



THE KENNEL CLUB
DOG HEALTH

Breed Health and Conservation Plan



Basset Hound
2017

INTRODUCTION

The Kennel Club launched a dynamic 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 support them in making balanced breeding decisions that make health a priority.

The Breed Health and Conservation Plans take a holistic 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 (Section 1 of the BHCP) 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 Coordinator and breed health committee or representatives if applicable. Priorities are agreed and laid out in Section 2. A collaborative action plan for the health of the breed is then agreed and incorporated as Section 3 of the BHCP. This will be monitored and reviewed.

SECTION 1: EVIDENCE BASE

The Basset Hound is currently a category two breed which indicates that it has Breed Watch points of concern. The breed moved from category three to category two on 1st January 2017 after considerable effort by the Breed Health Coordinator and breed clubs to meet the Kennel Club guidance. The particular points of concern listed for the Basset Hound in Breed Watch are:

- Excessive amounts of loose facial skin with conformational defects of the upper and/or lower eyelids so that the eyelid margins are not in normal contact with the eye when the dog is in its natural pose (e.g. they turn in, or out, or both abnormalities are present). Handlers should be discouraged from pulling skin forward over head and eyes.
- Excessive length of ears
- Hair loss or scarring from previous dermatitis
- Inadequate ground clearance – overly deep body and/or presence of excessive skin
- Incorrect bite
- Significantly overweight
- Signs of dermatitis in skin folds

Demographics

The number of registrations has been dropping quite steadily since a peak in 2006, as shown in Table 1.

Table 1: Number of Basset Hounds registered per year between 2006 and 2016

Year	Number of new registered Basset Hounds	Percentage of breed out of total annual registrations
2006	1495	0.55%
2007	1258	0.47%
2008	1433	0.53%
2009	1031	0.42%
2010	1003	0.39%
2011	912	0.37%
2012	766	0.33%
2013	721	0.32%
2014	572	0.26%
2015	580	0.26%
2016	539	0.24%

The number of Basset Hounds registered by year of birth between 1990 and 2016 are shown in Figure 1. Trend of registrations over year of birth (1980-2014) is +10.43 per year (with a 95% confidence interval of +1.53 to +19.32). [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.]

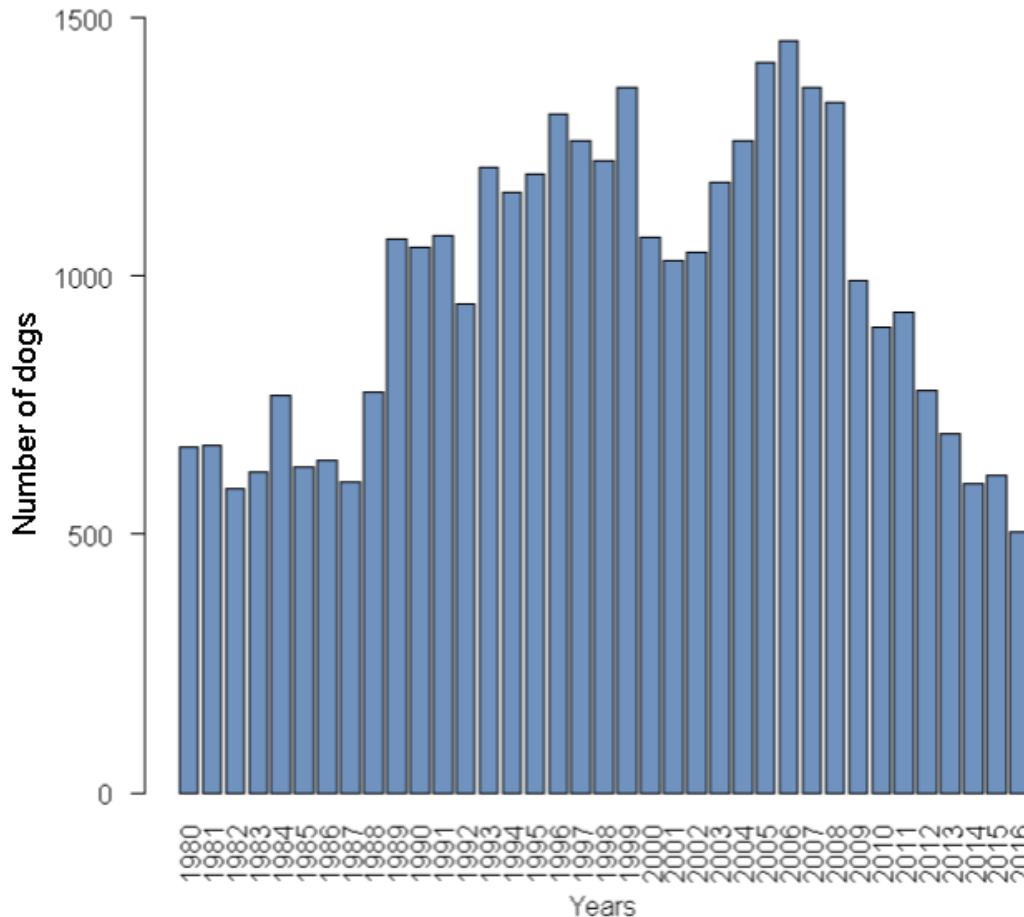


Figure 1: Number of registrations of Basset Hound per year of birth, 1990 - 2016

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 attempted to acknowledge possible limitations of the studies reported, including when the research involved dogs in other countries. Whilst there are often strong links between populations of a breed in different countries, there are also often differences between the populations and issues seen in one country may not be seen (or may have a different prevalence) in another. However, it may also be useful for UK breeders to be aware of conditions occurring in the breed in other countries which have not yet been seen in the UK population, especially given that movement of breeding stock does occur between countries.

It is worth taking into account that although many studies including the Basset Hound have a small sample size and a small number of the breed represented, this breed makes up a numerically small percentage of the overall dog population. For example, in 2016 out of 227,708 Kennel Club registrations only 539 (0.24%) of these registrations were Basset Hounds.

Cardiovascular conditions

No scientific references to conditions in this category could be found for the breed.

Dermatological conditions

Malassezia pachydermatis associated dermatitis: A study undertaken at the Royal Veterinary College (RVC) to establish the factors associated with increased *Malassezia pachydermatis* populations in dogs with pruritic skin disease found that 4.0% of the affected cohort admitted were Basset Hound dogs, with the breed being significantly over-represented, despite having an overall general population of 0.4% (n=1141). This resulted in the breed having a relative risk of 11.7 compared to all dogs presented to the dermatology clinic (Bond et al, 1996). Various contributing factors were established (e.g. environmental allergens, hypothyroidism, hyperadrenocorticism, atopy, flea allergies and idiopathic seborrhoea) but no specific causative factor could be concluded. This paper, in addition to previous studies undertaken in the USA (Plant et al, 1992), concluded that the breed is predisposed to this condition.

Other dermatological conditions: The breed has been described as being at risk of developing black hair follicular dysplasia, pododermatitis, intertrigo (dermatitis in skin folds) and pyoderma (Gough and Thomas, 2010). However no primary references or prevalence data relating to these conditions was found in the literature.

Endocrine conditions

No scientific references to conditions in this category could be found for the breed.

Gastrointestinal conditions

Gastric dilatation-volvulus syndrome (GDV, bloat): GDV is an acute, life-threatening condition featuring rapid accumulation of air in the stomach, malposition of the stomach to a varying degree and a rise in intragastric pressure, frequently leading to the development of cardiogenic shock (Glickman et al, 2000). A study using data from the 2004 Purebred Dog Health Survey investigating the proportion of deaths from different breeds due to gastric dilatation volvulus found 8.5% of deaths in the Basset Hound population (n=142) was due to the condition (Evans et al., 2010). This represented a breed-specific prevalence ratio for death due to GDV of 3.5 (95% C.I. 2.0 to 6.1) indicating an increased risk compared to dogs of other breeds; however 12 other breeds appeared to be at greater risk than the Basset Hound in this study.

Haematological conditions

Hereditary thrombopathy (Basset Hound thrombopathia): This inherited platelet disorder renders affected dogs at risk of spontaneous haemorrhage and significant blood loss following injury or surgery (Patterson et al, 1989). The mutation responsible for this condition is reported to have been identified at Auburn University, USA, in 2006 and a DNA test for the mutation is marketed, however no papers relating to this could be found.

Hepatic conditions

No scientific references to conditions in this category could be found for the breed.

Immunological conditions

X-linked severe combined immunodeficiency and Mycobacterium avium complex infection are reported in the breed (Gough and Thomas, 2010), however no primary references or prevalence estimates could be found for these conditions.

Musculoskeletal conditions

The Basset Hound is a chondrodystrophic breed (Parker et al, 2009). This means that they have abnormal cartilage and bone growth resulting in characteristic disproportionate dwarfism. This is considered to be a breed characteristic in the Basset Hound and a number of other breeds (including Dachshunds and Corgis) rather than a disease condition.

Elbow dysplasia: The Basset Hound was reported to be at elevated risk of fragmented coronoid process (FCP) and ununited anconeal process (UAP; both forms of elbow dysplasia), with breed-associated odds ratio compared to mixed breeds of 19.5 and 2.7 (95% C.I. 9.9-38.3 and 1.7-2.1) respectively, based on dogs which had attended veterinary teaching hospitals in the USA; however these results were only based on 10 cases and 16 non-cases of FCP and 17 cases and 49 non-cases of UAP in the breed (LaFond et al, 2002).

Panosteitis: The Basset Hound was reported to be at elevated risk of panosteitis, with a breed-associated odds ratio compared to mixed breeds of 3.5 (95% C.I. 2.8-4.3), based on dogs which had attended veterinary teaching hospitals in the USA; this result was based on 122 cases and 238 non-cases in the breed (LaFond et al, 2002).

Patellar luxation: The breed was reported to be at elevated risk of patellar luxation, with a breed-associated odds ratio compared to mixed breeds of 2.0 (95% C.I. 1.2-3.1), based on dogs which had attended veterinary teaching hospitals in the USA; however, this result was based on just 39 cases and 32 non-cases in the breed (LaFond et al, 2002).

Neoplastic conditions

Cutaneous squamous cell carcinomas: A textbook reference was found which listed the Basset Hound as being one of the most commonly affected breeds with this condition (Kahn and Line, 2005). However no primary references or prevalence estimates could be found.

Other neoplastic conditions: textbook references to breed predispositions to anal sac adenocarcinoma, cutaneous squamous cell carcinoma, myxosarcoma, pilomatrixoma and trichoepithelioma have been reported (Gough and Thomas, 2010). However, no primary references or prevalence estimates could be found for the breed.

Neurological conditions

Cervical vertebral malformation ('wobbler' syndrome): A British study investigating the prevalence of wobbler syndrome in different breeds reported 16 cases in the Basset Hound (Lewis, 1992). The paper concluded that the condition most commonly arises in the C2/C3 vertebrae and that younger dogs were more susceptible. Alternatively, a more recent study reported the C4/C5 vertebrae as most frequently affected (94.4% of affected Basset Hounds) – however, only 18 affected Basset Hounds were assessed (De Decker et al, 2012).

Intervertebral disc disease (IVDD): IVDD has long been known to be more common in chondrodystrophic breeds such as the Basset Hound. In such breeds, the condition typically develops around three to seven years of age, with disc degeneration mainly occurring in the cervical (neck) or thoracolumbar spine (Smolders et al, 2012). A study at the RVC established that Basset Hounds had a mean body length to height at withers ratio of 1.40 (standard error 0.03); this ratio placed them as the eighth 'longest' breed in the study. For comparison, the 'longest' breed was the Miniature Long Haired Dachshund with a mean ratio of 1.66 (standard error 0.03). Seven dogs of the breed were admitted to the study and one (14.0%) was diagnosed with intervertebral disc extrusion, giving a probability of a dog of the breed developing the condition of 0.3 to 0.6 (Packer et al, 2013).

Lafora's disease: The breed has been reported to be predisposed to this condition (Gough and Thomas, 2010). However no primary references or prevalence estimates could be found in the scientific literature.

Ocular conditions

Primary closed angle glaucoma (PCAG, PACG, pectinate ligament dysplasia, goniodysgenesis): A British study on the external factors influencing the development of pectinate ligament dysplasia found a prevalence of 73.2% affected Basset Hounds (145 of 198 examined) within their study population (Oliver et al, 2016). Some 34.8% were found to be mildly affected (grade 1), 36.4% moderately affected (grade 2), and 2.0% severely affected (grade 3). A significant positive correlation was established between age and the development of the condition, and a higher proportion of female dogs was found to be affected than males in this study.

Primary open angle glaucoma (POAG): The same research group established that a mutation in the gene *ADAMTS17* results in the development of primary open angle glaucoma in Basset Hound breed (Oliver et al, 2015). All affected dogs were found to be homozygous for the mutation and the remaining clinically unaffected dogs (n=50) were either heterozygous or homozygous for the normal allele. Genotyping was undertaken for 223 Basset Hounds recruited for a separate study which revealed the mutation frequency to be 0.081, and the predicted frequency for affected dogs in the population to be 0.007.

Other ocular conditions: Literature produced by the American College of Veterinary Ophthalmologists (ACVO) for breed ocular predispositions reported the Basset Hound to be susceptible to ectropion, entropion, glaucoma, macroblepharon, distichiasis, nictitans cartilage anomaly/eversion, persistent pupillary membranes, cataract, persistent hyaloid artery and retinal dysplasia (Genetics Committee of the ACVO, 2015).

Throughout 2015, 40 Basset Hounds were examined for ocular disorders. The resultant prevalence data is shown in Table 2 below, alongside that for previous time periods. Overall, 70.0% of Basset Hounds examined in 2015 had normal eyes. However, it is important to note that this data is based on a small sample (n=40) and from dogs based in the United States.

Table 2: ACVO examination results for Basset Hounds, 2000 - 2015

Disease Category/Name	Percentage of Dogs Affected		
	2000-2009 (n=919)	2010- 2014 (n=272)	2015 (n=40)
Eyelids			
Ectropion	9.2%	3.3%	10.0%
Entropion	1.1%	2.6%	2.5%
Distichiasis	1.2%	2.6%	2.5%
Nasolacrimal			
Keratoconjunctivitis sicca	0.1%	0.4%	5.0%
Nictitans			
Third eyelid cartilage anomaly	0.8%	2.9%	5.0%
Cornea			
Corneal endothelial degeneration	0.1%	0.0%	2.5%
Uvea			
Persistent pupillary membranes (iris to iris)	3.4%	1.8%	2.5%
Lens			
Cataracts (significance unknown)	3.3%	4.4%	2.5%
Punctate cataract (posterior cortex)	0.7%	0.4%	2.5%
Punctate cataract (equatorial cortex)	0.0%	1.5%	2.5%
Punctate cataract (nucleus)	0.1%	0.0%	2.5%
Incipient cataract (posterior cortex)	0.5%	0.4%	2.5%
Incipient cataract (nucleus)	0.0%	0.4%	2.5%
Incomplete cataract (nucleus)	0.0%	0.0%	5.0%
Incomplete cataract (capsular)	0.0%	0.0%	2.5%

Reproductive conditions

Persistent Müllerian Duct Syndrome: This condition has been reported in the Basset Hound in continental Europe but the causative mutation has not been found and prevalence estimates were not reported (Meyers-Wallen, 2012).

Respiratory conditions

No scientific references to conditions in this category could be found for the breed.

Urological conditions

Cysteine urolithiasis: The Basset Hound was reported to be at risk of cysteine urolithiasis, based on uroliths submitted to the Minnesota Urolith Center in America between 1981 and 1997 (Osborne et al, 1999). However, no prevalence estimates could be found in the literature.

Purebred/pedigree dog health survey results

2004 Morbidity results: Health information was collected for 226 live Basset Hounds of which 109 (48%) were healthy and 117 (52%) had at least one reported health condition. The top categories of diagnosis were dermatologic (17.9%, 45 of 251 reported conditions), reproductive (13.5%, 34 of 251 reported conditions), musculoskeletal (11.2%, 28 of 251 reported conditions) and gastrointestinal (8.4%, 21 of 251 reported conditions). The most frequently reported specific conditions were false pregnancy (10.8% prevalence, 14 cases in the 130 female Basset Hound participants), pruritus (itchy skin; 6.7% prevalence, 15 cases), otitis externa (6.2% prevalence, 14 cases), food allergy (4.9% prevalence, 11 cases), fungal skin infection (4.9% prevalence, 11 cases) and heart murmur (4.9% prevalence, 11 cases).

2004 Mortality results: A total of 142 deaths were reported for the breed. The median age at death for Basset Hounds 11 years and 4 months (min = 3 months, max = 16 years and 8 months). The most frequently reported causes of death by organ system or category were cancer (31.0%, 44 of 142 deaths), old age (13.4%, 19 of 142 deaths), gastrointestinal (11.3%, 16 of 142 deaths), cardiac (7.7%, 11 of 142 deaths) and neurological (5.6%, 8 of 142 deaths). The three most frequently reported specific causes of death were cancer – type unspecified (31.0%, 44 of 142 deaths), gastric dilatation/volvulus (11.3%, 16 of 142 deaths) and heart failure/heart attack (7.7%, 11 of 142 deaths).

2014 Morbidity results: Health information was collected for 120 live Basset Hounds of which 55 (45.8%) had reported no conditions and 65 (54.2%) reported affected by at least one condition. The most frequently reported specific conditions were skin (cutaneous) cyst (9.56%, 13 of 136 conditions), lipoma (8.09%, 11 of 136 conditions), hypersensitivity (allergic) skin disorder (7.35%, 10 of 136 conditions) and chronic itching (6.62%, 9 of 136 conditions). Regarding other conditions mentioned in the literature review above, the prevalence of Basset Hounds affected by pyoderma to be 3.31% and for intertrigo 4.13%,

2014 Mortality results: A total of 14 deaths were reported for the breed. The range of death for Basset Hounds was 7 – 14 years. The most frequently reported causes of death were cancer – unspecified, cardiomyopathy, old age, old age combinations, aggression and GDV.

VetCompass results

No VetCompass data relating to the Basset Hound were available.

Insurance data

UK Agria data

Insurance data were available for dogs insured with Agria UK. It was difficult to determine the underlying population at risk for these conditions so prevalence estimates could not be calculated for these conditions, nevertheless the number of settlements due to particular conditions provides useful information about the relative frequency of these conditions. Data relating to two different types of policies were supplied. Full policies are available to dogs of any age. Free policies are available to breeders of Kennel Club registered puppies and cover starts from the time the puppy is collected by the new owner; cover under free policies lasts for five weeks from this time. It can be assumed that settlements under full policies, as shown in Table 3, refer to dogs outside of the initial five week free period; settlements under free policies, shown in Table 4, will have occurred in the five week free period and will therefore relate to young puppies. It is possible that one dog could have more than one settlement for a condition within the 12-month period shown.

Table 3: Top 10 conditions and number of settlements for each condition between 1st August 2016 and 31st July 2017 for Basset Hounds insured on full policies with Agria UK

Condition	Number of settlements
Atopy [§]	21
Chronic otitis externa	13
Acute pancreatitis	12
Corneal ulcer (non-traumatic)	12
Skin allergy [§]	11
Idiopathic epilepsy	11
Vomiting	11
Osteoarthritis/degenerative joint disease	9
Chronic inflammatory disease – stomach/intestine	9
Infection or inflammatory disorders -skin	8

[§] N.B. - Allergy is any exaggerated immune response to a foreign antigen regardless of mechanism. A dog can be allergic without being atopic. Atopy is a genetic predisposition to an exaggerated Immunoglobulin E (IgE)-mediated immune response to allergens in the environment. The treatment of atopy will be different to the treatment of non-atopic allergy.

Table 4: Conditions and number of settlements for each condition between 1st August 2016 and 31st July 2017 for Basset Hounds insured on free (puppy) policies with Agria UK

Condition	Number of settlements
Acute gastroenteritis	2
Diarrhoea	2
Vomiting and diarrhoea	1
Trauma/foreign body – upper airways	1
Dermoid cyst	1
Foreign body – outer ear/pinna	1

Swedish morbidity and mortality insurance data were also available from Agria for the Basset Hound. Reported rates are based on dog-years-at-risk (DYAR) which take into account the actual time each dog was insured during the period (2006-2011). The number of DYAR for the Basset Hound in Sweden during this period was less than 200, so these results should be interpreted with caution.

Swedish Agria insurance morbidity data

The most common specific causes of veterinary care episodes (VCEs) for Agria-insured Basset Hounds in Sweden between 2006 and 2011 are shown in Figure 2. The top five specific causes of VCEs were vomiting/diarrhoea/gastroenteritis, dermatitis/pyoderma/folliculitis, otitis, skin tumours and pyometra/endometritis.

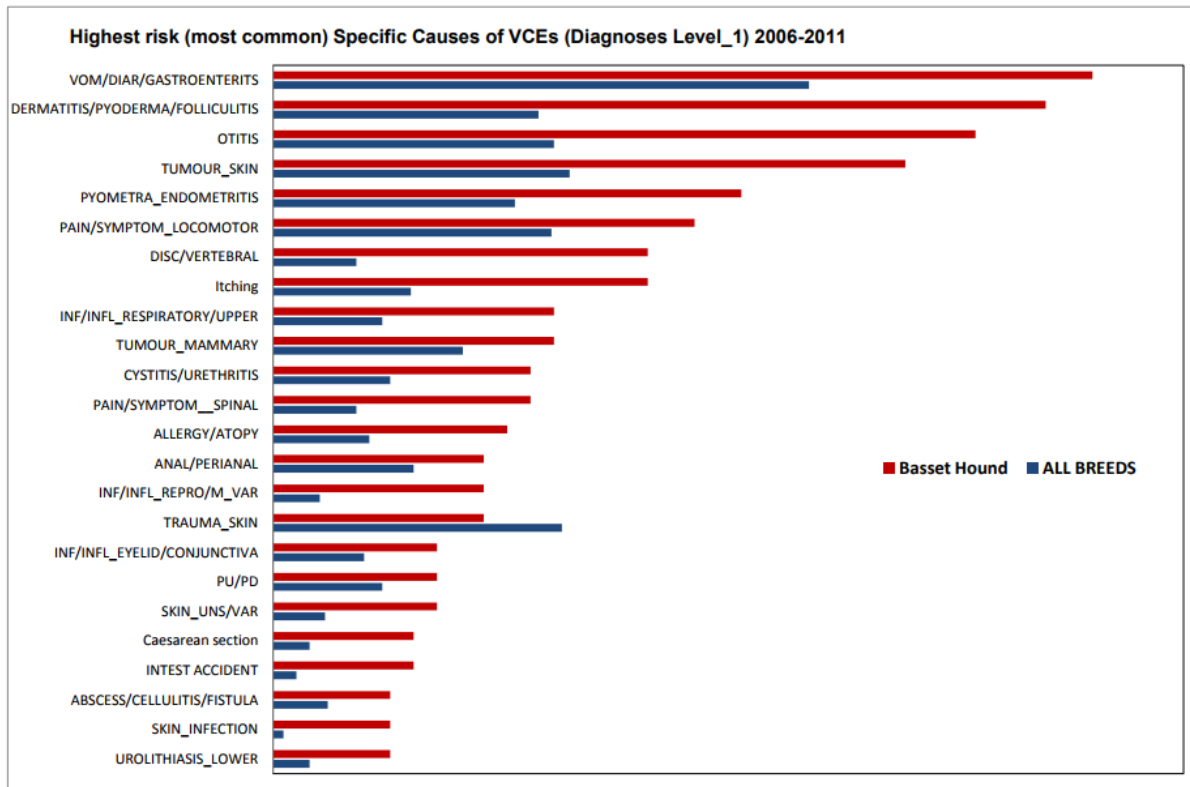


Figure 2: The most common specific causes of VCEs for the Basset Hound compared to all breeds in Sweden between 2006 and 2011, from Swedish Agria insurance data.

Swedish Agria insurance mortality data

Median age at death for Basset Hounds from Swedish Agria insurance data was 6.4 years for males and 7.8 years for females. The most common cause of death was disc/vertebral, and the risk of this was much higher for Basset Hounds than the all-breed average.

Breed-specific health surveys

The Basset Hound Health Group sent out a health survey in 2014 and received a total of 914 usable forms. The dogs involved consisted of 410 (45%) dogs and 504 (55%) bitches, with a range of age from four months – 17 years 4 months. The study also included data from 55 deceased dogs.

Cancer

Some 3.83% of respondents recorded cancer in their dogs (n = 35), the specific conditions reported are shown in Table 5.

Table 5: Cancers reported and their prevalence in the 2014 Basset Hound Health Group survey

Condition	Percentage
Lymphoma	0.76%
Mammary tumour	0.76%
Mass cell tumour	0.66%
Haemangiosarcoma	0.55%
Melanoma	0.44%
Bone tumour	0.22%
Seminoma	0.11%
Bowel	0.11%
Pancreatic	0.11%
Synovial Cell sarcoma	0.11%
Total	3.83%

Ocular

Some 5.80% of dogs recorded eye problems (n = 53). The prevalence data for different eye conditions is shown in Table 6. Age of the dogs in which these conditions were reported is shown in Figure 3.

Table 6: Eye conditions reported and their prevalence in the 2014 Basset Hound Health Group survey

Condition	Percentage
Cherry Eye	2.73%
Entropion	1.42%
Ectropion	0.33%
Glaucoma	0.66%
Blue Eyes	0.44%
Juvenile Cataract	0.22%
Conjunctivitis	0.33%
Eye Infection	0.44%
Watery eye	0.44%
Red Itchy eye	0.33%
Cloudy eye	0.33%
Cataract	0.22%
Dry eye	0.22%
Dermoid cyst	0.22%
Blocked tear ducts	0.22%
Endothelial corneal dystrophy	0.11%
Retinal atrophy	0.11%
Corneal oedema	0.11%
Corneal ulcers	0.11%
Total	8.99%

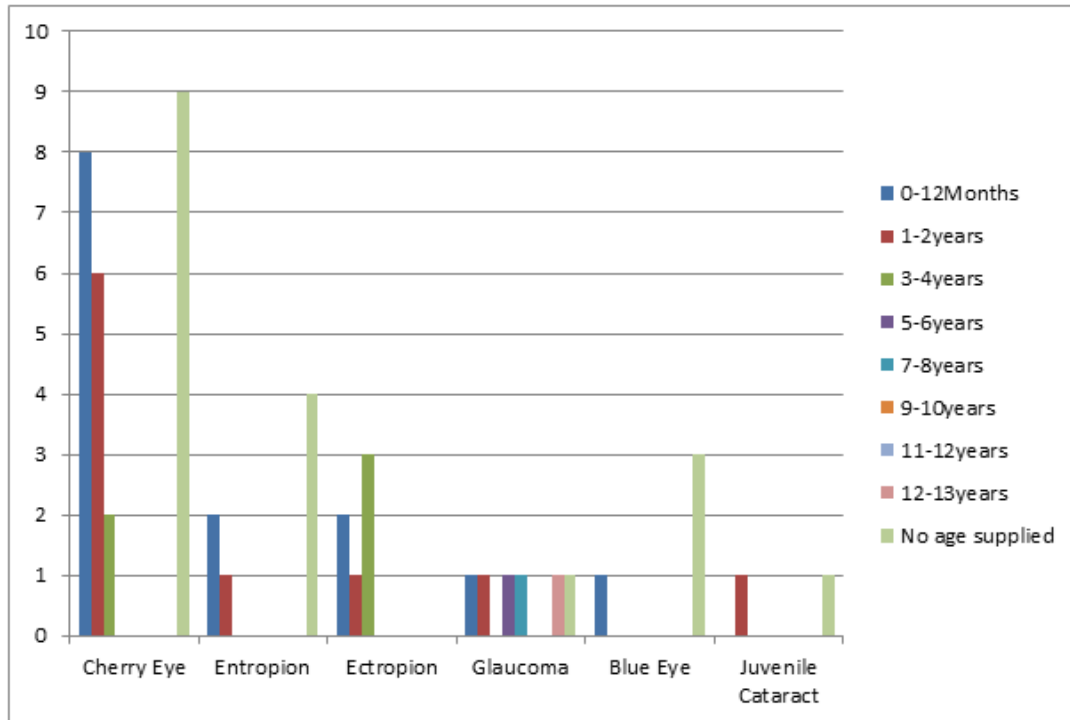


Figure 3: Age of Basset Hounds reported to have experienced particular ocular conditions in the 2014 Basset Hound Health Group survey

Conformation

A total of 17.18% of dogs (n = 157) reported problems with conformation. The breakdown for individual conditions is shown in Table 7. Age of the dogs in which these conditions were reported is shown in Figure 4.

Table 7: Conformation-linked conditions and their prevalence in the 2014 Basset Hound Health Group survey

Condition	Percentage
Lameness/Limping	8.21%
Back problems	3.72%
Hip Dysplasia (HD)	0.98%
Elbow Dysplasia (ED)	2.63%
Panosteitis	1.64%
Luxating Patella	0.22%
Wobblers Syndrome	0.22%
Weak in front paws	0.11%
Trips over feet	0.11%
Pulled muscle	0.11%
Front limbs turn out excessively	0.11%
Minor kink in tail	0.11%
Total	18.17%

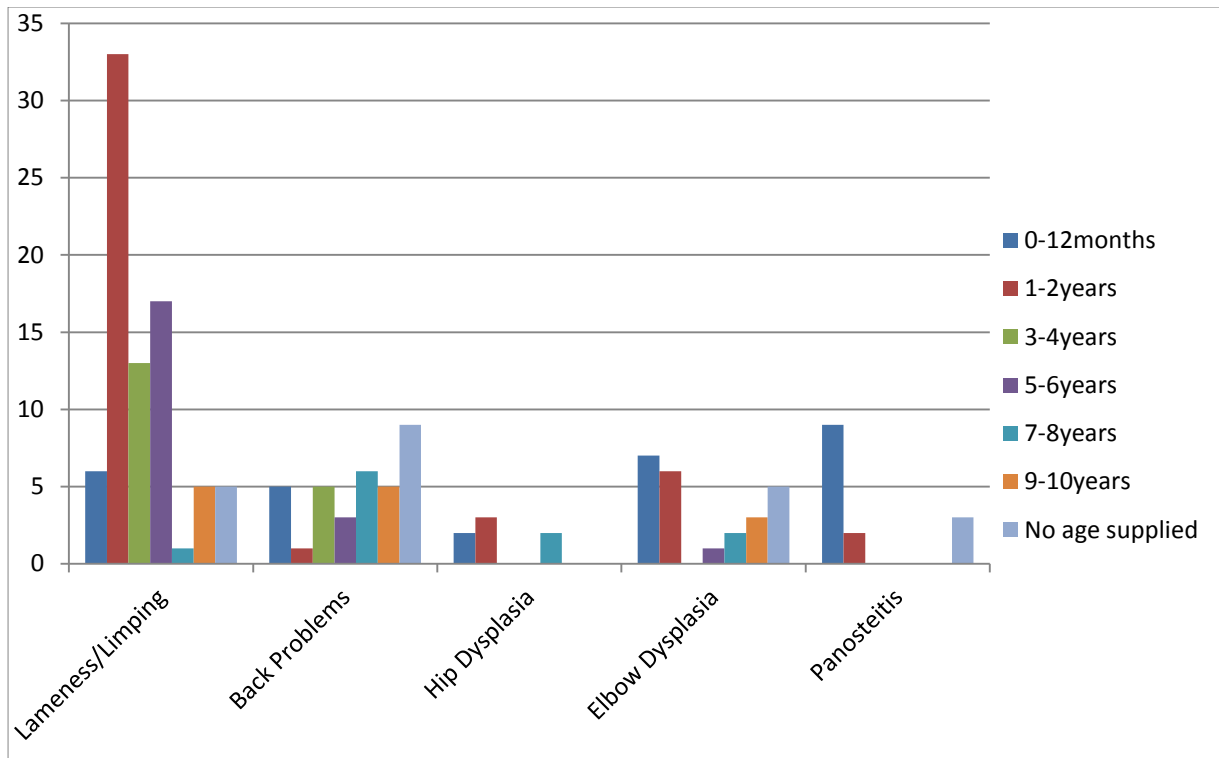


Figure 4: Age of Basset Hounds reported to have experienced particular conformation-linked conditions in the 2014 Basset Hound Health Group survey

Note: Of the above, Lameness/Limping/HD/ED/Panosteitis were mostly diagnosed within the first 24 months (for clarification purposes 24 months is considered to be the approximate/estimated age when the joints and bones reach full maturity in the Basset Hound and the conditions stated may easily be misidentified). The majority of owners chose to rest and restrict their hounds and found that the problem resolved itself completely, without medical intervention. In the graph above, approximately half of the lameness and limping reported in the age groups 3-4 and 5-6 are attributable to diagnosed back, HD or ED issues and are therefore declared in ALL.

Visual health check reports/clinical reports/judges' health monitoring

As a category two breed, judges' health monitoring forms are mandatory. The points of concern reported are shown below in Table 8.

Table 8: Percentage of Basset Hounds exhibited at Dog shows with points of concern for 2014, 2015 and 2016.

Point of concern	2014	2015	2016
Incorrect bite	2.86%	2.34%	0.70%
Significantly overweight	0.42%	1.11%	0.93%
Excessive facial skin with eyelid defects	1.01%	0.33%	1.05%
Signs of dermatitis in skin folds	0.00%	0.44%	0.12%
Inadequate ground clearance and presence of excess skin	0.74%	1.89%	0.93%
Hair loss or scarring from previous dermatitis	0.10%	0.00%	0.12%
Excessive length of ears	0.10%	0.22%	0.00%
Unsound movement	0.31%	0.44%	0.00%
Total dogs shown	944	960	861

Breed Club health activities

The breed has a health committee/group/council, an active Breed Health Coordinator and a dedicated breed health website. The considerable efforts the breed has been making towards improving the health of the breed are reflected in its recent move from category three to category two in Breed Watch.

In 2013 the Basset Hounds Health Group launched a Health Award Scheme, with bronze, silver and gold levels.

The bronze level certificate is designed for young Basset Hounds (aged 6 months or older) to undergo a basic health assessment. The health assessment form is self-explanatory, and requires a veterinary surgeon to comment on:

1. Basic sounding with a stethoscope
2. Visual/auditory assessment of the dogs breathing
3. Visual assessment of the Nostrils, Skin, Ear Canals.
4. Basic clinical assessment of the Eyes.
5. Establish hearing or not
6. Tail, Testes & Temperament
7. General comments

The silver level certificate is given to Basset Hounds which have obtained their bronze level certificate and have undergone a KC/BVA/ISDS Gonioscopy Test, regardless of the result.

The gold level certificate requires dogs to have obtained their bronze and silver level certificates and to be KC/BVA/ISDS Gonioscopy unaffected.

More information is available here:

<http://www.bassetsrus.co.uk/Health%20Certificates%20VAF%202015.pdf>

BHC annual report

The Breed Health Coordinator's Annual Health Report 2016 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 problems, 2 eye problems, 3 cancer. In terms of what the breed has done in the last year to help tackle these listed health and welfare concerns, for eye problems the breed clubs have been actively supporting and involved with the research undertaken at the Animal Health Trust; with gonioscopy testing in conjunction with James Oliver; and continue to monitor and encourage owners to follow the breed's health scheme. In the 2017 Annual Health Report, the top three conditions remained the same. An additional action point had been to incorporate the POAG DNA test into the health scheme from 1st January 2019.

DNA test results

There are now four DNA tests available for Basset Hounds, Basset thrombopathia, X-linked severe combined immunodeficiency, Lafora's disease and POAG. The results of these tests are not currently recorded by the Kennel Club. DNA test results are only recorded for Official Kennel Club DNA Testing Schemes which involve collaboration between the Kennel Club, the breed clubs and the DNA testing facilities.

The AHT have provided a breakdown of POAG DNA test results received so far, shown in Table 9.

Table 9: DNA test results for POAG for Bassetts tested at the AHT up to 04/12/17

Country	Normal	Carrier	Affected	Total
Denmark	27	11	0	38
Finland	4	0	0	4
Germany	20	0	0	20
Norway	7	0	0	7
United Kingdom	4	2	0	6
Total	62	13	0	75

Canine Health Scheme results and EBVs

Under the Kennel Club Assured Breeder Scheme it is required that Basset Hounds undergo gonioscopy to detect PCAG and recommended that they participate in the British Veterinary Association (BVA)/Kennel Club (KC) Elbow Dysplasia Scheme.

Estimated breeding values (EBVs) are currently only available for breeds with large numbers of dogs with hip and elbow scores for the respective EBV.

HIPS

Only four Basset Hounds have been hip scored as part of the BVA/KC Hip Dysplasia scheme in the 15 years to 2016, and the median hip score received was 12.5 (range 10-33).

ELBOWS

Only six Basset Hounds have been elbow scored as part of the BVA/KC Elbow Dysplasia Scheme since the scheme launched in 1998, which is surprising given that it is an ABS recommendation; the scores received are shown in Table 9 below.

Table 9: Elbow scores and number of dogs receiving those scores since 1998 for the Basset Hound

Elbow score	Number of dogs
0	1
1	1
2	4
3	0

EYES

Until this year, the Basset Hound has been on Schedule A of the BVA/KC/International Sheep Dog Society (ISDS) Eye Scheme for primary closed angle glaucoma/pectinate ligament dysplasia only. Schedule A 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. The results of the past five years of examinations are shown in Table 8 below.

Table 8: Number of Basset Hounds which underwent gonioscopy and their results

Year	Number examined	Number affected	Percentage affected
2012	58	8	13.8%
2013	43	10	23.3%
2014	70	5	7.1%
2015	26	0	0
2016	39	6	15.4%

The BVA also records 'sightings', in which non-Schedule A conditions are recorded for dogs which have participated in the BVA/KC/ISDS eye scheme. The following information was received relating to Basset Hounds:

- In 2012, two Basset Hounds were reported to have entropion
- In 2013, five Basset Hounds were reported to have entropion, one was reported to have persistent hyperplastic primary vitreous, one was reported to have a nuclear cataract and one was reported to have macropalpebral fissure
- There were no sightings reported for the Basset Hound in 2014
- In 2015, one Basset Hound was reported to have cataract (other)
- In 2016, two Basset Hounds were reported to have ectropion, one was reported to have entropion and one was reported to have corneal lipid deposition

The BVA/KC/ISDS Eye Panel Working Party decided that the Basset Hound should move to Schedule A for Primary Open Angle Glaucoma (POAG) under the Eye Scheme from 1st July 2017. Breeds move to Schedule A (indicating that the condition is inherited in the breed) based on scientific evidence including a prevalence of at least 1% over a minimum three-year period and/or peer-reviewed scientific literature. Recent research, described above in the literature review, revealed a higher than expected prevalence of POAG in the Basset Hound and clear evidence that the condition is inherited as an autosomal recessive trait.

Tonometry (measurement of intraocular pressure) and regular examination of breeds at risk when dogs are 3 years of age or older may be helpful, however it is DNA testing for the mutation responsible for the condition that is the essential strategy. Basset Hound which have a DNA test result of clear or carrier for the POAG mutation do not need repeated tonometry, but would still benefit from participating in the Eye Scheme as clinical examination may detect other ocular conditions of relevance.

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 2015, an estimated effective population size of 74.2 was reported (estimated using the rate of inbreeding over the period 1980-2014). The rate of inbreeding has remained relatively steady but is below an effective population size of 100 (inbreeding rate of 0.50% per generation) which results in the rate of loss of genetic diversity in a breed/population increasing dramatically (Food & Agriculture Organisation of the United Nations, "Monitoring animal genetic resources and criteria for prioritization of breeds", 1992).

Annual mean observed inbreeding coefficient (showing loss of genetic diversity) and mean expected inbreeding coefficient (from simulated 'random mating') over the period 1980-2014 are shown in Figure 5. Over this period the rate of inbreeding has remained relatively steady but quite high. For full interpretation see Lewis et al, 2015 <https://cgjournal.biomedcentral.com/articles/10.1186/s40575-015-0027-4>.

The current annual breed average inbreeding coefficient is 10.3%. This value is calculated each June and represents the average inbreeding coefficient of all Basset Hounds registered between January and December of the previous year i.e. in 2016.

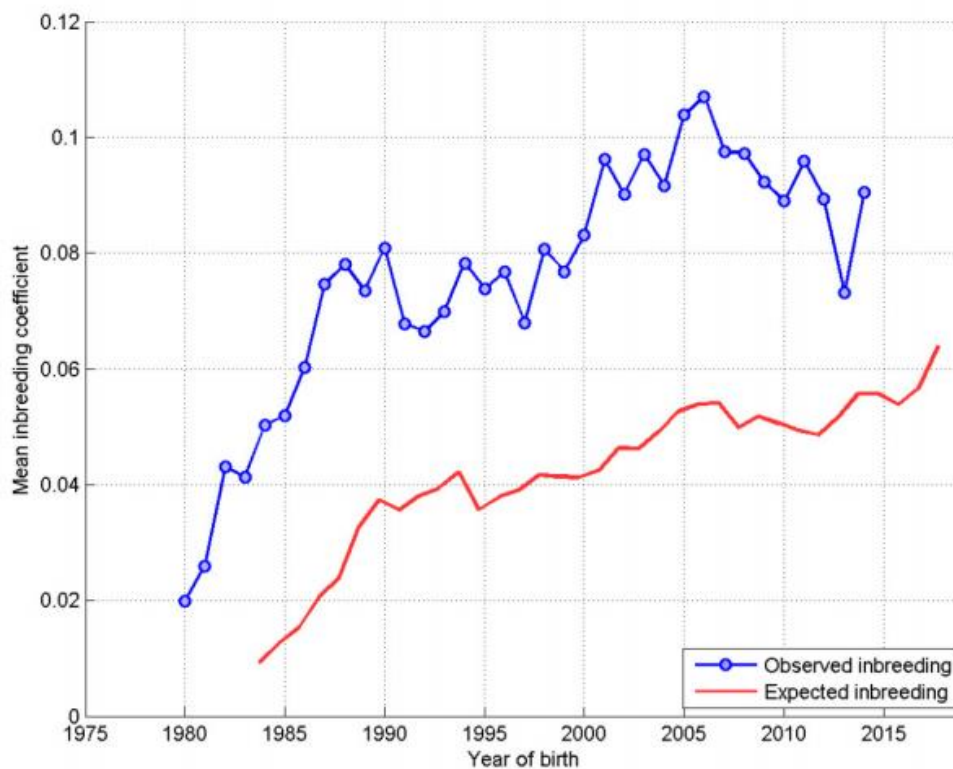


Figure 5: Annual mean observed and expected inbreeding coefficients

Below is a histogram ('tally' distribution) of number of progeny per sire and dam over each of seven 5-year blocks (Figure 6). 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). It appears that the extensive use of popular dogs as sires has eased a little (the 'tail' of the blue distribution shortening in figure 6).

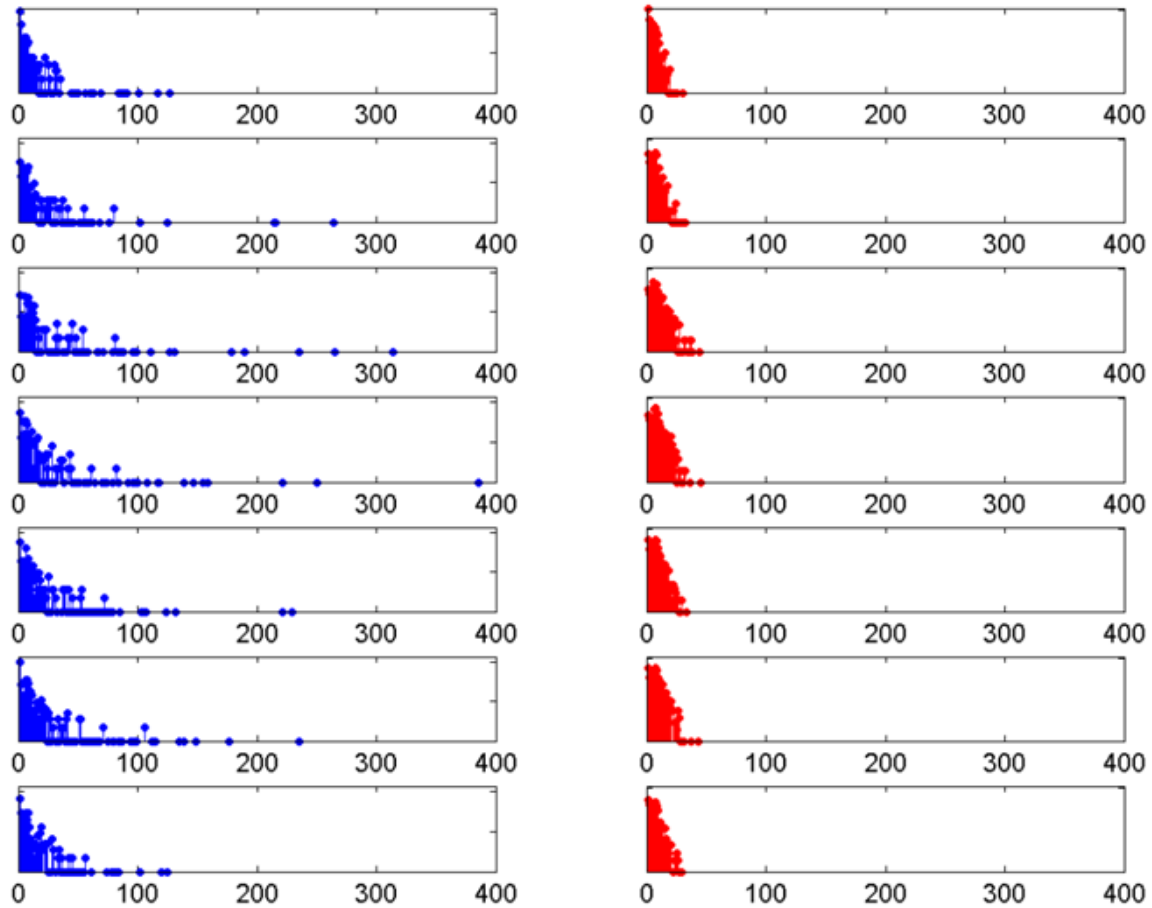


Figure 6: Distribution of progeny per sire (blue) and per dam (red) over 5-year blocks (1980-4 top, 2010-14 bottom). Vertical axis is a logarithmic scale.

Current research projects

The Basset Hound was part of the Animal Health Trust's Give a Dog a Genome project; it is as a result of this that the mutation causing POAG in the breed was identified.

There is ongoing research at the AHT into PCAG.

SECTION 2: PRIORITIES

A meeting was held with the Basset Hound Health Group on 27th November 2017 to discuss Section 1 of the BHCP and agree the priority issues for the health of the breed.

Reports of dermatological conditions in the Basset Hounds in the scientific literature were discussed. *Malassezia pachydermatis* associated dermatitis showed some breed predisposition, and the Basset Hound breed clubs assisted with the 1996 study by Bond et al. There were four additional dermatological conditions with no primary references.

It was noted that several conditions reported in the literature review have not been seen in the UK population, including hereditary thrombopathy. Gastric dilatation volvulus syndrome (GDV) had been noted in the breed, but was felt it has been less common in recent years. It was reported as the second most frequently reported specific cause of death in the 2004 mortality study.

Musculoskeletal conditions were discussed, including elbow dysplasia, panosteitis and patellar luxation. Concern was raised over possible misdiagnosis of elbow dysplasia. Construction of the Basset was discussed and the need for judges to understand the correct angulation, which may have an impact on the elbow joint.

Cancer was noted as a concern in the Basset Hound health survey, however, not the specific types noted in the literature review. Again, this may be due to limited amount of information and lack of post mortem examinations and biopsies being conducted.

Three neurological conditions, cervical vertebral malformation ('wobblers' syndrome), intervertebral disc disease (IVDD) and Lafora's disease, were discussed. Cervical vertebral malformation ('wobblers' syndrome) had been seen in the breed in the 1980s with a limited number of cases noted and actively removed from any breeding programme. The group considered that it was not currently seen in the UK population. There was awareness of some cases of IVDD, which was supported by back problems being reported in 3.72% of dogs in the Basset Hound health survey. There have only been three confirmed cases of Lafora's disease in the breed in the UK, two of which were related. The condition is being monitored, however, it is not thought to be wide spread.

There was discussion over ocular conditions with particular emphasis on PCAG and POAG.

The population analysis, which was published in 2015, was discussed. The 'popular sire' effect, which is known to be a significant cause of loss of genetic diversity, was mentioned with reference to Figure 5. This provides evidence of some popular sires in the breed.

The group agreed from the information provided and their own experience that genetic diversity, eye conditions, skin conditions and musculoskeletal conditions, including back conditions, were the priorities for the Basset Hound.

SECTION 3: ACTION PLAN

- The Basset Hound Health Group to continue encouraging participation in the Basset Hound Health Group Health Award Scheme
- The Basset Hound breed clubs to agree amended wording on front conformation of the Basset for the breed standard, to be sent to the Breed Standards and Stud Book committee
- The Basset Hound Health Group to continue to participate in the PCAG research at the AHT
- The Kennel Club to provide further information for judges via the upcoming Breed Watch illustrated guide, to assist with specific judges' education relating to eye conformation
- The Kennel Club to assist the Basset Hound Health Group with a survey on elbow dysplasia
- The Kennel Club to investigate opportunities for research into GDV/bloat in the breed
- The Kennel Club to monitor the outcomes of the IVDD study at the University of California Davis
- The Kennel Club will review progress with the Basset Hound Health Group in November 2018

References

Bond, R., Ferguson, E.A., Curtis, C.F., Craig, J.M., and Lloyd, D.H. (1996) Factors associated with elevated cutaneous *Malassezia pachydermatis* populations in dogs with pruritic skin disease. *Journal of Small Animal Practice* **37**, 103-107

British Veterinary Association/Kennel Club - Hip Dysplasia Scheme: Breed Specific Statistics. [Accessed: 05/10/2016]

Evans, K.M. and Adams, V.J. (2010) Mortality and morbidity due to gastric dilatation-volvulus syndrome in pedigree dogs in the UK. *Journal of Small Animal Practice* **51**, 376-381

Genetics Committee of the American College of Veterinary Ophthalmologists (2015) Ocular disorders presumed to be inherited in purebred dogs, Eighth Edition
<http://www.acvo.org/new/diplomates/resources/ACVOBlueBook20158thEdition.pdf>
[Accessed 30/06/2017]

Glickman, L.T., Glickman N.W., Schellenberg, D.B., Raghavan, M. and Lee, T.L. (2000) Incidence of and breed-related risk factors for gastric dilatation-volvulus in dogs. *Journal of the American Veterinary Medical Association* **216** (1): 40-45

Gough, A. and Thomas, A. (2010) Breed dispositions to disease in dogs and cats. Second Edition. Blackwell Publishing Ltd

Kahn, C.M. and Line, S., Editors (2005) The Merck Veterinary Manual. Ninth Edition. Merck, New Jersey, USA

LaFond, E., Breur, G.J. & Austin, C.C. (2002) Breed Susceptibility for Developmental Orthopedic Diseases in Dogs. *Journal of the American Animal Hospital Association* **38**: 467-477

Lewis, D. (1992) Cervical spondylomyelopathy ('wobbler syndrome') in dogs. *In Practice* **14**: 125-130

Meyers-Wallen, V.N. (2012) Gonadal and sex differentiation abnormalities of dogs and cats. *Sexual Development* **6**: 46-60

Oliver, J.A., Forman, O.P., Pettitt, L. and Mellersh, C.S. (2015) Two Independent Mutations in ADAMTS17 Are Associated with Primary Open Angle Glaucoma in the Basset Hound and Basset Fauve de Bretagne Breeds of Dog. *PLOSone* **10** (10)

Oliver, J.A.C., Ekiri, A. and Mellersh, C.S. (2016) Prevalence of pectinate ligament dysplasia and associations with age, sex and intraocular pressure in the Basset hound, Flatcoated retriever and Dandie Dinmont terrier. *Canine Genetics and Epidemiology* **3**: 1

Osborne, C.A., Lulich, J.P., Polzin, D.J., Sanderson, S.L., Koeler, L.A., Ulrich, L.K., Bird, K.A., Swanson, L.L., Pederson, L.A. and Sudo, S.Z. (1999) Analysis of 77,000 canine uroliths. Perspectives from the Minnesota Urolith Center. *The Veterinary Clinics of North America: Small Animal Practice* **29** (1): 17-38

Packer, R.M.A., Hendricks, A., Volk, H.A., Shihab, N.K. and Burn, C.C. (2013) How long and low can you go? Effect of conformation on the risk of thoracolumbar intervertebral disc extrusion in domestic dogs. *PLOS ONE* **8**(7): e69650.
doi:10.1371/journal.pone.0069650

Parker, H.G., VonHoldt, B.M., Quignon, P., Margulies, E.H., Shao, S., Mosher, D.S., Spady, T.C., Elkhoulou, A., Cargill, M., Jones, P.G., Maslen, C.L., Acland, G.M., Sutter, N.B., Kuroki, K., Bustamante, C.D., Wayne, R.K., and Ostrander, E.A. (2009) An expressed Fgf4 retrogene is associated with breed-defining chondrodysplasia in domestic dogs. *Science* **325**: 995-998

Patterson, W.R., Estry, D.W., Schwartz, K.A., Borchert, R.D. and Bell, T.G. (1989) Absent platelet aggregation with normal fibrinogen binding in basset hound hereditary thrombopathy. *Thrombosis and Haemostasis* **62**: 1011-1015

Smolders, L.A., Bergknut, N., Grinwis, G.C.M., Hagman, R., Lagerstedt, A.-S., Hazewinkel, H.A.W., Tryfonidou, M.A. and Meij, B.P. (2013) Intervertebral disc degeneration in the dog. Part 2: Chondrodystrophic and non-chondrodystrophic breeds. *The Veterinary Journal* **195**: 292-299