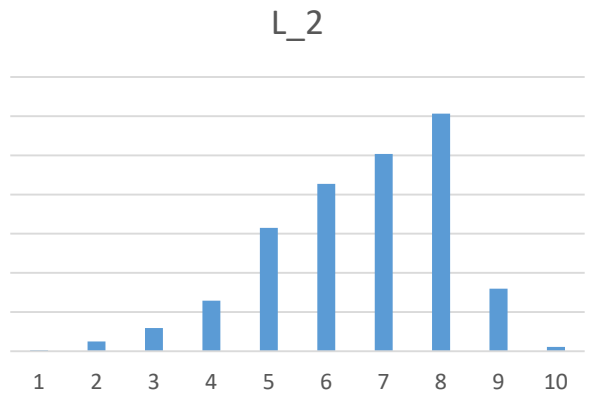
*** The test of leashed dogs has been unchanged in all these years**

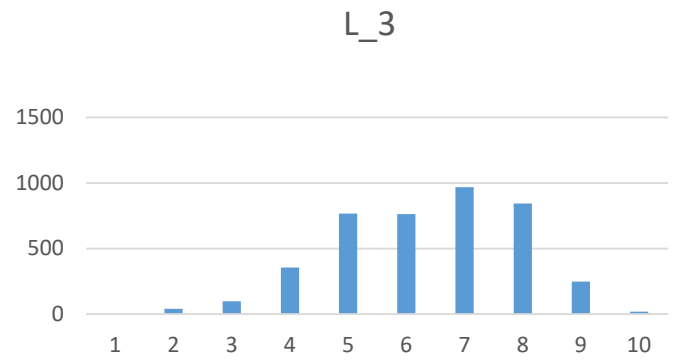
**** The test of non-leashed dogs changed dramatically in 2004/2005. therefore only results from the "new" test**

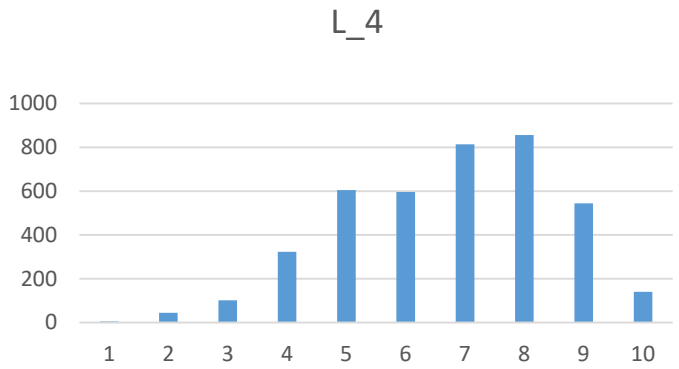
Distribution of scores- leashed dogs

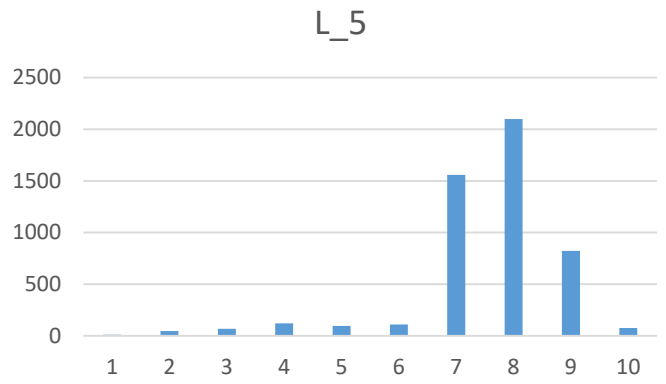
(score 10 «the best» in all traits)





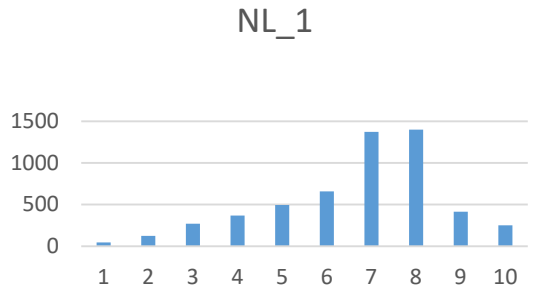


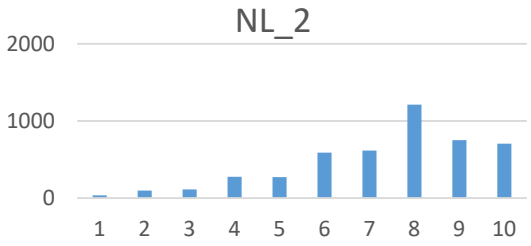


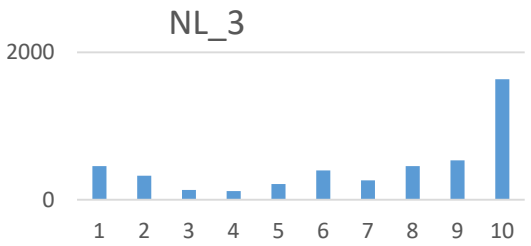


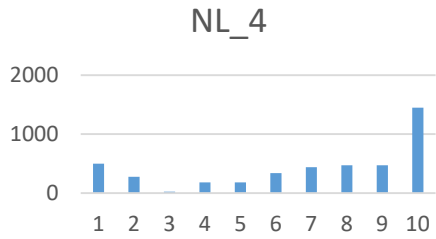
Distribution of scores- non-leashed dogs

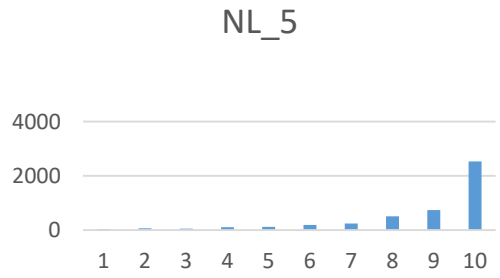
(score 10 «the best» in all traits)

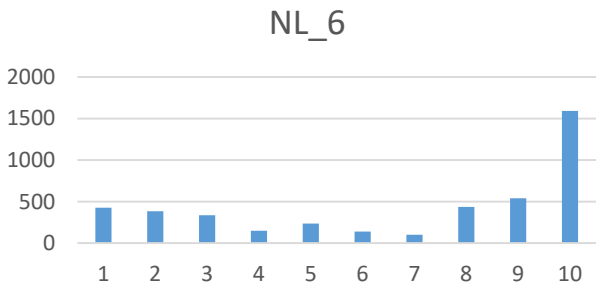


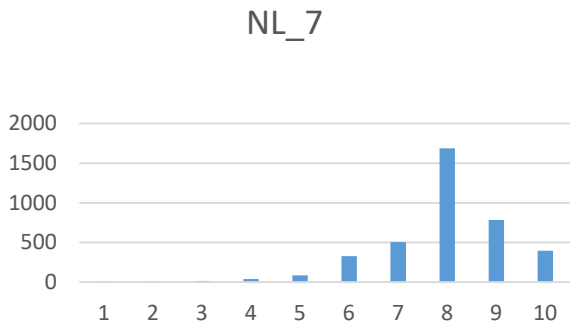


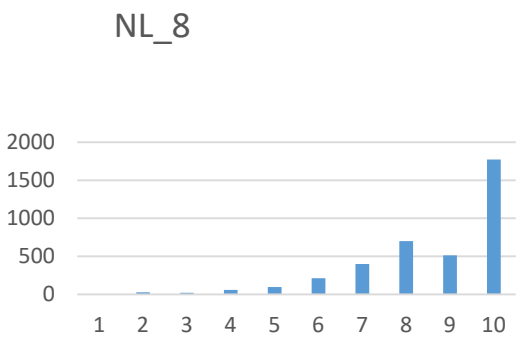


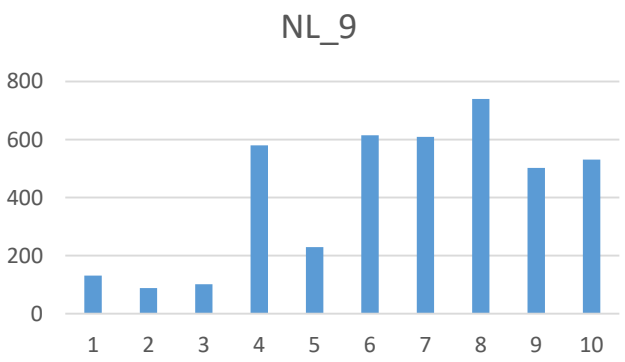


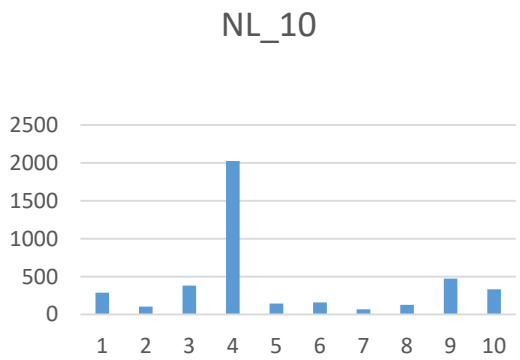












STATISTICAL MODEL:

Repeatability model

Fixed effects: SEX: 2 levels

Season (month within year):

Leashed: 93 levels

Non-leashed: 50 levels

Regression variable: Age (1-11 years)

Random effects in BLUP-analyses:

Animal:Permanent environment

Animal: Additive genetic

Results 1 – Fixed effects- both groups of traits

TRAIT	Sex	"best"	Season-month	Age	R^2 model fixed effects
L1	x	f	xx	xx	0.07
L2	-	f	xx	xx	0.10
L3	xx	f	xx	xx	0.05
L4	xx	f	xx	xx	0.04
L5	xx	f	xx	xx	0.05
NL1	xx	m	xx	xx	0.04
NL2	xx	m	xx	xx	0.04
NL3	xx	m	xx	x	0.04
NL4	xx	m	xx	-	0.05
NL5	xx	m	xx	x	0.05
NL6	xx	m	xx	-	0.04
NL7	-	m	xx	xx	0.03
NL8	-	f	xx	-	0.04
NL9	-	f	-	-	0.02
NL10	-	f	-	-	0.01

Results 1 – Fixed effects comments

The fixed effects explained 4-10 % of phenotypic variation in leashed traits, and 1-5 % in non-leashed traits

Sex differences were all in favour of females in leashed traits but in favour of males in all significant non-leashed traits.

In the leashed traits, traits were improved with age of magnitude of 0.06 to 0.10 point/year, except for “Behaviour in front of elk” (L 4).

In non-leashed traits, traits were improved by age in all significant traits except “Loudness of barking” (NL 7), where the youngest dogs had the best score.

Comments:

Are there biological explanations for the sex differences? Are females more “obedient” and therefore having better scores in leashed traits?

Are the environmental effects better controlled in leashed traits?

Results 2 – Genetic parameters

TRAIT		Heritabilities
L1	Quality of search for elk	0.16
L2	Ability to find elk	0.16
L3	Quality of keeping elk at bay	0.09
L4	Behaviour in front of or when finding elk	0.06
L5	Tracking elk	0.15
NL1	Quality of search for elk	0.08
NL2	Ability to find elk	0.05
NL3	Ability to keep elk at bay	0.05
NL4	Quality of keeping elk at bay	0.06
NL5	How the dog cling to the elk if the elk runs	0.08
NL6	How the dog conducts itself during baying	0.07
NL7	Loudness of barking	0.02
NL8	Use of barking	0.14
NL9	Willingness to keep contact with leader	0.01
NL10	How the dog follows commands from the leader	0.02

Heritabilities were generally lower in non-leashed traits (0.01-0.14) than in leashed traits (0.06-0.16)

Results 3 – Genetic parameters

Genetic correlations between the two groups of traits

	NL1	NL2	NL3	NL4	NL5	NL6	NL7	NL8	NL9	NL10
L1	-0.23	-0.57	-0.46	-0.20	-0.30	-0.69	0.14	-0.07	-0.34	-0.07
L2	-0.11	-0.15	-0.56	-0.44	ne	ne	0.87	0.12	ne	ne
L3	-0.19	-0.25	-0.68	-0.61	ne	-0.62	-0.08	-0.22	ne	ne
L4	0.13	-0.05	-0.57	ne	-0.43	-0.68	-0.27	-0.26	-0.20	0.34
L5	-0.31	-0.53	-0.61	ne	-0.37	-0.71	-0.34	-0.09	-0.59	0.21

Red: negative **Black: positive**

Genetic correlations between performance traits in the two groups were generally negative and unfavourable.

Implications and recommendations

The low heritabilities proofs the need for using breeding values as a selection tool in oppose to pure phenotypic selection used in most dog breeds

Should the most important traits be selected into a joint breeding value?

(our recommendations: L1 L2 L5 and NL1 NL2 NL5 NL8 are the most basic traits and could be selected to simplify the breeding goal).

Do they really want to breed in two separate genetic sub-groups or should all dogs be tested for both leashed and non-leashed traits???

(our comments: 3 + 4 traits could be included in a joint breeding value . Additionally there should be presented breeding values separately for leashed and non-leashed traits.)

FUTURE

- **Due to the relative small population size (900 pups born annually) it is important not to split the population in two separate breeding populations. This must be taken into consideration when the breeding goal is defined.**
- **Furthermore, the avoidance of inbreeding should be an important aspect of the breeding program.**
- **Continue tissue sampling in the population (at present, >1000 dogs with stored DNA samples) in order to create a solid reference population for future studies**

THANK YOU FOR YOUR ATTENTION

- AND ALL THE BEST TO OUR NATONAL BREED