

RAS – Breed strategy of the Norwegian Lundehund – NLK (2014-2018)

This document is a rough translation of sections 3-8 of the breed specific breeding strategy for the Norwegian Lundehund breed, approved by the Norwegian Kennel Club (NKK) in 2013. The Norwegian version can be downloaded from the NKK website: <http://web2.nkk.no/filestore/RAS/RAS-Norsk-lundehund-ver-1.pdf>

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Breed population

Population size

By the end of 2012, there were 582 Lundehunds in Norway and approximately 1.400 worldwide. There are Lundehunds in Europe and North America. In 1969, Sweden was the first country to import Norwegian Lundehunds. Norsk Lundehund Klubb officially approved of exports from 1971 onwards, as the number of Lundehunds in Norway reached 200 for the first time since serious efforts to save the breed started. In the following years, Lundehunds were exported to several new countries.

The table below shows the 13 countries with the highest numbers of Lundehunds in 2010. Parentheses indicate that the breed club does not cooperate with Norsk Lundehund Klubb.

Country	First registered import(s)	Approx. number of dogs 2010	Breed club
Norway	-	582 (2012)	-
Sweden	1969	150	SLK
Finland	1973	160	SL
Denmark	1976	100	NLD
USA	1987	250	NLAA
France	1986	22	CFCN
Luxembourg	1996	10	TCL
The Netherlands	1989	72	Scandia
Germany	1979	65	DCNH
Switzerland	1977	27	SKNH/CSCN
Austria	1990	10	(ÖCNHS)
Canada	1986	9	
Belgium	1988	6	
The Czech Republic	2003	9	

Table 1. There are about 1.400 Lundehunds worldwide. Lundehunds are bred in eleven countries in addition to Norway. Nine of these countries have breed clubs that cooperate with Norsk Lundehund Klubb.

Fluctuations in population size

The table below shows the population size from 1920 until 2012. Two serious genetic bottlenecks in this period have resulted in a very limited gene pool.

Year/ period	Number of dogs	Notes
1920-1939	Approx. 50 + 6	Most dogs were at Måstad, some at Røst, and 6 dogs were sent to Eastern Norway in 1939
1943-44	Approx. 5	An outbreak of canine distemper brought the breed close to extinction
1945-1955	Approx. 50	Puffin hunting was still going on at Måstad and Røst, although mostly for recreational purposes
1960	Approx. 6	All current Lundehunds are bred from these six individuals exclusively: Three of them from the same litter, two half siblings of the same mentioned three, as well as a Lundehund of unknown breeding.
1962-1971	Increasing towards 200	Most of the Lundehunds were kept in Eastern Norway
1971-1983	Slowly increasing to approx. 500 worldwide.	A limited number of dogs were exported from Norway
1983-1994	Slowly increasing to approx. 500 in Norway	An increasing number of breeders in Europe and USA
1994-2009	Approx. 500 in Norway	Increasing towards 1.200 worldwide
2010	526 in Norway	Approx. 1.400 world wide
2012	582 in Norway	Approx. 1.400 world wide

Table 2. *The number of Lundehunds, 1920-2012*

Average litter size

The table shows Norwegian litter statistics for the past 22 years, gathered from the Norwegian Kennel Club online database, DogWeb.

Year	Litters	Puppies	Average litter size
1990-1994	94	240	2,55
1995-1999	110	312	2,83
2000	28	71	2,54
2001	30	95	3,17
2002	24	78	3,25
2003	36	102	2,83
2004	24	70	2,92
2005	27	74	2,74
2006	25	67	2,68
2007	22	72	3,27
2008	24	67	2,79
2009	24	62	2,58
2010	19	45	2,37
2011	20	53	2,65
2012	32	88	2,75

Table 3. *Lundehund puppies in Norway 1990-2012.*

As is obvious from the graph below, the number of puppies born fluctuates. This is partly because there are few breeders, and many bitches will be given a year's rest after they have had a litter. The limited number of breeders and brood bitches make the breed vulnerable.

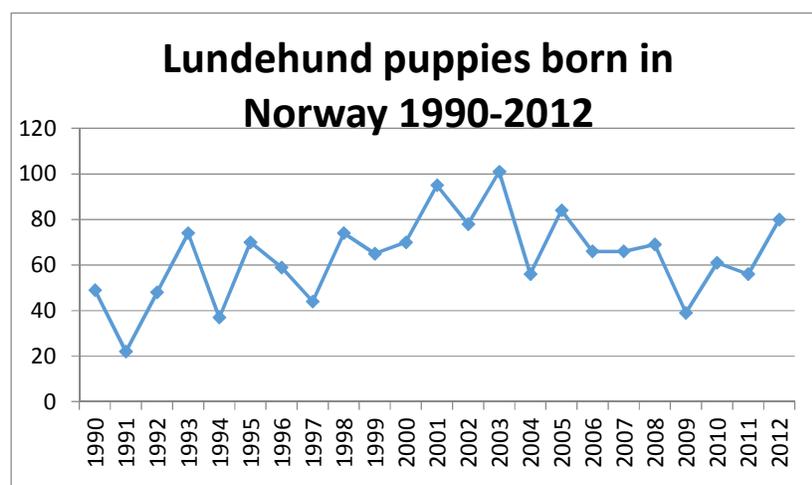
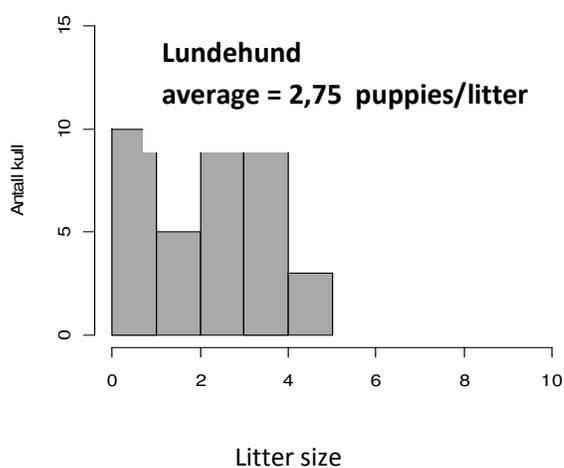
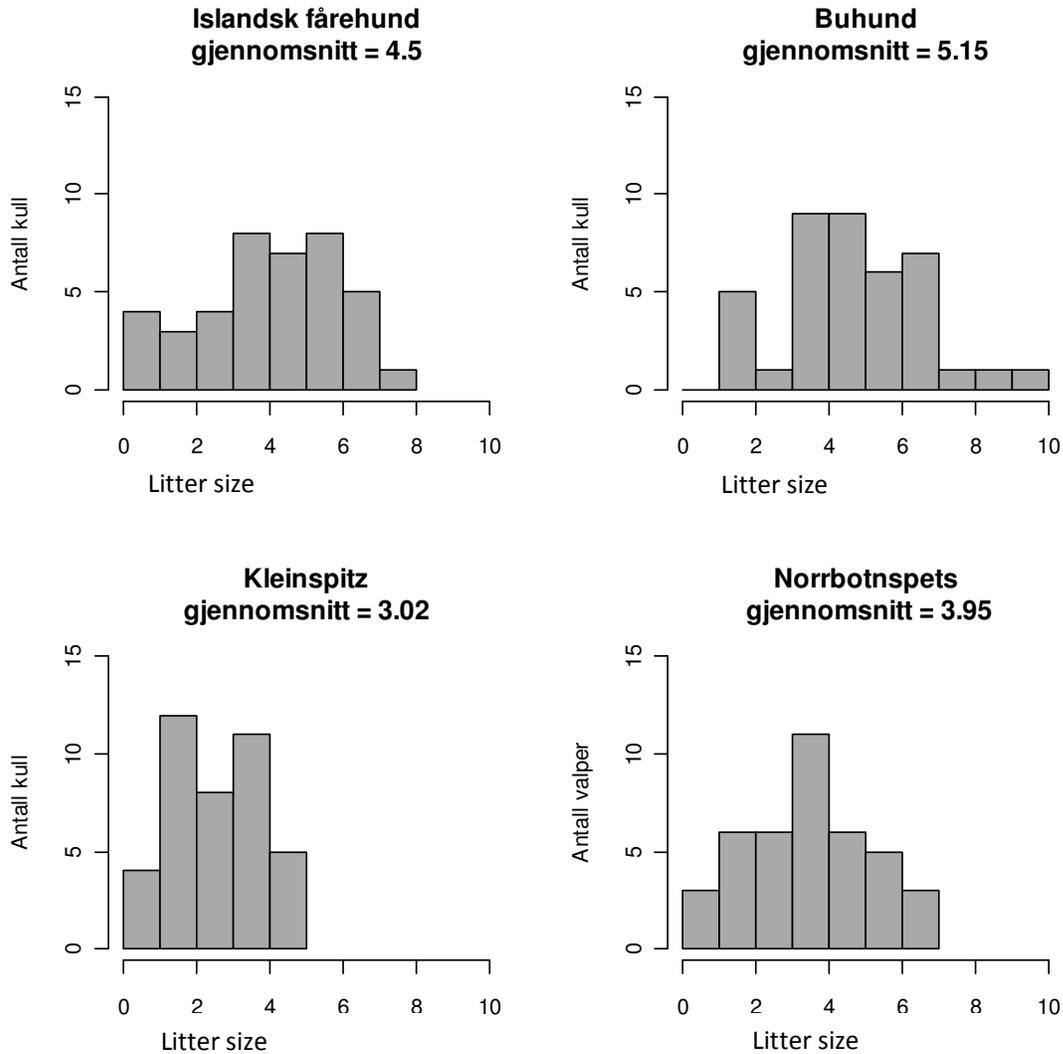


Figure 1. *Puppies born 1990-2012.*

Between 2002 and 2006, the total number of puppies born was 391. During the next five years, from 2007 to 2011, the total number was 299. This was a 24 % decrease compared to the five previous years. 2012 was a good year, however, with 88 puppies born from 32 litters. To preserve the breed, even more puppies must be born.

The average litter size between 1990 and 2012 was 2.75. This is quite low compared to breeds of similar physical size. Below is a comparison from 31 December 2012 between the last 40 litters born of Lundehund and four other breeds. The Icelandic Sheepdog and the Norwegian Buhund are of larger physical stature than the Lundehund and will naturally produce larger litters. What is remarkable is that as many as 25 % of the Lundehund litters only produced one puppy. The number of single-puppy litters is much lower in the other breeds.





Figur 3. Litter sizes for Icelandic Sheepdog (*islandsk fårehund*), Norwegian Buhund (*buhund*), Miniature German Spitz (*kleinspitz*), Norrbottenspets. Gjennomsnitt = average.

It would seem that three or four puppies is the ideal litter size for a Lundehund. Only three litters of six are known. Litters of five or six can result in decreased birth weight and survival rates. Although inbreeding coefficients have been deliberately reduced since 1982, litter sizes have not increased significantly for the past 22 years, possibly due to inbreeding.

Effective population size (N_e)

The most basic method for calculating effective population is based on the number of males and females bred in each generation. For our purposes, a generation is five years. The table shows the number of Lundehunds registered in the periods 2000-2004 and 2005-2009 that also have registered offspring.

Year registered	Males	Females	Ne
2000-2004	42	49	90
2005-2009	34	48	80

Table 4. Effective population size, *Ne*, 2000-2004 and 2005-2009.

Effective population size, *Ne*, is calculated thus:

$$Ne = \frac{4 \times Nm \times Nf}{Nm + Nf} \quad Nm = \text{number of males}, Nf = \text{number of females}$$

For a population of dogs to be considered viable, *Ne* must exceed 100. Also, there must be close to equal numbers of males and females. The effective population size of the Norwegian Lundehund is too small to be considered viable. *Measures must be made to make use of more individual Lundehunds for breeding.*

This way of calculating population size does not take into account the number of founders. Therefore, an alternative method based on pedigree analysis will provide a more accurate estimate. This requires considerable computing powers and will be conducted by [NordGen](#) based on information from the Norsk Lundehund Klubb database.

Coefficient of Inbreeding (COI)

Between the years 2010 and 2013, Norsk Lundehund Klubb recommended that the COI for Lundehunds based on a five generation pedigree should not exceed 3.25. Breeders have been encouraged to plan breedings with COIs low as practically possible.

Recommendations have changed since the 1990s, when even breeding between cousins was allowed, and sometimes even necessary. The recommendations have become more restrictive as the population size has increased.

Year of birth	Average coefficient of inbreeding based on a five-generation pedigree
1985	7.76
1988	6.23
1998	4.55
2003	2.06
2008	1.50
2009	1.65
2010	0.68
2011	1.22
2012	0.92

Table 5. Development of average coefficient of inbreeding based on a five-generation pedigree, 1985-2012

The average coefficient of inbreeding has gradually come down from 7.76 in 1985 to 0.92 in 2012, as a result of the breeders' tireless efforts and loyalty to club recommendations. Even so, we have not seen any positive effect on litter sizes and fertility. The reason is probably the limited number of founders. Genetic diversity is too limited, due to the breed history of two genetic bottlenecks. This has also been confirmed through recent genetic studies (Melis et al. Animal Genetics 2012).

To avoid further loss of genetic diversity, breeding should still not exceed a COI higher than 3.25 based on a five-generation pedigree. However, new genetic material is also needed to increase genetic diversity.

Lundehund breeding stock

Limiting the use of popular sires

Since 1982, Norsk Lundehund Klubb has subscribed to geneticist Dr. Per-Erik Sundgren (Swedish University of Agricultural Sciences) recommendation to restrict the number of puppies a stud dog is allowed to sire. The number of puppies any one dog can sire equals 5 % of the number of puppies born in the past five years. The below table shows how this number has changed over the years since 1990.

Period	Number of puppies born	Number of puppies a stud dog is allowed to sire
1990-1994	240	12,0
1991-1995	261	13,1
1992-1996	287	14,4
1993-1997	283	14,2
1994-1998	284	14,2
1995-1999	312	15,6
1996-2000	313	15,7
1997-2001	349	17,5
1998-2002	383	19,2
1999-2003	411	20,6
2000-2004	416	20,8
2001-2005	419	21,0
2002-2006	391	19,6
2003-2007	385	19,3
2004-2008	350	17,5
2005-2009	342	17,1
2006-2010	313	15,7
2007-2011	299	15,0
2008-2012	315	15,8

Table 6. Recommendations for stud dogs 1990 – 2012.

The decline in numbers from 2009 to 2011 resulted in a 25% reduction in the number of puppies a dog could sire in 2012 compared to 2003-2006. *In other words, we must still focus on breeding a sufficient number of puppies, ensuring that as many Lundehunds as possible, male and female, are allowed to reproduce.*

Number of Stud Dogs and Brood Bitches

The table shows the number of dogs registered in two five-year periods that also have registered offspring.

Year registered	Dogs	Bitches
2000-2004	42	49
2005-2009	34	48
Total 2000-2009	76	97

Table 7. *Number of Lundehunds bred in the 2000-2004 and 2005-2009 generations respectively.*

Fewer dogs than number of bitches are allowed to reproduce. This is a common occurrence in many breeds. But, as discussed in the section on effective population size, the number of breeding dogs is too low to maintain the breed long term. It is therefore important to increase the total number of breeding animals, at the same time striving to use as many dogs as bitches for breeding.

Importing Breeding Stock

Breeding stock is imported to Norway from other countries on a regular basis. However, imports will already be closely related to the Lundehund population in Norway, as the breed is very rare and descended from a very limited number of founders. Therefore, imports will not add to the gene pool, as they might do in other breeds.

Long and Short Term Goals for the Breed Population

The following goals for the breed population are considered vital for preserving the breed. They all require constant attention of breeders in years to come.

Long Term Goals for the Breed Population

- Increasing the number of Lundehunds in Norway to 1.000 individuals by 2025
- Increasing the effective population size to 200 (90 males and 110 females) in 2020-2025
- Increasing the effective population size as calculated from a pedigree analysis
- Increasing average litter size to 3.7 by reducing the frequency of single-puppy litters
- Increasing genetic diversity through outcrossing

Short Term Goals (2015) for the Breed Population

- Increasing the number of Lundehunds in Norway to 620
- Increasing the number of stud dogs to 46, brood bitches to 55 for the 2010-2015 period
- Calculating the effective population size based on a pedigree analysis
- Assessing the first generation of outcross puppies

Strategy for Reaching the Population Goals

Increasing the effective population size to 200 (90 males and 110 females) in 2020-2025

Strategy:

Increasing the number of female and male Lundehunds used for breeding.

Plan of action:

- All puppy bitch buyers must commit to breeding at least one litter from their bitch, unless there are medical reasons not to breed her.
- Develop the Norsk Lundehund Klubb online database as a tool to find suitable matches.
- Highest recommended coefficient of inbreeding to remain at 3.25 based on a five-generation pedigree
- Further develop the existing network of volunteers all over the country who can assist and guide novice breeders to ensure that more dogs succeed in mating naturally
- Further develop advisory services for novice breeders.
- Increasing the demand for puppies through promoting the breed at shows, performance events, competitions, fairs and through the media

Increasing the effective population size as calculated from a pedigree analysis

Strategy:

Increasing genetic diversity

Plan of action:

- Cooperating with NordGen to calculate the effective population size based on information from the Norsk Lundehund Klubb database.
- Increasing the effective population size as calculated from a pedigree analysis through outcrossing

Increasing the number of Lundehunds in Norway to 1.000 individuals by 2025

Strategy:

Increasing the number of breeders and the number of litters bred each year

Plan of action:

- All puppy bitch buyers must commit to breeding at least one litter from their bitch, unless there are medical reasons not to breed her.
- Further develop the existing network of volunteers all over the country who can assist and guide novice breeders to ensure that more dogs succeed in mating naturally
- Further develop advisory services for novice breeders.
- Organizing seminars for breeders
- Increasing the demand for puppies through promoting the breed at shows, performance events, competitions, fairs and through the media
- Applying to the Norwegian Kennel Club for a continuation of the exemption from their rules granted on 1 July 2014 that allows breeders of Lundehunds to mate their bitches from the age of 15 months.

Increasing average litter size to 3.7 by reducing the frequency of single-puppy litters

Strategy

Improving fertility through increasing genetic diversity within the breed.

Plan of action

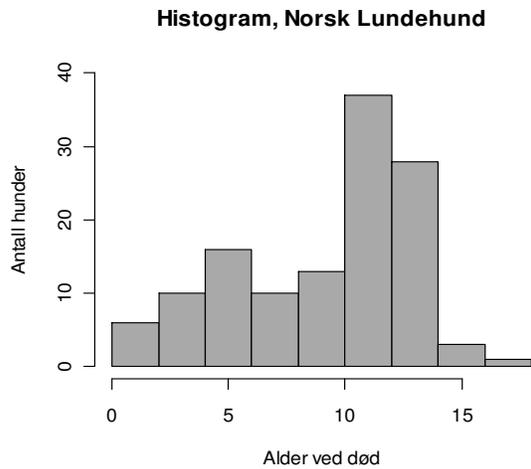
Planning and conducting an outcross project in cooperation with NordGen and the [Norwegian Genetic Resource](#) Centre.

Health

Overview of Breed Health

The Lundehund does not have many health issues and is generally a healthy, low-maintenance dog, well suited for weather conditions in coastal areas of Norway. Norsk Lundehund Klubb conducts surveys about every two years, in which all owners of Lundehunds are interviewed by phone on the health status of their dogs. Responses from the past two surveys (2010/2012) have been processed to provide an overview of average life span, causes of death and a general overview of health issues in the breed during this period.

For the 2010-2012 period, the survey has collected information about causes of death and age of death for a total of 124 Lundehunds. The average life span for these dogs was 9 years and 3 months, while 50 % of them lived to be 10 years and 5 months or more. Below is shown a graphical representation of how life span for the group is distributed, the horizontal axis showing age of death, the vertical axis showing the number of dogs that died at this age.



Figur 4. Distribution of life span for 124 Lundehunds, 2010-2012

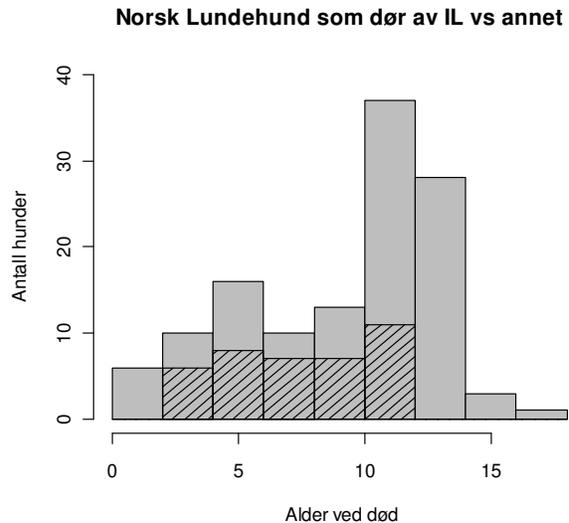
Causes of death were reported to be as follows:

Cause of death	Number of dogs	%
Intestinal lymphangiectasia (IL)	39	31
Gastrointestinal diseases	13	11
Cancer	11	9
Other causes	28	22
Trauma	6	5
Old age	27	22

Table 8. Causes of death for Lundehunds 2010-2012

About 30 % of Lundehunds die from intestinal lymphangiectasia (IL)

Below is shown how deaths from IL are distributed as compared to deaths by other causes. Again, the horizontal axis represents age of death, the vertical axis represents the number of dogs that died at this age.



Figur 6. Age of death for Lundehunds that died 2010-2012. Lundehunds that died from IL (striped columns) compared to Lundehunds that died from other causes 2010-2012 (grey columns).

Besides IL and gastrointestinal diseases, the category «other causes» is quite significant at 22 %. However, there are no causes in this category that significantly more frequent than others.

Prevalence of health issues, diseases and/or defects

Other than IL, the Norwegian Lundehund as a breed is not afflicted by any medical problems that warrant mandatory health screenings of any kind. The breed has one significant health problem, IL, discussed below.

IL

Intestinal lymfangiectasia (IL) is a gastrointestinal disorder. The most common symptoms are diarrhea and vomiting, but it can also present itself through sudden heart failure, accumulation of fluid in the heart or abdomen, or lethargy. The disease can be fatal, but can also respond well to the correct diet and medication. It is not known what causes the disease. There is reason to believe that there is a hereditary predisposition, but it is not known how this is inherited. It is therefore impossible to predict which dogs are at particular risk to develop the disease. The book *Lundehundboka* (Espelien, 2012, Vigmostad & Bjørke) gives a detailed description of the disease and treatment protocols.

Treatment

The chances of survival for a dog with IL is greatly improved if treatment commences as soon as possible, preferably administered by a veterinarian familiar with the disorder and its treatment. The dog must be treated with cortisone for an undefined period and fed a special diet for a long time. It needs veterinary care, medication and a strictly controlled diet for a long period.

Diet

A dog suffering from IL must be fed a special diet. A diet consisting of rice, fish or chicken and other low-fat, high protein foods with added trace elements is recommended. A very low-fat diet is essential to reduce the strain on the diseased lymph vessels.

Occurrence

The prevalence of IL is high in the breed, and mortality is as high as 30 %. It can affect dogs throughout their life span. Some dogs are old when they die, but quite a few die as young as 5 or 6 years of age (table 8, figure 6). A 2012 survey for all Lundehunds born in Norway in 2000 and 2001 had a 50 % response rate. It revealed that average age at which dogs with IL were first diagnosed were at 5.9 years of age. This corresponds quite well with the many deaths caused by IL at around 5 years of age. Better treatment means that quite a few dogs survive their first outbreak of IL. Some remain in remission throughout the rest of their lives, whereas others relapse one or several times.

The breed's resilience to IL must be improved. A concerted effort to reduce the problem through a reduction in COI since the 1980s has not yielded satisfactory results. The prevalence of the disease in the breed is currently at an unacceptably high level.

Coat

Some Lundehunds have coat and skin issues. The type of problem varies, as do diagnoses. Diagnoses have also been proven wrong, as owners who were told their dog had a chronic illness have seen their dog make a full recovery. The reasons for the problems are often unclear. However, some cases seem to be caused by malabsorption of important nutrients in the early stages of an outbreak of IL.

Eyes

In some countries (in particular Germany and Finland), quite a few Lundehunds have been screened for eye disorders. A few cases of juvenile localized central capsular cataracts/polar cataracts have been confirmed. These do not seem to impair the vision of the affected dog, and do not seem to worsen with age. Senile/late onset cataracts are quite common, and can present themselves from around the age of 8. Norsk Lundehund Klubb considers the breed to be free from any eye disorders that affect the dogs' lives.

Patellar luxation (dislocation)

A few Lundehunds have been diagnosed with luxating patellas. Norsk Lundehund Klubb does not consider the condition to be a widespread problem, and a screening programme is not warranted at this point.

Fertility Issues

Well socialized Lundehunds will usually mate without problems or need for human intervention. Nevertheless, problems with mating have been reported. Females do not always show distinct signs of being in heat, and can sometimes not be mated because her genitalia remain too tight for the male to enter. Some females do not conceive after mating. Experienced breeders report fewer problems. Males are sometimes clumsy and seem unable to breed for that reason. Some of these cases could be due to poor timing. However, sperm quality has also been poor in all examined specimens from Lundehunds. This might explain why some females do not conceive.

Goals for Breed Health in the Long and Short term

IL is by far the most serious health issue in the breed and top priority must be given to fighting this disease in years to come. Some skin and coat issues related to the malabsorption of certain nutrients will hopefully also be reduced as the prevalence of IL decreases.

Long Term Goals for Breed Health

- Decreasing the prevalence of IL in the breed to a level acceptable from an animal welfare point of view
- Improving fertility

Short term Goals for Breed Health

- Reducing the number of deaths from IL at an early age through preventative measures and improved treatment and care.

Decreasing the Prevalence of IL in the Breed to a level acceptable from an animal welfare point of view

Strategy

Improving the breed's resilience to IL

Plan of action

- Decreasing the risk of IL through the dissemination of knowledge amongst owners and the veterinary profession
- Improving treatment of IL.
- Decreasing the breed predisposition for IL through an outcross project conducted in close cooperation with NordGen and The Norwegian Genetic Resource Center.

Improving fertility

Strategy

Improving fertility in both male and female Lundehunds

Plan of action

- Improving genetic diversity through an outcross project in close cooperation with NordGen and The Norwegian Genetic Resource Center.

Temperament and utilization

Original function and possible uses today

The Lundehund was originally used for tracking and retrieving young puffins from their nests in inaccessible nesting locations. They were required to retrieve their prey unharmed, as the down, feathers and meat were all valuable resources. These dogs still retrieve objects willingly without chewing on them. Their instincts for finding nests have recently been successfully utilized for gathering eggs from sea gulls at the Tromsø Airport in Northern Norway, as the huge number of birds at the airport represent a safety hazard. The Lundehunds work independently, but in close proximity to their owner. In their original environment at Måstad, the dogs were not constrained, but would not go hunting on their own. The Lundehund can still easily be trained to follow their owner off leash, as long as they are in safe distance from traffic. The Lundehund is a skillful and accurate tracking dog. As they are agile and constructed for moving through difficult terrain, they make ideal companions for hikers. The breed originated in a coastal area, and is well suited for the wet and windy weather conditions of such areas and enjoy accompanying their people on board small boats.

Long and short term goals

Goals for temperament and function are the same for both the long and the short term.

Goals for breed temperament and function

Preserving the breed's original temperament and working ability.

Strategy

Strategy

Preserving the breed's original instincts.

Plan of action

- Developing breed-specific methods for temperament assessment

Behaviour

The Lundehund is alert, lively and trusting. It is sociable and friendly and adjusts well to life as a member of the household in modern families. At Måstad, Lundehunds were left to move and socialize freely with each other as a pack. Even today, Lundehunds tend to get along particularly well with dogs of their own breed, regardless of sex.

The Lundehund was bred to work in close proximity to their owner, an instinct they still retain.

Lundehunds have soft bites and retrieve instinctively. They are skillful and natural trackers. They have an instinctive desire to climb and exploring crevices.

Behavioural problems

Some Lundehunds suffer from excessive anxieties. These dogs should not be bred.

Long and short term goals

Goals for behaviour are identical for the long and short terms.

Goals:

Preserving the breed's original behaviour and instincts.

Strategy

Strategy

Monitoring the development of behaviour and instincts within the breed.

Plan of action:

- Describing the Lundehund's breed typical behaviour

Conformation

The Lundehund is a primitive Spitz type dog and must have a conformation adapted to their original task. The breed standard and Norsk Lundehund Klubb's judge's compendium details the breed's conformation. The Lundehund was used for hunting puffins in coastal areas of Norway. It must be very agile and able to make its way through almost any terrain.

General impression

Small, rectangular, Spitz type dog with a wedge shaped head. Extra toes (polydactyly) are a distinguishing feature of the breed.

Conformation Judging of the Lundehund

In judging the conformation of the Lundehund, preference should be given to dogs that exhibit traits making them fit for their original function. Note:

- A short muzzle is undesirable. The muzzle should be in proportion to the head, with jaws of sufficient length and strength to retrieve puffins without harming them.
- A too pronounced stop is undesirable, as this makes for a head shape less fit for navigating through narrow crevices.
- The Lundehund should not have a barrel shaped chest, as this does not allow for the freedom of movement of the front limbs required for climbing and crawling on cliffs and rocks.
- Some Lundehunds have steep croups. The Lundehund should have a relatively straight topline with a strong, fairly level croup. The Lundehund's natural gait is not the trot, rather it is built for climbing. It should have moderately angulated limbs, the hindquarters not too straight.
- A Lundehund fit for function should display rotary front movement and move close in the rear when gaited in a show ring. In steep and rocky terrain, this type of movement allows for sure footed and agile climbing.

Avoiding Conformational Extremes

The Lundehund is a natural, primitive Spitz type dog with no conformational extremes. Most judges strike the right balance when it comes to how much emphasis should be placed on feet and toes when judging Lundehunds. It is important that this should remain so, and that breeders continue to focus on general impression and function rather than placing too much emphasis on conformational details. Many Lundehunds have a somewhat uneven or undershot bite. Breeders should be aware of this and avoid breeding two dogs together that are both moderately undershot or have uneven bites.

Conformation: Long and short term goals

Currently, long and short term goals for breed conformation are identical:

Preserving the breed's conformation and keeping it true its original function

It is important to preserve the anatomical traits that sets the breed apart from other dogs:

- Extremely flexible shoulder and neck joints
- Six toes on all feet
- Outer ears that can be folded to protect the ear canal when the dog goes under ground
- Rotary front movement and close hind movement
- A functional double coat typical of Spitz type breeds, protecting the dog from cold winds and rain. The coat should not retain moisture that will freeze in cold weather, and should be able to withstand exposure to sea water for long periods of time.
- Improving bites is a long term goal.

Priorities and strategy

Strategy

As many individuals as possible should be bred from, still trying to avoid doubling on

undesirable features.

Plan of action:

- Planning breedings in which the male and the female complement each other in terms of conformation and temperament, so as not to reinforce flaws through breeding.

Summary

Norsk Lundehund Klubb's main goals for the breed are as follows:

Preserving the Norwegian Lundehund as a healthy dog fit for function, retaining the breed's unique characteristics:

Long term goals can be summed up as follows:

- Increasing the number of lundehunds in Norway to a total of 1.000 by the year of 2025, as well as increasing the effective population size as calculated through pedigree analysis.
- Decreasing the prevalence of IL to a level acceptable in terms of animal welfare.

Short term goals can be summed up as follows:

- Increasing the number of Lundehunds in Norway every year.
- Promoting the breed so that it is considered an interesting option as a companion animal.
- Decreasing the IL mortality rate through preventative measures and correct treatment.