



THE KENNEL CLUB
DOG HEALTH

Breed Health and Conservation Plan

Polish Lowland Sheepdog Evidence Base

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INTRODUCTION

The Kennel Club launched a new resource for breed clubs and individual breeders – the Breed Health and Conservation Plans (BHCP) project – in September 2016. The purpose of the project is to ensure that all health concerns for a breed are identified through evidence-based criteria, and that breeders are provided with useful information and resources to raise awareness of current health and welfare concerns in their breed, and support them in making balanced breeding decisions.

The Breed Health and Conservation Plans take a complete view of breed health with consideration to the following issues: known inherited conditions, complex conditions (i.e. those involving many genes and environmental effects such as nutrition or exercise levels, for example hip dysplasia), conformational concerns and population genetics.

Sources of evidence and data have been collated into an evidence base which gives clear indications of the most significant health conditions in each breed, in terms of prevalence and impact. Once the evidence base document has been produced it is discussed with the relevant Breed Health Co-ordinator and breed health representatives where applicable. Priorities are agreed based on this data and incorporated into a list of actions between the Kennel Club and the breed to tackle these health concerns. These actions are then monitored and reviewed on a regular basis.

DEMOGRAPHICS

The number of Polish Lowland Sheepdogs registered by year of birth between 1980 and 2019 are shown in Figure 1. The 1980 registrations figure appears depressed for all breeds due to registrations moving across to the electronic system from paper files.

The trend of registrations over year of birth (1980-2019) was -0.51 per year (with a 95% confidence interval of +1.10 to -2.13) reflecting the overall fluctuation in the breed's numbers during this time. However, it appears to breed's numbers have been gradually reducing in the past 15 years.

[Put simply, 95% confidence intervals (C.I.s) indicate that we are 95% confident that the true estimate of a parameter lies between the lower and upper number stated.]

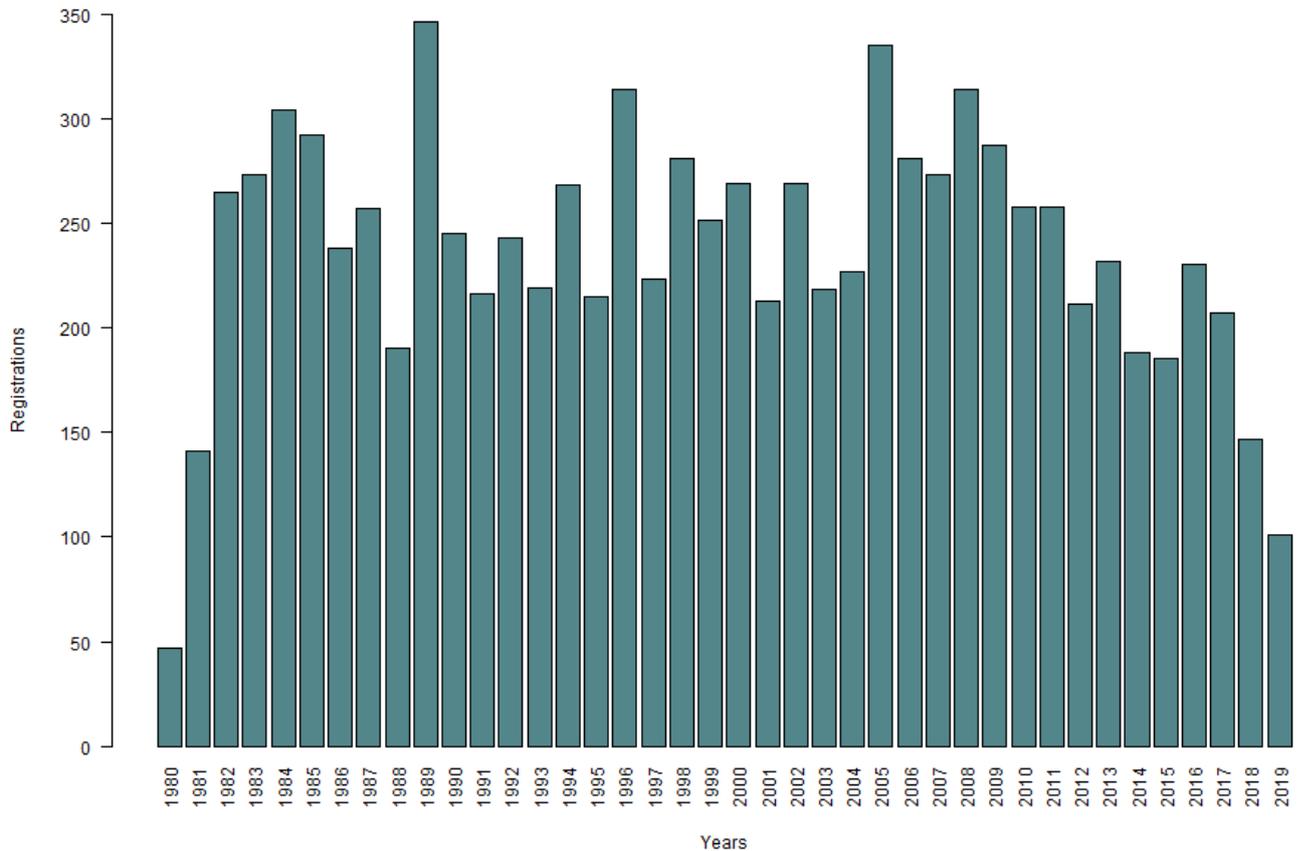


Figure 1: Number of Polish Lowland Sheepdog registrations per year of birth, 1980 – 2019.

BREED HEALTH CO-ORDINATOR ANNUAL HEALTH REPORT

Breed Health Co-ordinators (BHCs) are volunteers nominated by their breed to act as a vital conduit between the Kennel Club and the breed clubs with all matters relating to health.

The BHC's Annual Health Report 2019, yielded the following response to 'please list and rank the three health and welfare conditions that the breed considers to be currently the most important to deal with in your breed':

1. Skin conditions (ears & paws)
2. Diabetes
3. Thyroid problems

In terms of what the breed has done in the last year to help tackle these listed health and welfare concerns, the breed has focussed on providing information and awareness to owners regarding symptoms, treatments and prevention of these conditions.

The BHC's Annual Health Report 2018, yielded the following response to 'please list and rank the three health and welfare conditions that the breed considers to be currently the most important to deal with in your breed':

1. Central progressive retinal atrophy (CPRA)

In terms of what the breed has done in the last year to help tackle these listed health and welfare concerns, the breed has encouraged eye testing.

BREED CLUB HEALTH ACTIVITIES

The Polish Lowland Sheepdog has an active Breed Health Coordinator (BHC) and a webpage dedicated to health which can be found at: <https://www.plsc.org.uk/health>

BREED SPECIFIC HEALTH SURVEYS

Kennel Club Purebred and Pedigree Dog Health Surveys Results

The Kennel Club Purebred and Pedigree Dog Health Surveys were launched in 2004 and 2014 respectively for all of the recognised breeds at the time, to establish common breed-specific and breed-wide conditions.

2004 Morbidity results: Health information was collected for 45 live Polish Lowland Sheepdogs of which 24 (53%) were healthy and 21 (47%) had at least one reported health condition. The top categories of diagnosis were dermatologic (21.9%, 7 of 32 reported conditions), musculoskeletal (21.9%, 7 of 32 reported conditions), reproductive (12.5%, 4 of 32 reported conditions), respiratory (12.5%, 4 of 32 reported conditions), and cardiac (6.3%, 2 of 32 reported conditions). The most frequently reported specific conditions were kennel cough/ tracheobronchitis (3 reports), sarcoptic mange (2 reports) and hot spots/ pyotraumatic dermatitis/ wet eczema (2 reports).

2004 Mortality results: A total of 11 deaths were reported for the Polish Lowland Sheepdog. The median age at death was 9 years and 7 months (min = 2 years and 10 months, max = 15 years and 1 month). The most frequently reported causes of death by organ system or category were cancer (63.6%, 7 of 11), cardiac (9.1%, 1 of 11), endocrine (9.1%, 1 of 11), trauma (9.1%, 1 of 11), and other (9.1%, 1 of 11). These deaths consisted of three reports of cancer – unspecified, followed by one report for each of the following: liver cancer, pancreatic cancer, diabetes mellitus, heart disease, leukaemia, thymic cancer, trauma/ accident, and unknown.

2014 Morbidity results: Health information was collected for 23 live Polish Lowland Sheepdogs of which 16 (69.6%) had no reported conditions and 7 (30.4%) were reported to be affected by at least one condition. The most frequently reported conditions were dermatitis (3 reports), with one report for each of the following: arthritis, diabetes mellitus, hyperthyroidism, pseudopregnancy, pyometra, skin (cutaneous) cyst and lump - unspecified.

2014 Mortality results: A total of 7 deaths were reported for the breed. The range of age at death for the Polish Lowland Sheepdog was 6 years to 17 years. The most frequently reported causes of death were cancer (unspecified) (2 deaths), and then

one death for each of the following: cardiomyopathy, kidney disease, old age, pancreatitis and skin tumour.

LITERATURE REVIEW

The literature review lays out the current scientific knowledge relating to the health of the breed. We have attempted to refer primarily to research which has been published in peer-reviewed scientific journals. We have also incorporated literature that was released relatively recently to try to reflect current publications and research relating to the breed.

Congenital conditions

Natural bobtail: Many breeds have a natural short tail variation where puppies are born with a variety of tail lengths from no tail up to almost full tail. A recessive gene identified in the T-box transcription factor *T* gene (C295G – genes that encode embryonic limb development) is responsible for short tails in the Polish Lowland Sheepdog, as well as a number of other breeds (Gruszczynska et al, 2013; Haworth et al, 2001). Of 61 tested dogs of the breed 18 were found to be homozygotes for the wildtype gene (“normal” tails) and 43 heterozygotes (carriers). The authors also looked at average litter size depending on tail size (normal versus shortened), finding a significantly smaller litter size in shortened x shortened tail matings (4.28 puppies) compared to normal x normal (5.0 puppies) and normal x shortened (5.32 puppies).

This follows previous findings (Haworth et al, 2001; Indrebø et al, 2007) that the gene is embryonic and early postnatal lethal when homozygous, inducing developmental defects; but when heterozygous it does not cause these issues.

Cardiovascular conditions

Congenital heart defects: A retrospective Polish study of 301 dogs attending a veterinary hospital was undertaken to identify the prevalence of congenital heart defects in a number of breeds (Garncarz et al, 2017). A total of 30 dogs of the breed were included, of which three (5%) were found to be affected with patent ductus arteriosus, a condition where oxygenated blood from the left side of the heart incorrectly flows back into the pulmonary artery and lungs. There have also been small scale studies in which one or two dogs of the breed have been reportedly affected by this condition (Sebastian-Marcos et al, 2019; Kuczynski et al, 2012).

Musculoskeletal conditions

Elbow dysplasia: A further Polish study investigated the prevalence of elbow dysplasia in a number of different breeds between 1988 and 2005, including the Polish Lowland Sheepdog (Narojek et al, 2008). In total 133 dogs of the breed were included and assessed according to the FCI elbow grading system, with all of these dogs found to be free from any form of dysplasia.

INSURANCE DATA

There are some important limitations to consider for insurance data:

- Accuracy of diagnosis varies between disorders depending on the ease of clinical diagnosis, clinical acumen of the veterinarian and facilities available at the veterinary practice
- Younger animals tend to be overrepresented in the insured population
- Only clinical events that are not excluded and where the cost exceeds the deductible excess are included

However, insurance databases are too useful a resource to ignore as they fill certain gaps left by other types of research; in particular they can highlight common, expensive and severe conditions, especially in breeds of small population sizes, that may not be evident from teaching hospital caseloads.

Swedish Agria Data

Swedish morbidity insurance data were available from Agria for the Polish Lowland Sheepdog. Reported rates are based on dog-years-at-risk (DYAR) which take into account the actual time each dog was insured during the period (2011-2016), e.g. one full year of insurance is equivalent to one DYAR. The number of DYAR for Norfolk Terriers in Sweden during this period was 250 < 500, so results should be interpreted with caution.

The full Swedish insurance results are available through <https://dogwellnet.com/>, but key findings are reported below.

The most common general causes of veterinary care episodes (VCEs) for Agria-insured Polish Lowland Sheepdogs in Sweden between 2011 and 2016 are shown in Figure 2. The top five general causes of VCEs were injury, neoplasia (cancer), digestive, locomotor and skin.

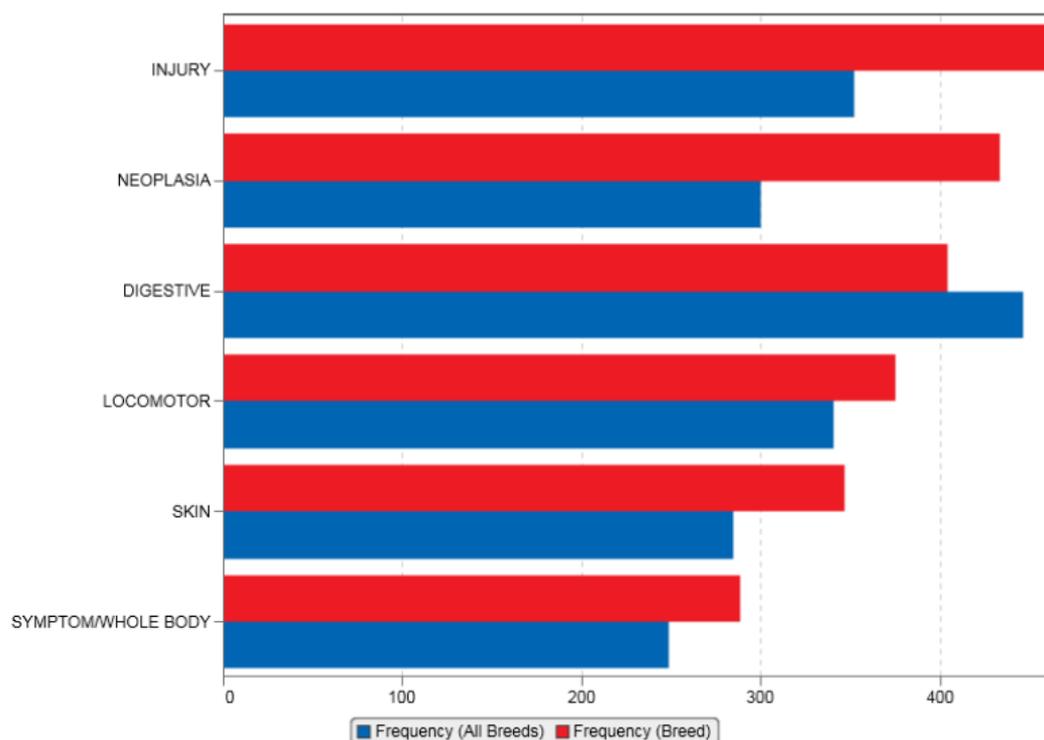


Figure 2: The most common general causes of VCEs for the Polish Lowland Sheepdog compared to all breeds in Sweden 2011 - 2016, from Swedish Agria insurance data.

The general causes of VCEs ordered by relative risk for the Polish Lowland Sheepdog are shown in Figure 3. In this analysis, the top five general causes of VCEs ordered by relative risk were neoplasia (cancer), injury, skin, clinical signs of the whole body, and locomotor. Rare conditions that occur sporadically may appear as a high relative risk; which may apply to some of these conditions, particularly due to the small number of dogs included.

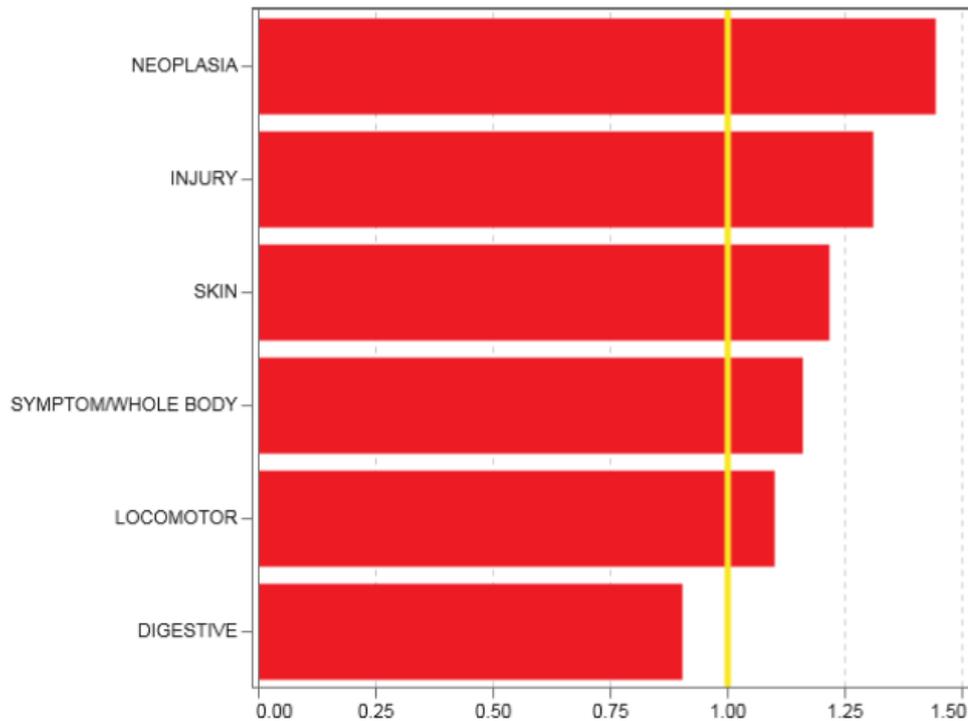


Figure 3: The general causes of VCEs for the Norfolk Terrier ordered by relative risk compared to all breeds in Sweden 2011 - 2016, from Swedish Agria insurance data.

The most common specific causes of veterinary care episodes (VCEs) for Agria-insured Polish Lowland Sheepdogs in Sweden between 2011 and 2016 are shown in Figure 4. The top five specific causes of VCEs were skin tumours and locomotory pain, however this was restricted to conditions where at least eight animals had a diagnosis. The same two conditions were the top specific causes by relative risk.

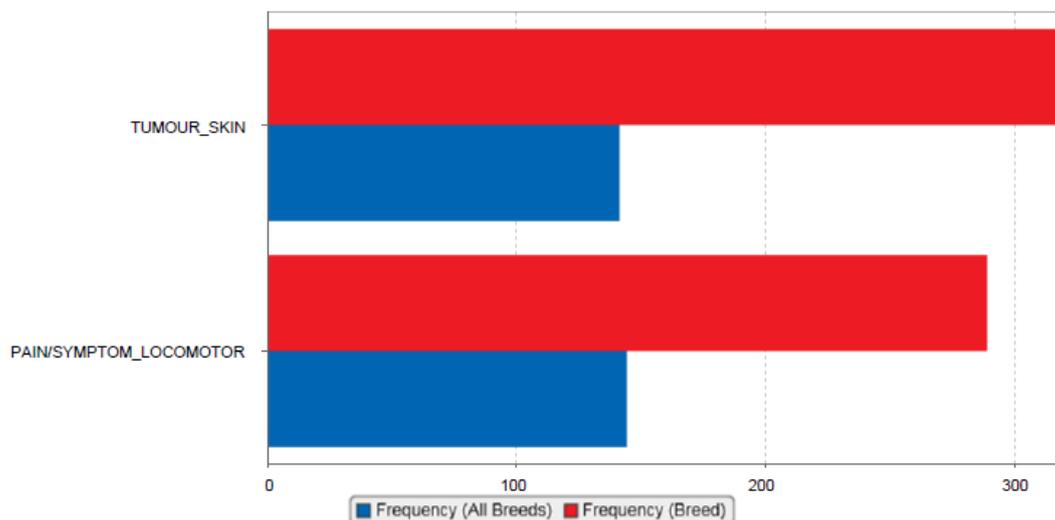


Figure 4: The most common specific causes of VCEs for the Polish Lowland Sheepdog compared to all breeds in Sweden 2011 - 2016, from Swedish Agria insurance data.

BREED WATCH

The Polish Lowland Sheepdog is a category one breed, meaning judges are not required to complete mandatory monitoring forms following an appointment as championship certificate level. To date no optional reports have been received for the breed.

PERMISSION TO SHOW

As of the 1st January 2020 exhibits for which permission to show (PTS) following surgical intervention has been requested will no longer be published in the Breed Record Supplement and instead will be detailed in BHCPs, and a yearly report will be collated for the BHC. In the past five years, one PTS has been granted for a Polish Lowland Sheepdog (not including neutering or caesarean section), with this being for overseas tail docking.

ASSURED BREEDER SCHEME

Currently within the Kennel Club (KC)'s Assured Breeders Scheme the only requirement for the Polish Lowland Sheepdog is:

- Hip scoring under the British Veterinary Association (BVA)/ KC Hip Dysplasia Scheme.

BREED CLUB BREEDING RECOMMENDATIONS

There are not currently any Breed Club breeding recommendations listed on the Kennel Club's website for the breed.

DNA TEST RESULTS

There are currently no recognised DNA tests for the Polish Lowland Sheepdog.

Whilst other DNA tests may be available for the breed, results from these will not be accepted by the Kennel Club until the test has been formally recognised, the process of which involves collaboration between the breed clubs and the Kennel Club in order to validate the test's accuracy.

CANINE HEALTH SCHEMES

All of the British Veterinary Association (BVA)/Kennel Club (KC) Canine Health Schemes are open to dogs of any breed with a summary given of dogs tested to date below.

HIPS

In total 235 dogs of the breed have been hip scored since 2000, with the mean hip score for the breed being 14.6 as of 2019. The mean hip score for dogs of the breed between 2000 and 2019 are given in Figure 5 below, which shows a very slight decline in mean score during this time. However, it is important to note that the mean will fluctuate per year especially given the small numbers of dogs tested, for example the maximum tested per year was 24 dogs in 2014, and the minimum just 6 dogs in 2000.

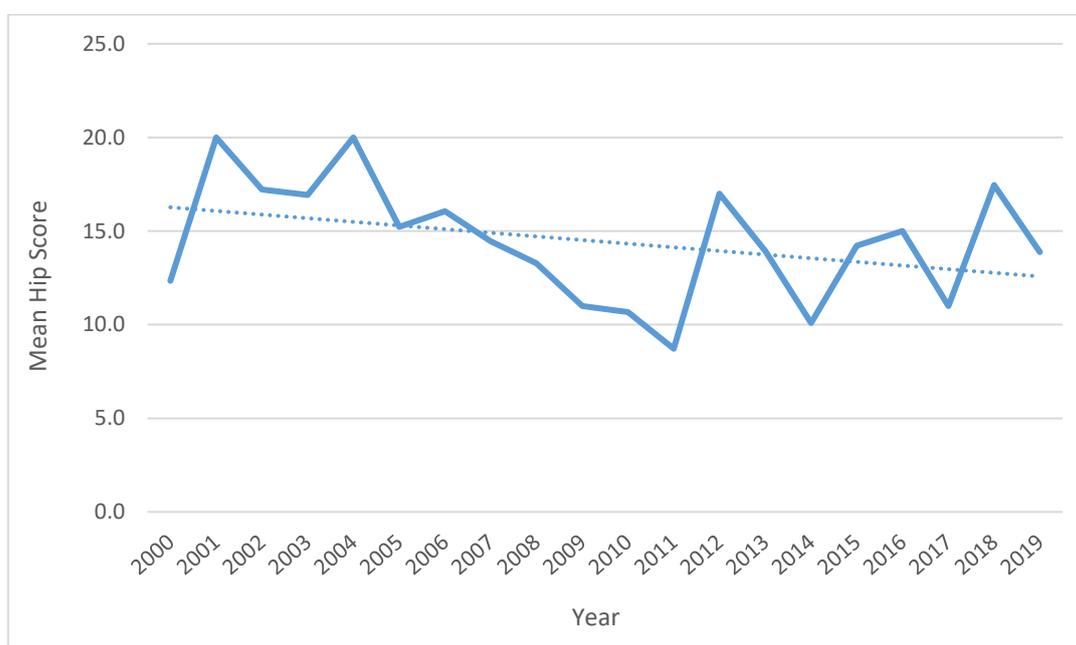


Figure 5: Mean hip scores for Polish Lowland Sheepdogs hip scored between 2000 and 2019.

The proportion of dogs registered per year with a known hip score also appears to be declining in the breed, with this being at just 3.4% in 2019 (Figure 6).

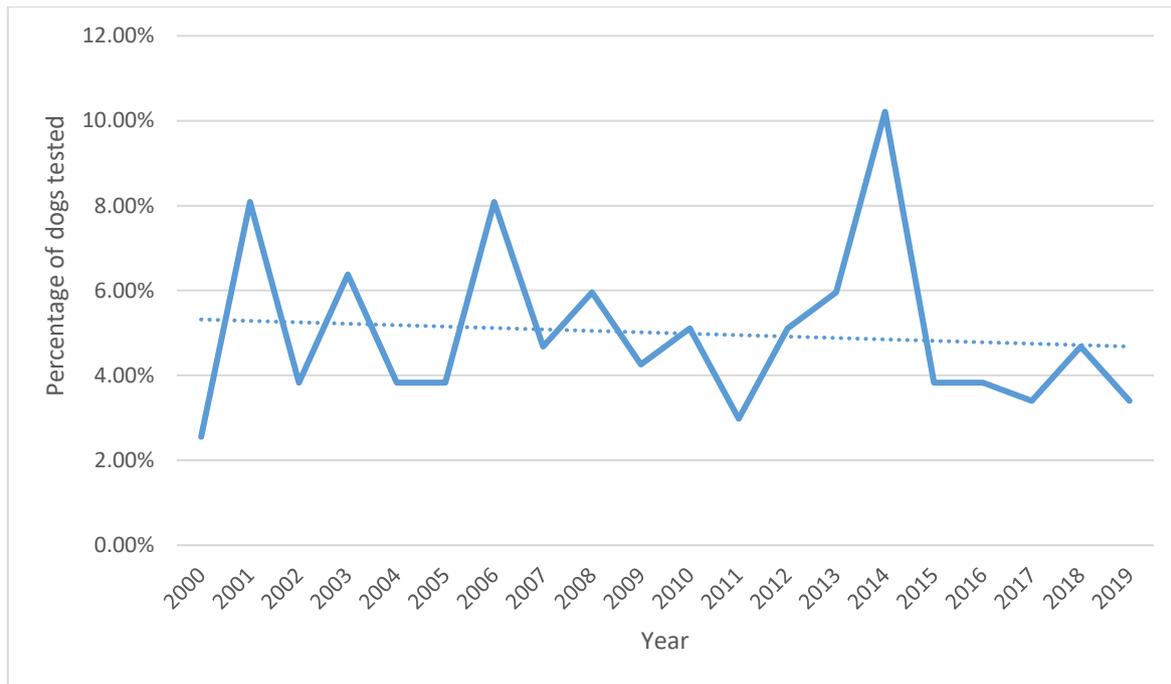


Figure 6: Proportion of Polish Lowland Sheepdogs with a known hip score between 2000 and 2019.

ELBOWS

No Polish Lowland Sheepdogs have been elbow graded under the BVA/KC Elbow Dysplasia Scheme in the past 20 years.

EYES

The breed is not currently on the BVA/KC/ISDS Known Inherited Ocular Disease (KIOD) list (formally Schedule A) or Schedule B for any condition under the BVA/KC/International Sheep Dog Society (ISDS) Eye Scheme.

KIOD lists the known inherited eye conditions in the breeds where there is enough scientific information to show that the condition is inherited in the breed, often including the actual mode of inheritance and in some cases even a DNA test.

Schedule B lists those breeds in which the conditions are, at this stage, only suspected of being inherited. As well as the Schedule A and B, the BVA records any other conditions affecting a dog at the time of examination, which is incorporated into an annual sightings report (Table 1).

Table 1: Reports on Polish Lowland Sheepdogs which have participated in the BVA/KC/ISDS Eye Scheme since 2012.

Year	Number Tested	Comments
2012	27 adults 0 litters	No comments
2013	29 adults 1 litter	1 – Other cataract
2014	36 adults 2 litters	2 – Other cataract 1 – Central PRA-like lesions
2015	34 adults 0 litters	1 – Distichiasis
2016	26 adults 0 litters	1 – Nuclear cataract 1 – Other cataract 1 – Multifocal retinal dysplasia (MRD)
2017	30 adults 0 litters	1 – Persistent hyperplastic primary vitreous (PHPV) 1 – GPRA-like appearance
2018	28 adults 0 litters	No comments
2019	<i>Awaiting report</i>	

AMERICAN COLLEGE OF VETERINARY OPHTHALMOLOGISTS (ACVO)

Results of examinations through ACVO are shown in Table 2 below. Between 2015 and 2019, 210 Polish Lowland Sheepdogs were examined, of which 67.6% (142 of 210 dogs) were found to be unaffected by any eye condition.

Whilst it is important to note that these data represent dogs in America, the organisation tend to examine a higher number of dogs than that in the UK, and therefore are a valuable source of information.

Table 2: ACVO examination results for the Polish Lowland Sheepdog, 1991 – 2019.

Disease Category/Name	Percentage of Dogs Affected	
	1991-2014 (n=1,017)	2015-2019 (n=210)
Eyelids		
Distichiasis	1.6%	1.9%
Cornea		
Corneal dystrophy	2.9%	3.3%
Uvea		
Persistent pupillary membrane (iris to iris)	6.5%	11.0%
Lens		
Cataract (suspect not inherited/significance unknown)	3.9%	5.2%
Significant cataracts (summary)	2.6%	11.0%
Retina		
Retinal dysplasia (folds)	1.0%	0.0%
Generalized progressive retinal atrophy (PRA)	1.6%	2.4%

Adapted from: <https://www.ofa.org/diseases/eye-certification/blue-book>

REPORTED CAESAREAN SECTIONS

When breeders register a litter of puppies, they are asked to indicate whether the litter was delivered (in whole or in part) by caesarean section. In addition, veterinary surgeons are asked to report caesarean sections they perform on Kennel Club registered bitches. The consent of the Kennel Club registered dog owner releases the veterinary surgeon from the professional obligation to maintain confidentiality (vide the Kennel Club General Code of Ethics (2)).

There are some caveats to the associated data;

- It is doubtful that all caesarean sections are reported, so the number reported each year may not represent the true proportion of caesarean sections undertaken in each breed.
- These data do not indicate whether the caesarean sections were emergency or elective.
- In all breeds, there was an increase in the number of caesarean sections reported from 2012 onwards, as the Kennel Club publicised the procedure to vets.
- In numerically small breeds such as this, there will be a wide amount of fluctuation between years.

The number of litters registered per year for the breed and the number and percentage of reported caesarean sections in the breed for the past 10 years are shown in Table 3.

Table 3: Number of litters of Polish Lowland Sheepdogs registered per year and number and percentage of caesarean sections reported per year, 2009 to 2019.

Year	Number of Litters Registered	Number of C-sections	Percentage of C-sections	Percentage of C-sections out of all KC registered litters (all breeds)
2009	15	0	0.00%	0.15%
2010	12	0	0.00%	0.35%
2011	11	1	9.09%	1.64%
2012	15	3	20.00%	8.69%
2013	15	2	13.33%	9.96%
2014	9	4	44.44%	10.63%
2015	11	2	18.18%	11.68%
2016	10	0	0.00%	13.89%
2017	9	1	11.11%	15.00%
2018	8	1	12.50%	17.21%
2019	4	0	0.00%	15.70%

GENETIC DIVERSITY MEASURES

The effective population size is the number of breeding animals in an idealised, hypothetical population that would be expected to show the same rate of loss of genetic diversity (rate of inbreeding) as the population in question; it can be thought of as the size of the 'gene pool' of the breed. In the population analysis undertaken by the Kennel Club in 2020, an estimated effective population size of **72.3** was reported (estimated using the rate of inbreeding over the period 1980-2020).

An effective population size of less than 100 (inbreeding rate of 0.50% per generation) leads to a dramatic increase in the rate of loss of genetic diversity in a breed/population (Food & Agriculture Organisation of the United Nations, "Monitoring animal genetic resources and criteria for prioritization of breeds", 1992).

An effective population size of below 50 (inbreeding rate of 1.0% per generation) indicates the future of the breed may be considered to be at risk (Food & Agriculture Organisation of the United Nations, "Breeding strategies for sustainable management of animal genetic resources", 2010).

Annual mean observed inbreeding coefficient (showing loss of genetic diversity) and mean expected inbreeding coefficient (from simulated 'random mating') over the period 1980-2020 are shown in Figure 7. The rate of inbreeding rapidly increased until around 2000, during which time genetic diversity was steadily lost from the population, but since appears to have plateaued and may be beginning to decrease, implying a maintenance and restoration in diversity at this time. It should be noted that there is wide fluctuation throughout the years due to the numerically small population.

It should be noted that, while animals imported from overseas may appear completely unrelated, this is not always the case. Often the pedigree available to the Kennel Club is limited in the number of generations, hampering the ability to detect true, albeit distant, relationships. For full interpretation see Lewis et al, 2015 <https://cgejournal.biomedcentral.com/articles/10.1186/s40575-015-0027-4>.

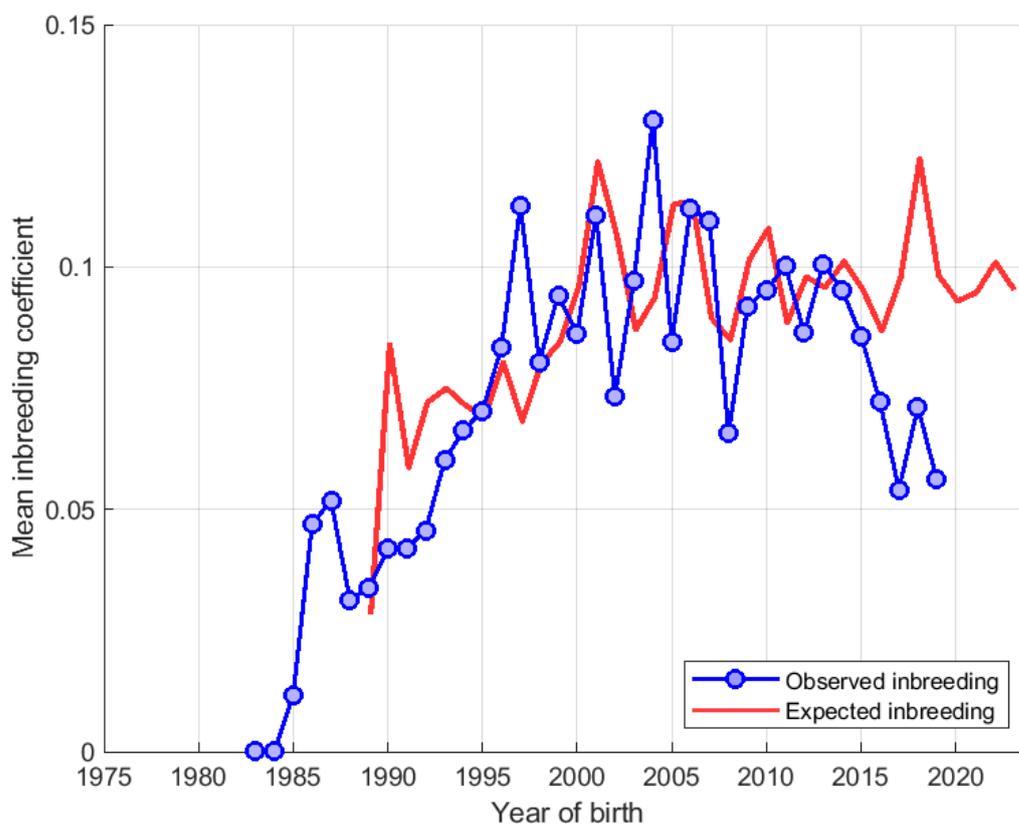


Figure 7: Observed and expected inbreeding coefficients.

Below is a histogram ('tally' distribution) of number of progeny per sire and dam over each of eight 5-year blocks (Figure 8). A longer 'tail' on the distribution of progeny per sire is indicative of 'popular sires' (few sires with a very large number of offspring, known to be a major contributor to a high rate of inbreeding). The number of popular sires is relatively small in the breed, however there was one sire responsible for almost 17% of puppies registered in the past five years. Prolonged

use of popular sires, and their immediate relatives, can result in rapid deterioration in genetic health and should be considered carefully.

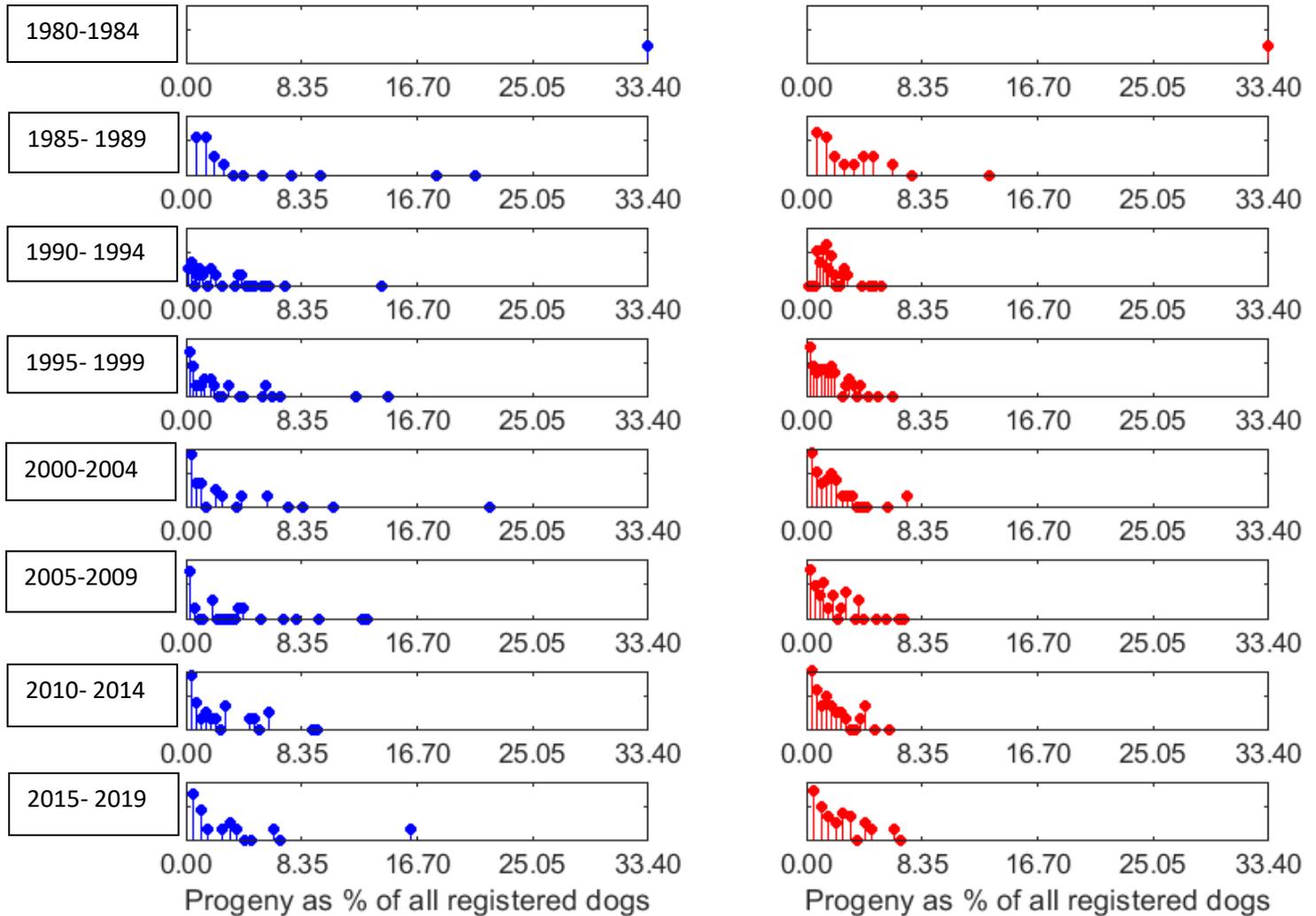


Figure 8: Distribution of the number of progeny per sire (blue) and per dam (red) over 5-year blocks (1980-4 top, 2010-14 bottom). Vertical axis is a logarithmic scale.

CURRENT RESEARCH

The breed are not currently involved in any research projects.

PRIORITIES

Correspondence between the breed representatives and the Kennel Club was undertaken in August 2020 to discuss the evidence base of the BHCP and agree the priority issues for the health of the breed. The group agreed from the evidence base that the priorities for the Polish Lowland Sheepdog were:

- Skin conditions (ears & paws)
- Diabetes
- Thyroid problems
- Central progressive retinal atrophy (CPRA)

ACTION PLAN

Following the correspondence between the Kennel Club and the breed regarding the evidence base of the Breed Health & Conservation Plans, the following actions were agreed to improve the health of the Polish Lowland Sheepdog. Both partners are expected to begin to action these points prior to the next review.

Breed Club actions include:

- The Breed Clubs to monitor the use of popular sires in the breed.
- The Breed Clubs to run a breed health survey, with the Kennel Club to assist in dissemination.
- The Breed Clubs to consider making a proposal to include routine eye testing as part of the Assured Breeder Scheme.

Kennel Club actions include:

- The Kennel Clubs to develop a piece on the use of popular sires in numerically small breeds.
- The Kennel Club to report back on the feasibility of recording routine thyroid tests on a dog's record.

REFERENCES

- Garncarz, M., Parzeniecka-Jaworska, M., Szalus-Jordanow, O. (2017) Congenital heart defects in dogs: a retrospective study of 301 dogs. *Med Weter* **73(10)**: 651-656
- Gruszczynska, J., Haska, A., Grzegorzolka, B. (2013) Detecting of C295G mutation *T* gene in Polish Lowland Sheepdog. *Scientific Annals of Polish Society of Animal Production* **9(4)**: 9-16
- Haworth, K., Putt, W., Cattanach, B., Breen, M., Binns, M., Lingaas, S., Edwards, Y.H. (2001) Canine homolog of the T-box transcription factor *T*; failure of the protein to bind to its DNA target leads to a short-tail phenotype. *Mammalian Genome* **12**: 212-218
- Indrebo, A., Langeland, M., Juul, H.M., Skogmo, H.K., Rengmark, A.H., Lingaas, F. (2008) A study of inherited short tail and taillessness in Pembroke Welsh Corgi. *Journal of Small Animal Practice* **49**: 220-224
- Kuczynski, L.A., Schwartz, P., Peddle, G., Huang, S., Mai, W., Giger, U. (2012) Goiter with vascular anomalies in a litter of Polish Lowland Sheepdogs *Journal of the American Animal Hospital Association* **48(4)**: 278-283
- Narojek, T., Fiszdon, K., Hanysz, E. (2008) Canine elbow dysplasia in different breeds. *Bull Vet Inst Pulawy* **52**: 169-173
- Sebastian-Marcos, P., Fonfara, S., Borgeat, K., Warren-Smith, C., Casamian-Sorrosal, D. (2019) Anatomical anomalies and variations of main thoracic vessels in dogs: a computed tomography study. *Journal of Veterinary Cardiology* **21**: 57-66