# Breed Health and Conservation Plan

# Japanese Shiba Inu

# 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 Japanese Shiba Inu registered by year of birth between 1990 and 2020 are shown in Figure 1. The trend of registrations over year of birth (1990-2020) was 6.90 per year (with a 95% confidence interval of 4.96 to 8.84), reflecting the increase in the breed's numbers over this time, with a peak in 2015. However, it is worth noting that the number of Japanese Shiba Inus registered per year has never exceeded 500 during the entire period analysed.

[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.]
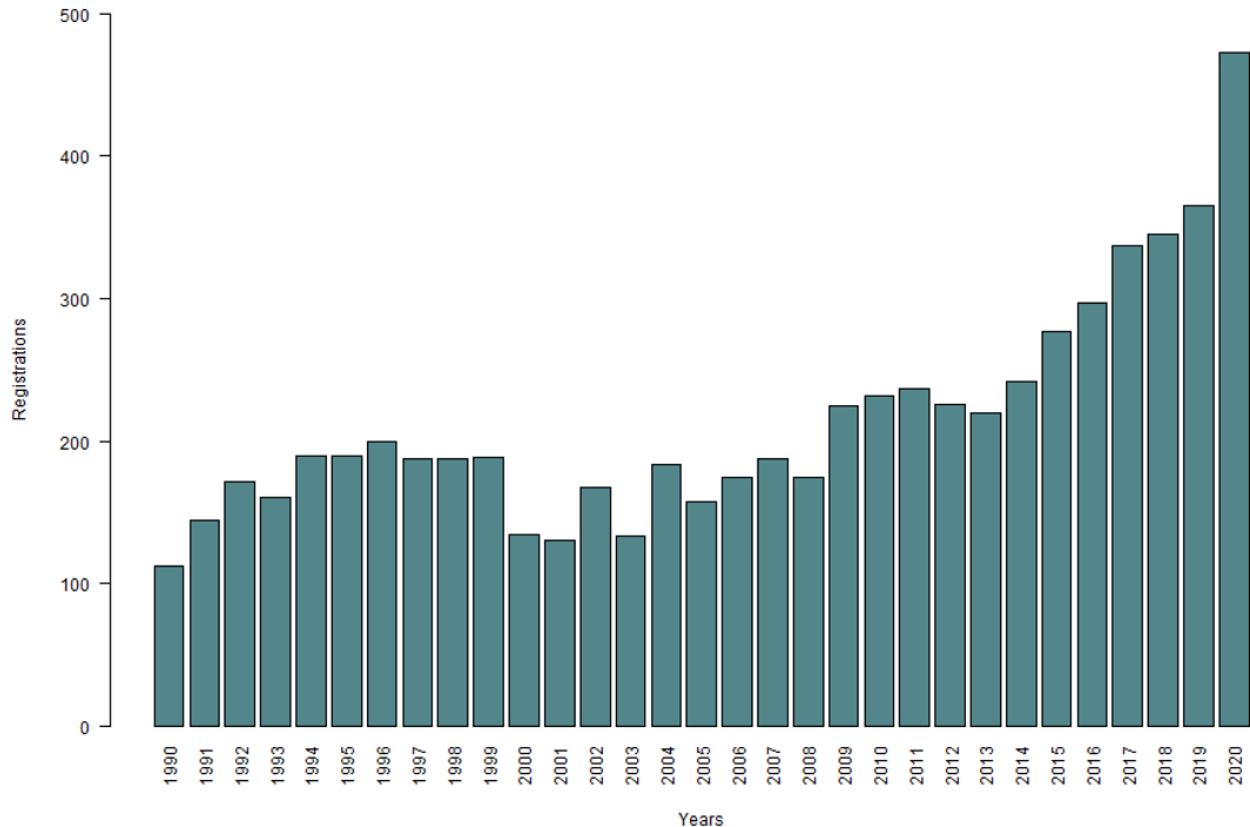
Figure 1: Number of registrations of Japanese Shiba Inus per year of birth, 1990 – 2020.

**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 most recent BHC's Annual Health Report (2020) 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. Glaucoma
2. Gangliosidosis 1 (GM1)
3. Gangliosidosis 2 (GM2)

In terms of what the breed has done in the last year to help tackle these listed health and welfare concerns, the breed has continued to encourage eye testing prior to breeding, has run eye clinics, and in February 2020 also offered a DNA testing station for GM1/GM2 at the breed Championship show. The breed have also implemented a new health survey for GM1/GM2 surveillance within the UK population.

## BREED CLUB HEALTH ACTIVITES

The Japanese Shiba Inu has an active Breed Health Coordinator (BHC), who works collaboratively with the Japanese Shiba Inu Club of Great Britain and the Association of the Japanese Shiba Inu.

A dedicated health website can be found at:

- https://www.shibahealth.co.uk/


## BREED SPECIFIC HEALTH SURVEYS

### Kennel Club Purebred and Pedigree Dog Health Survey Results

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

**2004 Morbidity results**:  Health information was collected for 56 live Japanese Shiba Inu of which 43 (77%) were healthy and 13 (23%) had at least one reported health condition. The top categories of diagnosis were ocular (23.5%, 4 of 17 reported conditions), reproductive (23.5%, 4 of 17 reported conditions), gastrointestinal (17.6%, 3 of 17 reported conditions), aural (5.9%, 1 of 17 reported conditions), and cardiac (5.9%, 1 of 17 reported conditions). The most frequently reported specific conditions were cataracts/ conjunctivitis/ glaucoma/ progressive retinal atrophy (PRA) (23.5% prevalence, 4 cases), infertility (23.5%, 4 cases), colitis/ acute gastroenteritis (17.6% prevalence, 3 cases), heart murmur (grade 4) (5.9% prevalence, 1 case), and otitis externa (5.9% prevalence, 1 case).

**2004 Mortality results**:  A total of three deaths were reported for the Japanese Shiba Inu. The median age at death was seven years (min = four years and six months, max = nine years).  The reported causes of death by organ system or category were endocrine - diabetes mellitus, hepatic - liver disease (unspecified), and poisoning.

**2014 Morbidity results:**  Health information was collected for 52 live Japanese Shiba Inu, of which 43 (82.7%) had no reported conditions and 9 (17.3%) were reported to be affected by one condition. The most frequently reported conditions were cryptorchidism (3.85% prevalence, 2 cases), hypersensitivity (allergic) skin disorder (3.85% prevalence, 2 cases), and patellar luxation/ slipping kneecap (3.85% prevalence, 2 cases).

**2014 Mortality results**: A total of just six deaths were reported for the breed and the range of age at death was five years to 17 years. The most frequently reported cause of death was old age (n=2). The following causes of death were reported just once each: aggression, lymphoma, road traffic accident, and urolithiasis.

*Please note that caution should be taken when drawing meaningful conclusions from these data, given the relatively small number of reports for the breed.*

## 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.

### Behavioural conditions

*Aggression:* The Shiba Inu is a Japanese breed closely related to wolves (Parker et al, 2004). Originally bred for hunting and guarding, they are now more often kept as companion animals. A number of Japanese studies have found that the breed tends to display unfavourable behaviours, in a companion capacity, such as 'aggression to dogs', 'watchdog barking', 'territorial defence', and 'snapping at children' (Takeuchi and Mori, 2006). One study used genomic DNA and a behavioural questionnaire to investigate the relationship between behavioural traits and neuro-transmitter-related genes in 77 Shiba Inus from Japan (Takeuchi et al, 2009). Findings suggested a genetic link between aggressive behaviour and the polymorphism of *c.471T>C* in the *SLC1A2* gene, with a significant association with 'aggression to strangers' (p=0.0006). The authors highlighted that aggression is a complex behaviorual issue as there are several possible contributing factors to consider.

A subsequent questionnaire (completed by 400 Shiba Inu owners) was developed to investigate associations between behavioural traits and directed aggression (owner, child, stranger, dog) (Kaneko et al, 2013). The authors found that 'sociability with humans' negatively correlated with both child and stranger directed aggression (p<0.001) and 'reactivity to stimuli' positively correlated with all four types of directed aggression (p=0.007 - p<0.001). This was supported by a further survey on 505 Shiba Inus from Japan, which replicated the findings of association between behaviour traits (such as 'reactivity to stimuli') and aggression in the breed (Arata et al, 2014).

### Gastrointestinal conditions

*Lymphocytic-plasmacytic enteritis (LPE)/ chronic enteropathy:* LPE is a form of inflammatory bowel disease (IBD), characterised by an overrepresentation of inflammatory cells (lymphocytes and plasma cells) within the wall of the intestine. In a retrospective study of 48 dogs diagnosed with LPE, dogs were classified as either survivors (n=32) or non-survivors (n=16). The Shiba Inu was overrepresented in both the overall population of dogs with LPE (n=9, OR 5.58, p<0.001) and in the non-survivor group (n=6, OR 14.52, p<0.001).

Chronic enteropathy is a gastrointestinal condition, in which the clinical signs are typically chronic diarrhoea, chronic vomiting, and weight loss. A retrospective study investigated chronic enteropathy in 99 affected dogs. Of these dogs, 21% were Shiba Inus (OR: 7.14) suggesting a likely predisposition in the breed (Ohmi et al, 2011). In this study, LPE was the most common cause of chronic enteropathy. The

Shiba Inus showed a poorer prognosis compared to non-Shiba Inus, most of which had severe lesions in the duodenum.

The researchers conducted a subsequent study on 22 Shiba Inus with chronic enteropathy and found 13 (59%) had clonality-positive results on PARR (polymerase chain reaction for antigen receptor rearrangement – a diagnostic test used to determine levels of immune cells) analysis (Ohmi et al, 2017). The median survival time was 48 days in clonality-positive dogs, compared to 271 days in clonality-negative dogs, suggesting that clonality-positivity was associated with a significantly shorter survival time (P=0.036). The researchers noted common clinical and pathogenic features between chronic enteropathy and T-cell (a type of immune cell) intestinal lymphoma, which could explain the breed's poor prognosis and reduced survival time, however further investigation is needed.

**Neoplastic conditions**

*T cell lymphoma:* In 2018, Matsumoto et al identified 276 cases of intestinal T-cell lymphoma across 43 breeds, of which seven breeds had an increased risk of developing the condition including the Japanese Shiba Inu (OR = 4.585, 95% CI 3.194-6.584). The mean age of Japanese Shiba Inus with intestinal T-cell lymphoma was 6.9 years (range 2 – 13 years). As a predisposition to chronic enteropathy has previously been reported in the Japanese Shiba Inu, it was suggested that underlying breed-specific factors may be contributing to the development of intestinal T-cell lymphoma in the breed.

**Neurological conditions**

*Gangliosidosis 1 (GM1)/ Gangliosidosis 2 (GM2):* GM1 is an autosomal recessively inherited lysosomal storage disease. It is a fatal condition caused by a deficiency in an enzyme called lysosomal acid β-galactosidase, which causes a build-up of material in neurological tissues. GM1 was first reported in the Japanese Shiba Inu in 2000 (Yamato et al, 2000). Following this, Yamato et al (2003) described the clinical and clinic-pathological characteristics in 10 homozygous (affected) Shiba Inus with GM1. In this study, the age of onset was five to six months, and the survival period was generally 14 to 15 months. The clinical signs were progressive and included: loss of balance, ataxia, dysmetria (inability to gauge distance), head tremors, generalised muscle spasms, intermittent lameness, lethargy, corneal clouding, and visual defects. The only clinico-pathological characteristic reported was abnormally large vacuoles (holes) in lymphocytes. In another study, Hasegawa et al (2013) found that the corpus callosum (part of the brain) was improperly formed in all cases of juvenile-onset gangliosidoses, and therefore concluded that improper development of the corpus callosum may be an additional indicator for diagnosis of the condition.

Although the prevalence of GM1 in the breed appears to be low, carriers have been reported in northern Japan (Yamato et al, 2008). It is also anticipated that a high prevalence of carriers may in fact be present over the whole of Japan due to additional positive DNA tests found in western Japan. Uddin et al (2013) developed a molecular epidemiology survey, which aimed to investigate the relationship between

regional prevalence and carrier frequency for GM1 in the Japanese Shiba Inu. The survey was completed for 590 clinically unaffected Shiba Inus from Japan, of which 1.02% (6 of 590) were carriers. Several affected (n=23) and carrier dogs were identified in an additional retrospective survey. Pedigree analysis of the affected and carrier dogs identified in the epidemiological and retrospective surveys revealed a close familial relationship.

Although GM1 has been recognised in the Shiba Inu for over 20 years, a paper in 2017 reported the first two cases of GM2 in the breed. Both dogs shared maternal and paternal ancestors, with clinical signs appearing at approximately 12 months of age. DNA sequencing confirmed both dogs were homozygous for a mutation in the gene *HEXB* (Kolicheski et al. 2017).

*Intervertebral disc herniation (IVDH)*: IVDH is a spinal condition caused by a gradual deterioration of the intervertebral discs. Intervertebral discs hold the spine together, give the back its flexibility and protect the spine by cushioning any impact. As dogs get older these discs can degenerate and harden (calcify). The calcification of these discs means they do not absorb shock as effectively and can lead to a slipped disc (disc herniation) and spinal cord compression. A retrospective study of 297 dogs with IVDH in Japan found that Shiba Inus suffered from both cervical IVDH (2.3%, 3 out of 132 cases across all breeds) and thoracolumbar IVDH (2.4%, 4 out of 165 cases across all breeds) (Itoh et al, 2008). Across breeds, males tended to suffer from the condition more than females. The breed's possible predisposition was not analysed, and no further papers could be found to suggest any overrepresentation in the breed.

**Ocular conditions**

*Primary glaucoma/ goniodysgenesis/ pectinate ligament abnormality (PLA):* Primary glaucoma is an inherited condition caused by an abnormality in the pectinate ligament (PL) and iridocorneal angle (ICA), leading to a build-up of pressure in the eye and secondary damage to ocular tissues, causing blindness and pain.

A study investigating the incidence of glaucoma in 1,244 dogs found 127 dogs (162 eyes) of 29 breeds had glaucoma, of which 129 eyes had primary glaucoma and 33 eyes had secondary glaucoma (Kato et al, 2006a). In this study, the Japanese Shiba Inu showed the highest incidence of primary glaucoma (33%, 42 of 127 dogs) suggesting a strong predisposition in the breed.

Glaucoma can be categorised into either primary open angle glaucoma (POAG) or primary angle closed angle glaucoma (PCAG). A study of 114 dogs found that, within Japan, the Shiba Inu exhibited the highest incidence of POAG (Kato, 2006b). In this study, the researchers used dogs presented to the Veterinary Medical Centre at the University of Tokyo between 1998 - 2003 to compare the shape of the PL and the width of the ICA in glaucomatous Shiba Inus (n=46) and non-glaucomatous Shiba Inus (n=68). Changes in both PL and ICA were found in the majority of affected dogs with a statistically significant difference in ICA abnormalities observed between affected and non-affected dogs (p<0.0001). Nevertheless, many of the dogs in the non-glaucomatous group also had narrow or slightly narrow ICA. In dogs with

narrower ICAs, the PLs were thicker. These findings suggest that ICA narrowing and PL thickening are common abnormalities in the breed, and may contribute to the development of glaucoma.

Following this, Kato et al (2007) identified sequence variants in the *myocilin* gene in both Shiba Inus with glaucoma (n=5, all with closed ICA) and Shiba Inus without glaucoma (n=5, three with open and two with closed ICA), suggesting that mutations in the *myocilin* gene were unlikely to play a significant role in the development of PCAG in the breed. However, several mutations in exon 1 may predispose them to an aqueous outflow obstruction leading to the development of glaucoma. More recently, Kanemaki et al (2013) investigated associations between polymorphisms of three candidate genes and glaucoma in the Shiba Inu and found an association with *SRBD1* and glaucoma in the breed.

Given that several genes have been suggested as having a role, it is likely the condition has a complex mode of inheritance. Therefore, currently the best method for breeders to select away from the condition is to undertake regular gonioscopy in their breeding stock. Further information on dogs screened to date can be found on page 13.

## 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 Japanese Shiba Inu. 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 DYAR is equivalent to one whole year of insurance. The number of DYAR for Japanese Shiba Inu in Sweden during this period was between 2,500 and 5,000.

A summary of the data are given below, with the full report available at: https://dogwellnet.com

Specific causes for veterinary care episodes

The most common specific causes of veterinary care episodes (VCEs) for Agria-insured Japanese Shiba Inu in Sweden between 2011 and 2016 are shown in Figure 2. The top five specific causes of VCEs were vomiting/ diarrhoea/ gastroenteritis, pain during locomotion, itching, otitis, and skin trauma.
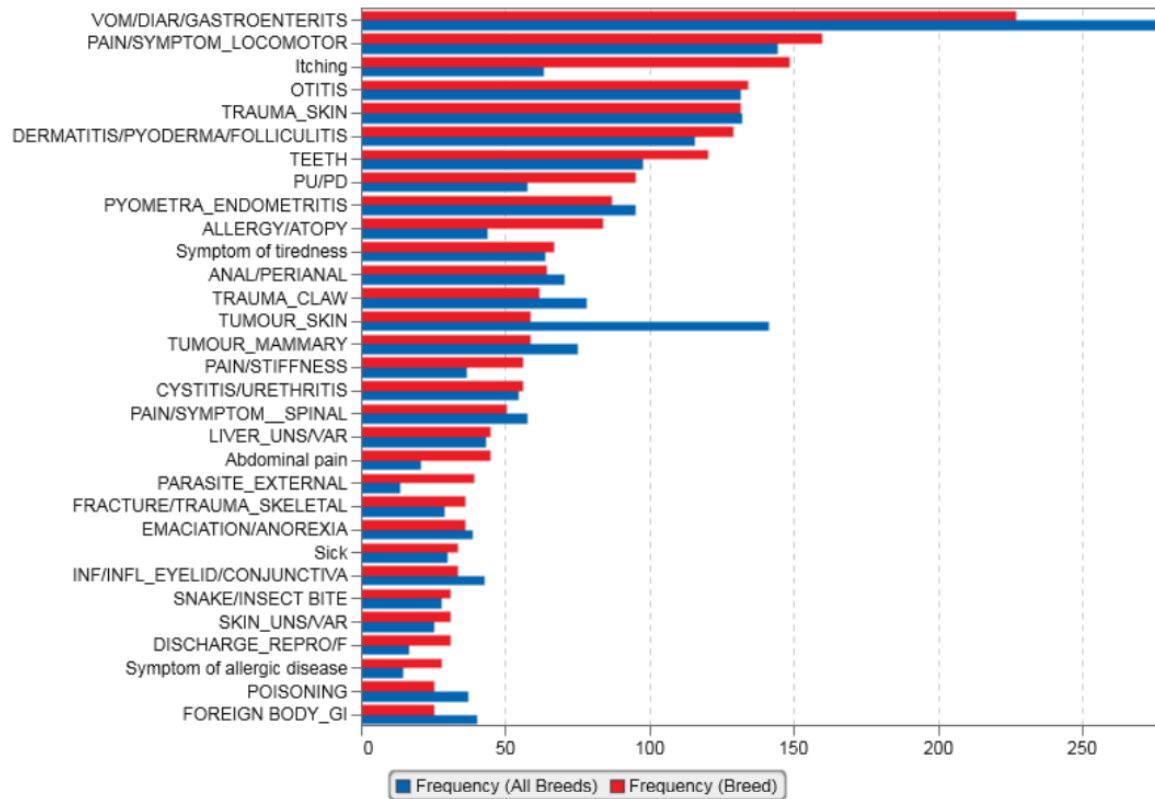


Figure 2: The most common specific causes of VCEs for the Japanese Shiba Inu compared to all breeds in Sweden between 2011 and 2016, from Swedish Agria insurance data.

Relative risk for veterinary care episodes

The specific causes of VCEs ordered by relative risk are shown in Figure 3 for the Japanese Shiba Inu. In this analysis, the top five specific causes of VCEs ordered by relative risk were external parasite, itching, abdominal pain, symptom of allergic disease, and allergy/ atopy.

It is worth noting that with relative risk analysis some less frequently reported conditions may appear with a high relative risk, particularly due to the small dataset.
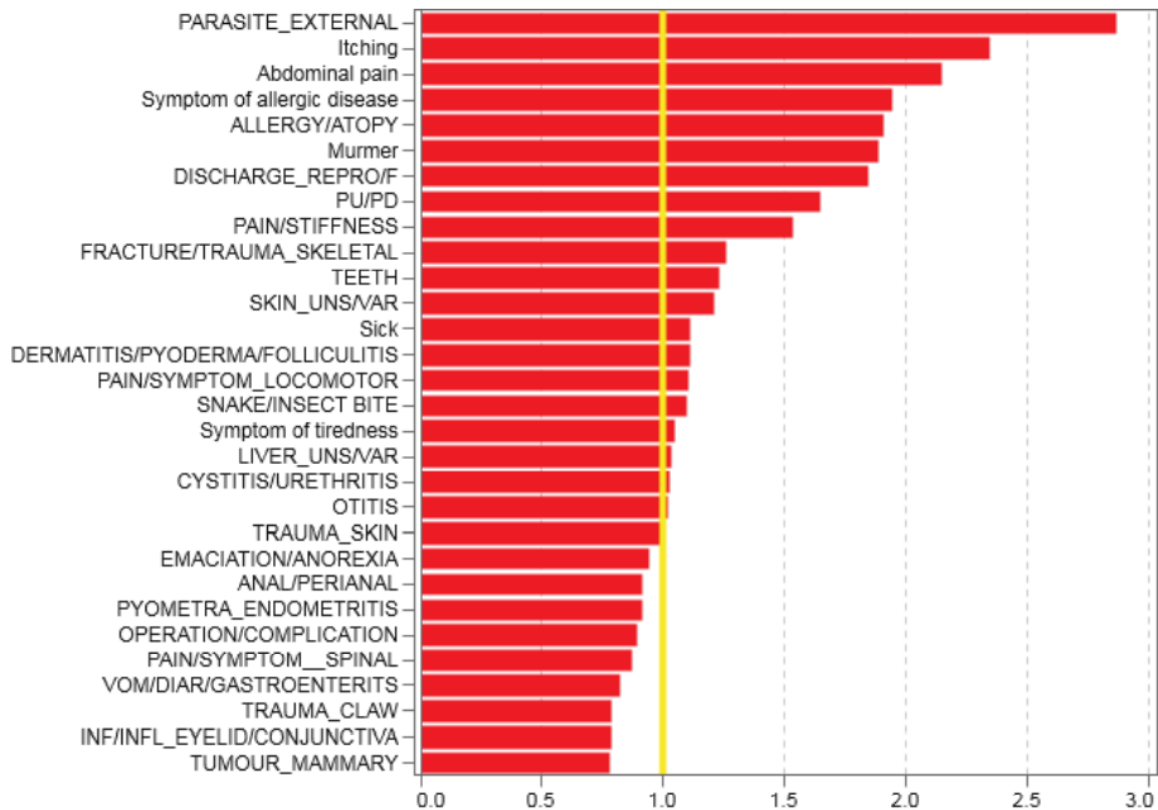
Figure 3: The specific causes of VCEs for the Japanese Shiba Inu ordered by relative risk compared to all breeds in Sweden between 2011 and 2016, from Swedish Agria insurance data. The yellow line indicates the baseline risk for all breeds.

**BREED WATCH**

The Japanese Shiba Inu is a category one breed, meaning judges are not required to complete mandatory monitoring forms following an appointment at 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 report has been received for the Japanese Shiba Inu (excluding neutering or caesarean sections) and this was for fractures.

## ASSURED BREEDERS SCHEME

Currently within the Kennel Club (KC)'s Assured Breeders Scheme (ABS) there are the following requirements for the Japanese Shiba Inu:

- Eye testing under the BVA/KC/ISDS Eye Scheme
- PLA (gonioscopy) testing under the BVA/KC/ISDS Eye Scheme

There are currently no recommendations for this breed within the ABS.

## 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 this breed.

Whilst 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

To date (20/10/2021), 66 Japanese Shiba Inus have been hip scored under the BVA/KC Hip Dysplasia Scheme, with a median hip score of 9 (range 0-39).

### ELBOWS

To date (20/10/2021), no Japanese Shiba Inus have been elbow graded under the BVA/KC Elbow Dysplasia Scheme.

### EYES

The Japanese Shiba Inu is currently on the BVA/KC/ISDS Known Inherited Ocular Disease (KIOD) list (formally Schedule A) for the following condition:

- Goniodysgenesis/ primary glaucoma (G)

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.

Grading of pectinate ligament abnormality (PLA) was formally introduced from July 2017, explaining the differences in reporting prior to this date (either goniodysgenesis affected or unaffected). The new system was introduced to give breeders a better understanding of the degree of abnormality their dog was affected by and therefore allow them to make more informed breeding decisions, with PLA a known risk factor in the development of glaucoma. PLA grade 0 or 1 are dogs showing little abnormality and are therefore suitable for breeding.

To date (20/10/2021), 663 Japanese Shiba Inus have been gonioscopy tested, with a breakdown of results given in Table 1 below.

Table 1: Gonioscopy/ PLA results for Japanese Shiba Inu to date

| Date of Gonioscopy | Number of Japanese Shiba Inu Tested | | | | |
|---|---|---|---|---|---|
| June 2017 – Nov 2021 | PLA Grade 0 | PLA Grade 1 | PLA Grade 2 | PLA Grade 3 | Total |
| | 101 | 70 | 5 | 0 | 176 |
| < June 2017 | Gonio Unaffected | Gonio Affected | Total | | |
| | 654 | 38 | 692 | | |

Twenty-three dogs of the breed have also been screened as part of the scheme's general eye test, with 11 with observations made (results with owner), and 12 unaffected.

As well as the KIOD list, the BVA record any other conditions affecting a dog at the time of examination, which is incorporated into an annual sightings report. Results of Japanese Shiba Inu tested between 2012 and 2018 are shown in Table 2 below. The reports for 2019 onwards are still pending.

Table 2: Reports on Japanese Shiba Inus that have participated in the BVA/KC/ISDS Eye Scheme between 2012-2018.

| Year | Number Examined | Conditions Noted |
|------|-----------------|------------------|
| 2012 | 19 Adults | No comments |
| 2013 | 74 Adults | No comments |
| 2014 | 44 Adults | No comments |
| 2015 | 46 Adults | No comments |
| 2016 | 64 Adults | No comments |
| 2017 | 56 Adults | 12 – PLA grade 0<br>11 – PLA grade 1<br>2 – PLA grade 2 |
| 2018 | 61 Adults | 1 – Persistent hyperplastic primary vitreous (PHPV)<br>1 – Anterior cortical cataract |
| 2019 | *Awaiting report* | |
| 2020 | *Awaiting report* | |

## AMERICAN COLLEGE OF VETERINARY OPHTHALMOLOGISTS (ACVO)

Results of examinations through ACVO are shown in Table 3 below.  Between 2015 and 2019, 1136 Shiba Inu were examined, of which 76.9% (874 of 1136 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 3: ACVO examination results for Japanese Shiba Inu, 1991 - 2019

| Disease Category/Name | Percentage of Dogs Affected | |
|------------------------|-----------------------------|---|
| | **1991-2014**<br>(n=4,195) | **2015-2019**<br>(n=1,136) |
| **Eyelids** | | |
| Distichiasis | 2.3% | 2.4% |
| **Uvea** | | |
| Persistent pupillary membrane, iris to iris | 3.9% | 4.8% |
| Persistent pupillary membrane, lens pigment foci/ no strands | 0.3% | 4.1% |
| **Lens** | | |
| Cataract, suspect not inherited/ significance unknown | 4.2% | 6.2% |
| Significant cataracts | 4.2% | 6.1% |

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.

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 4.

Table 4: Number of Japanese Shiba Inu litters registered per year, and number and percentage of caesarean sections reported per year, 2009 to 2020.

| 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 | 84 | 0 | 0.00% | 0.15% |
| 2010 | 92 | 0 | 0.00% | 0.35% |
| 2011 | 87 | 1 | 1.15% | 1.64% |
| 2012 | 89 | 3 | 3.37% | 8.69% |
| 2013 | 77 | 1 | 1.30% | 9.96% |
| 2014 | 95 | 3 | 3.16% | 10.63% |
| 2015 | 105 | 2 | 1.90% | 11.68% |
| 2016 | 110 | 3 | 2.73% | 13.89% |
| 2017 | 132 | 1 | 0.76% | 15.00% |
| 2018 | 128 | 4 | 3.13% | 17.21% |
| 2019 | 127 | 5 | 3.94% | 15.70% |
| 2020 | 141 | 3 | 2.13% | 14.41% |

## 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 **81.9** was reported (estimated using the rate of inbreeding over the period 1980-2014).

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 many 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 1980-2014 are shown in Figure 4. The observed inbreeding coefficient increased until a peak in 2000. Since this time, the observed inbreeding coefficient has gradually decreased again.

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
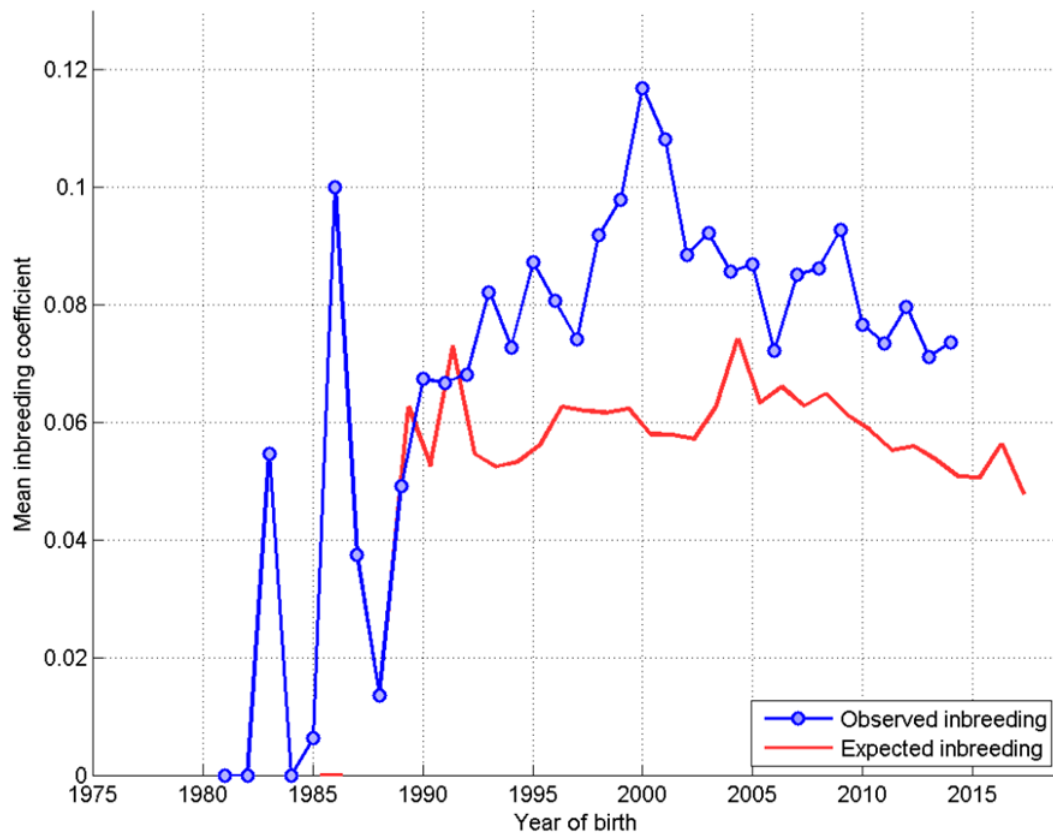https://cgejournal.biomedcentral.com/articles/10.1186/s40575-015-0027-4.

Figure 4: Annual mean observed and expected inbreeding coefficients.

The current annual breed average inbreeding coefficient is **4.1%.**

Below is a histogram ('tally' distribution) of number of progeny per sire and dam over each of seven 5-year blocks (Figure 5). 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). Throughout the period analysed, there is evidence of several popular sires being used. Continued use of these dogs, and their immediate progeny, can rapidly decrease the gene pool of the breed and result in inbreeding depression.
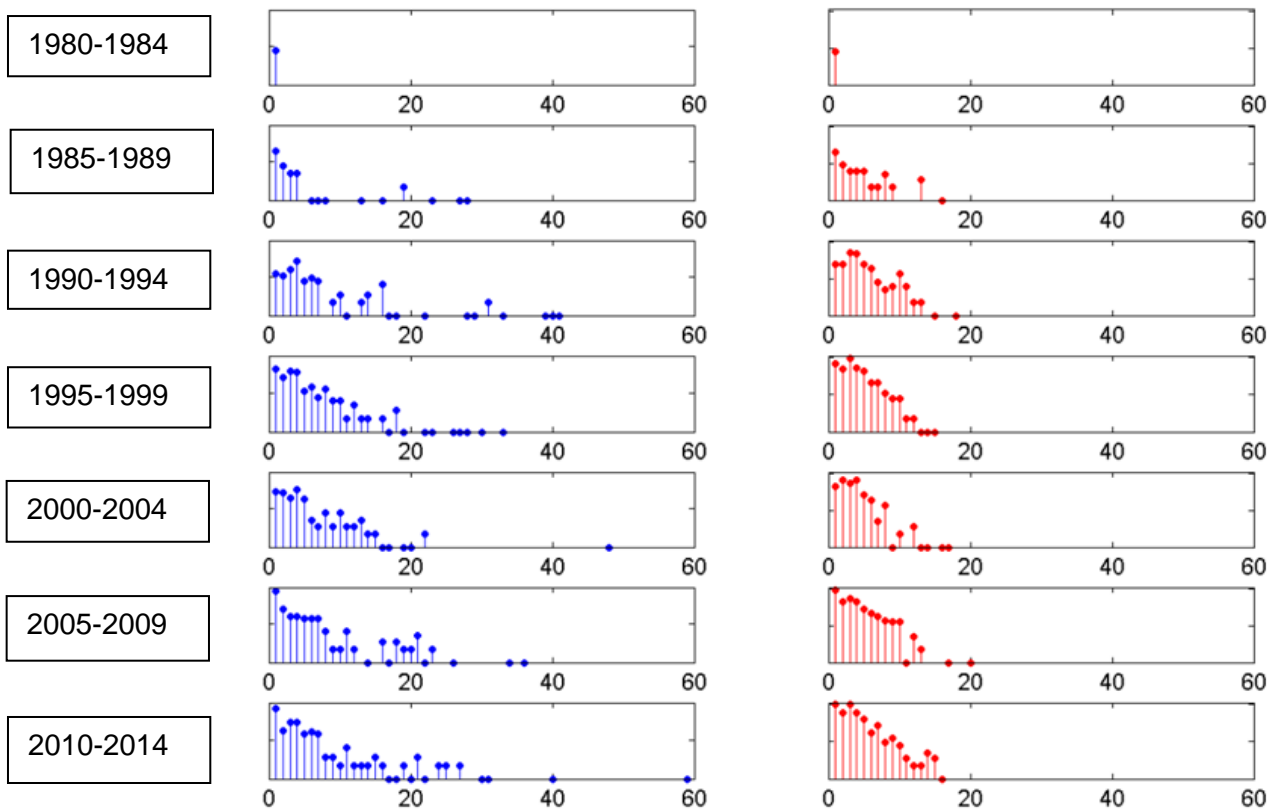
Figure 5: Distribution of the proportion of progeny per sire (blue) and per dam (red) over 5-year blocks (1980-4 top, 2010-4 bottom). Vertical axis is a logarithmic scale

## CURRENT RESEARCH

The breed are continuing to monitor research at the University of Pennsylvania, which aims to identify genetic markers for POAG in the Japanese Shiba Inu.

**PRIORITIES**

Correspondence between the breed representatives and the Kennel Club was undertaken in November 2021 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 Japanese Shiba Inu were:

1. Glaucoma
2. Gangliosidosis 1 (GM1)/ Gangliosidosis 2 (GM2)
3. Breed engagement

**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 Japanese Shiba Inu. Both partners are expected to begin to action these points prior to the next review.

**Breed Club actions include:**

- The Breed Clubs to continue to encourage eye testing prior to breeding

- The Breed Clubs to continue to promote their new health website to breeders and owners

- The Breed Clubs to continue to monitor the breed's health via surveys/ breeder reports

- The Breed Clubs to continue to monitor the use of popular sires and raise awareness of the importance of considering genetic diversity when breeding

**Kennel Club actions include:**

- The Kennel Club to advertise the breed's health website to encourage owners to report illness and cause of death, and promote their Gangliosidosis Health Surveillance Survey

- The Kennel Club to produce a piece on the importance of considering genetic diversity and popular sires when breeding, specifically for numerically small breeds

- The Kennel Club to update the breed's population analysis

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