

Factors affecting the viability of The Irish Water Spaniel

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Summary

The Irish Water Spaniel has a very small worldwide population and no more than about 350 puppies are registered around the world each year with the UK and US being the predominant populations. The mean breed coefficient of inbreeding is around 25% and the lack of genetic diversity this number implies is almost certainly a primary factor in the high levels of cancer (particularly of young dogs), seizures and immune mediated conditions suffered by the breed. Human factors such as the age profile of breeders, the lack of interest in the breed by the wider public and a lack of genetic knowledge of breeders is likely to see the population struggle to maintain current numbers and as a consequence, the rate of loss of genetic diversity will accelerate, with all that implies for the future health and viability of the breed. A fixation on health testing (of dubious value) to the exclusion of sound genetic management is a feature of the breed's breeders.

Introduction

The Irish Water Spaniel is classified by the Kennel Club as one of its vulnerable native British and Irish breeds, the qualification for which is UK registration numbers of less than 300 per year. The standard story often heard about these breeds is that 100 years ago they had significantly higher numbers of registrations than they do today and that for various reasons their numbers have declined significantly. One objection to the Kennel Club classifying these breeds as vulnerable that is sometimes heard, is that many of these breeds have significant populations overseas. The Irish Water Spaniel does not fit either of these pictures with low registration numbers the norm throughout its history, both in the UK and Ireland where it was developed and in its limited overseas travels. Indeed, in the UK registrations were lower 100 years ago than they are today with numbers peaking at 80 in 1924 and staying below this until 1973.

Population and population genetics

The modern Irish Water Spaniel can trace its ancestry to a single dog, Boatswain, born in 1834 in Albert Road in what is now Dún Laoghaire, Ireland. His breeder, Justin McCarthy divulged very little about the breed's origins but it is thought to have derived from the southern Irish Water Spaniel rather than the now extinct northern type. One thing is clear tho' as determined by modern genetic techniques, the breed is not descended from the Poodle as has long been held the case, rather its closest relatives are other spaniel breeds such as the Springer, Cocker and Brittany ¹.

From the UK and Ireland the breed quickly reached the US, Canada, Australia and New Zealand during the 19th century and these remain populated to this day with the US having the largest population in the world but even so, the estimated registered population is a paltry 1,000-1,200. There are a number of continental European countries where Irish water spaniels have a presence but only one, Finland has produced at least one litter in each of the last 10 years. The world population is estimated to be in the order of just 2,500 -3,000 animals. In the UK the registered numbers of Irish water spaniels have always been extremely low, Table 1 shows the registrations each year since 1900.

Table 1: UK Irish Water Spaniel Registrations from 1900 (source: The Kennel Club)

Year	Registrations	Year	Registrations	Year	Registrations	Year	Registrations
		1989	144	1959	19	1929	49
2018	111	1988	127	1958	10	1928	68
2017	69	1987	144	1957	27	1927	61
2016	116	1986	170	1956	21	1926	74
2015	132	1985	122	1955	40	1925	60
2014	88	1984	115	1954	16	1924	80
2013	101	1983	117	1953	47	1923	74
2012	148	1982	83	1952	41	1922	50
2011	101	1981	98	1951	49	1921	43
2010	117	1980	121	1950	49	1920	25
2009	131	1979	121	1949	48	1919	11
2008	101	1978	104	1948	63	1918	5
2007	162	1977	40	1947	65	1917	15
2006	105	1976	32	1946	42	1916	12
2005	106	1975	112	1945	33	1915	10
2004	121	1974	94	1944	15	1914	30
2003	121	1973	117	1943	8	1913	20
2002	145	1972	62	1942	4	1912	16
2001	112	1971	56	1941	10	1911	24
2000	142	1970	31	1940	5	1910	33
1999	72	1969	35	1939	16	1909	33
1998	134	1968	24	1938	56	1908	38
1997	155	1967	29	1937	30	1907	33
1996	164	1966	45	1936	56	1906	45
1995	104	1965	31	1935	29	1905	30
1994	136	1964	33	1934	34	1904	43
1993	80	1963	53	1933	23	1903	38
1992	144	1962	22	1932	38	1902	46
1991	153	1961	39	1931	32	1901	27
1990	144	1960	35	1930	38	1900	41

Across the world the picture is hardly more encouraging, with no more than around 350 registered puppies each year (including those from the UK). Table 2 shows all of the puppies born in 2018 with the top 6 countries listed being the only ones where at least 1 litter was born in each of the past 10 years.

Table 2: 2018 Worldwide Irish Water Spaniel registrations (based on calendar date)

Includes official figures and estimates.

Country	No of litters	No of puppies
United Kingdom	17	124
United States	15	102
Ireland	< 10	?
Canada	3	20
Australia	2	13
Finland	2	16
Netherlands	1	9
New Zealand	1	6
Switzerland	1	7

Total: 42 litters, plus an unknown (but small) number from Ireland.

Total: 297 puppies, plus an unknown (but small) number from Ireland.

Clearly with such small numbers of animals produced over such a protracted timescale population genetics analyses will undoubtedly provide interesting reading.

The mean breed coefficient of inbreeding (F) for the Irish water spaniel has been estimated at 25% based on both pedigree analysis of a whole breed/whole history database and by direct DNA analysis. This value is of course equivalent to sibling matings with unrelated parents.

“It is widely believed that pedigree dogs are very inbred, due to closed registries and breeding practices, and that this has had a detrimental effect on the health and welfare of many pedigree breeds”².

“Inbreeding is inevitable in closed populations with a finite number of ancestors and where there is selection. Therefore, management of the rate of inbreeding at sustainable levels is required to avoid the associated detrimental effects of inbreeding. Studies have shown some pedigree dog breeds to have high levels of inbreeding and a high burden of inherited disease unrelated to selection objectives, implying loss of genetic diversity may be a particular problem for pedigree dogs”².

Lewis et al carried out pedigree analysis on all of the KC registered breeds including the Irish water spaniel in 2015 the aim being to ascertain “parameters describing the rate of loss of genetic diversity due to inbreeding and the presence of any general trend across all breeds. The results for the Irish water spaniel should have been a huge wake up call to breeders. Unfortunately it was not.

Using the Kennel Club’s database the analysis was carried out for the years 1980 to 2014. The rate of inbreeding (ΔF , how quickly F rises over generations) was measured. The rate of inbreeding has to be managed in order for breeds not to succumb to the detrimental effects on the wider population resulting in the loss of genetic variation, loss of heterozygosity, possible effects of inbreeding depression, and a higher rate of spread of deleterious alleles.

ΔF is often expressed as the effective population size N_e which in simple terms can be considered as the gene pool of the breed.

The rate of loss of genetic diversity within a breed or population increases dramatically when $N_e < 100$ ¹³, while a population with $N_e < 50$ is considered to be at high risk of the detrimental effects of inbreeding¹². Therefore, ΔF and N_e can be used to determine the history and sustainability of populations and inform appropriate breeding strategies where the aims are genetic improvement and the conservation of genetic resources².

Table 3 is taken from Lewis et al² and provides the key metrics for Irish water Spaniels.

Table 3: Rate of inbreeding and effective population size for Irish Water Spaniels from 1980 – 2014.

For the whole period the effective population size was 71

	1980-1984	1985-1989	1990-1994	1995-1999	2000-2004	2005-2009	2010-2014
Rate of inbreeding (%)	2.24	1.87	3.99	3.69	1.23	-2.6	-0.148
Effective population size	22.32	26.707	12.51	13.541	40.498	n/a	n/a

As suggested by Lewis the increase in genetic diversity was caused by a significant influx of overseas IWS from 2005 and in particular since the introduction of the pet passport scheme, but as has already been discussed, the overseas gene pool is extremely small and is closely related to the existing UK population. In addition, the data was only calculated from 1980, but to provide truly accurate figures one would have to go back to the founders of the breed.

Going further back in time several genetic bottlenecks have been caused in the UK population by the significant

over use of certain sires. Between 1947 and 1953, 25% of all IWS registered in the UK were sired by a single dog, Ch Shotwick Bruin and between 1966 and 1974, 25% of all IWS registered in the UK were sired by Bruin's great great grandson, Sh Ch Jakes of Tarbay. The data provided by Lewis also shows for all time periods from 1980 a significant influence of popular sires.

The probable impact of inbreeding; small effective population size; small annual registrations worldwide and a small census population worldwide undoubtedly play the major contributory role in the high incidence of a number of the principle health concerns in the breed. Furthermore, long runs of homozygosity in the IWS genome resulting in the high mean breed value of F suggest that the breeding away from these health issues within the confines of the current population structure is illusory.

Health concerns

Table 4 – Primary health concerns in The Irish Water Spaniel.

Cancer	Specifically the rate of cancer in younger dogs.
Seizures/idiopathic epilepsy	Probably significantly under reported.
Immune mediated	Including contact allergies, food allergies and autoimmune diseases such as immune mediated haemolytic anaemia and symmetrical lupoid onychodystrophy.
Reproductive issues	False pregnancy, pyometra, irregular heat cycles and inability to conceive.
Dermatologic	This includes idiopathic alopecia and follicular dysplasia as well as diet related issues.

The principle health studies concerning the Irish water spaniel are the 2004 Kennel Club breeds health survey¹⁰; the 2001 Irish Water Spaniel Club of America health survey⁶, the 2008 Sporting Irish Water Spaniel preliminary longevity study¹⁴ and the 2010 Irish Water Spaniel Club of America (IWSCA) worldwide health study⁵. These studies together with unpublished data collected on an ad hoc basis show that cancer is the single biggest health issue affecting Irish water spaniels and more specifically, the numbers of younger dogs getting cancer.

Table 4 lists the principle health concerns based on these various studies although there are many others that could be included.

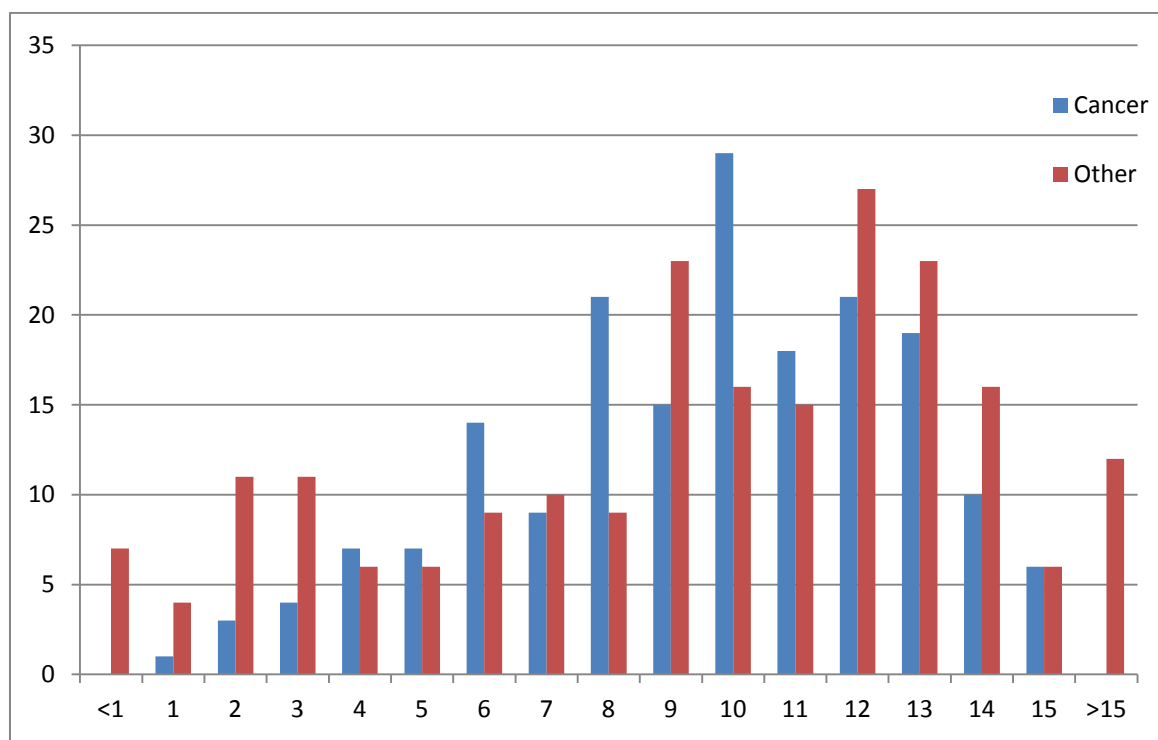
In 2004 the Irish water spaniel had the highest incidence of cancer deaths in The Kennel Club survey, coming out at 55.8%^{3,4}. Table 5 shows an extract from these data.

Table 5 An extract of proportional cancer related mortality by breed from (3) based on data from (4)

Breed	All deaths	Cancer-related death			Median age at death
		N	%	95% CI	
Irish water spaniel	95	53	55.8	45.8–65.8	9.33
Flat-coated retriever	610	331	50.3	50.3–58.2	9.83
Hungarian wirehaired vizsla	15	7	46.7	21.4–71.9	9.83
Bernese mountain dog	394	180	45.7	40.8–50.6	8.0
Rottweiler	137	62	45.3	36.9–53.6	8.92
Italian spinone	47	21	44.7	30.5–58.9	9.0
Leonberger	47	21	44.7	30.5–58.9	7.08
Staffordshire bull terrier	117	52	44.4	35.4–53.4	12.75
Welsh terrier	23	10	43.5	23.3–63.7	12.67
Giant schnauzer	39	16	41	25.6–56.6	10.0
Airedale terrier	81	32	39.5	28.9–50.2	10.75
Golden retriever	927	360	38.8	35.7–42.0	12.25
Boxer	130	50	38.5	30.1–46.8	10.25
Briard	71	27	38.0	26.7–49.3	11.17
French bulldog	71	27	38.0	26.7–49.3	9.0
Bullmastiff	96	36	37.5	27.8–47.2	7.46
Alaskan Malamute	14	5	35.7	10.6–60.8	10.71
Saluki/gazelle hound	132	47	35.6	27.4–43.8	12.0
Nova Scotia duck tolling retriever	9	3	33.3	2.5–64.1	8.0
Basset griffon vendeen	76	25	32.9	22.3–43.5	12.04
Beagle	241	79	32.8	26.9–38.7	12.67
English setter	384	126	32.8	28.1–37.5	11.58

This would not be such an issue if the majority of cancer related deaths were in older dogs. However, the IWSCA 2010 health survey showed that from the age of 4 to about 9 or 10 cancer as a cause of death out stripped all other causes combined and dogs less than 2 years old also died from cancer. This data is shown in Table 6⁵

Table 6 Cancer deaths vs all other deaths combined.



Whilst many different types of cancers have been reported in Irish Water Spaniels the most frequently occurring appear to be: Lymphoma, Mast Cell, Osteosarcoma and haemangio sarcoma (both forms having been reported).

After cancer, seizures including idiopathic epilepsy are probably the second most significant condition with 10% of American respondents in the 2010 Irish Water Spaniel Club of America health survey indicating their dogs have had seizures. In the UK this is almost certainly under reported in the health surveys that have been carried out.

The third largest concern is around immune mediated conditions.

Human factors

The IWS faces challenges from human factors as well.

Most established breeders around the world represent an ageing population and there do not appear to be many younger breeders coming along to provide succession. In 2018, of the 17 litters born in the UK, 9 were bred by first time breeders. Had they not stepped in the registrations for 2018 would have been just 61. It remains to be seen whether enough new breeders can be found but even if they can there is no guarantee of finding homes. The registrations for 2019 are just 69 for the first 9 months and are expected to be below 100 for the full year. IWS face intense pressure from other breeds and changing lifestyles, not everyone wants a dog that requires a lot of both physical and mental exercise and whose coat requires regular attention and that of course, is if they have even heard of them.

In general breeders do not understand the importance of population genetics to the future wellbeing of the breed. Many breeders still breed litters with inbreeding coefficients well above the breed mean level of 25%. They also do not understand, or do not accept the relationship between inbreeding and the high level of health problems in the breed. They also tend to think of complex genetic conditions such as cancer and immune mediated conditions in terms of simple Mendelian inheritance and therefore believe they can breed around them. Unfortunately, it is poorly understood by breeders that as inbreeding increases the ability to select for anything, including selecting away from disease becomes more and more difficult. Long runs of homozygosity in the genome means that for many gene loci there is little or nothing left in the gene pool to breed to.

If these attitudes and lack of knowledge are not addressed then the rate of inbreeding is likely to continue apace to the point where health issues cannot be resolved from the existing gene pool, if indeed they can be now. Even if breeders change what they do, the ongoing small effective population size and low number of breed registrations worldwide will mean that the level of inbreeding will continue to grow and indeed the rate is likely to accelerate.

In 2005 the former Kennel Club Genetics Consultant, Dr Jeff Sampson conducted a breed health seminar for The Sporting Irish Water Spaniel Club (Appendix 1) and warned that many breeds, small in number, such as The Irish Water Spaniel will be in serious trouble. There is no reason to suppose that this does not remain the case.

APPENDIX 1

**Breed health seminar by Dr Jeff Sampson, at the invitation of The Sporting Irish Water Spaniel Club
30 July 2005, Clows Top, Worcestershire. Extract taken from the SIWSC winter 2005 newsletter.**

On Saturday afternoon there was a seminar by the Kennel Club's Dr Jeff Sampson and Liverpool University's Wendy Hallows. The subject matter was the prevention of inherited diseases in breeds with small gene pools and the UK DNA Archive for Companion Animals. The seminar was well attended, including representatives of other breeds with small gene pools and most of the main IWS working breeders, indeed, such was the interest in the subject matter and related topics, the seminar lasted considerably longer than anticipated.

Dr Sampson's subject matter was both interesting and informative and he made the point that even breeds large in number have their origins and hence their gene pools very much restricted. He gave the example of the Golden Retriever, where all dogs today owe their ancestry to a mating by Lord Tweedmouth of a Tweed water Spaniel (now extinct) and a yellow flat coat apparently as a bit of a joke, as yellow flat coat pups were generally killed by the Victorians as being undesirable. This initial mating was followed up with a second Tweed water Spaniel, two Labradors and a Blood Hound, and that was it, the Golden Retriever was born, using just six dogs. He went on to say that in the next twenty years he fully expects many breeds to really start struggling as a result of their restricted gene pools and cited the Field Spaniel that currently has issues regarding fertility. The signs of this will be in **reduced life span, fertility problems** and of course **inherited diseases** and, reading between the lines **extinction** of many breeds, including our own Irish Water Spaniel.

However, all is not lost and he went on to describe how genetic diversity can occur and our options for making increased genetic variation in what are highly inbred breeds. Indeed it has been said that the IWS is the most inbred dog in the world, if that is the case, disaster could be just around the corner. One of the solutions he cited may be seen by many as highly controversial: the use of endorsements on puppies' pedigrees by breeders to restrict which dogs can be bred from. Excuse me!!! Did I hear that right? he is proposing that in breeds with restricted gene pools we restrict the gene pool still further by the use of endorsements. That could be a real problem as in the canine world in general, breeders, despite their protestations do not always put the well being of their breed at the top of their agenda. It is good to know tho' that the majority of working IWS breeders do not use endorsements.

Other interesting snippets included the advice that breeders should not get hung up on breeding by numbers, a reference to such things as hip and elbow scores. He said that relatively high hip scores for example, should not necessarily be a bar to breeding, whereas certain eye conditions definitely should be a bar because they are that much more serious. He believes that science will be able increasingly to help breeders determine the relative seriousness of various conditions and therefore help them make informed decisions. He also mentioned that many breeds will probably need to be outcrossed with other breeds to save them. Here too science will be able to help. He said that individual breeds had a unique genetic signature and that in a couple of years time DNA analysis will show what breeds went into the genetic make up of any given breed. Perhaps all the historical speculation about what breeds the IWS is made up from will at last be answered.

Wendy Hallows went on to describe the work of Liverpool University and the UK DNA Archive for Companion Animals. Advances in molecular biology have made it possible to quickly analyse the DNA of both animals and humans. In addition, there is growing evidence that many of the diseases in animals, including dogs are as a result of a combination of genes inherited by the parents (nature) and the external or environmental factors they have experienced during their lives (nurture). All six UK veterinary schools are now engaged in investigating the underlying environmental and genetic factors involved in a wide range of diseases of companion animals. The archive has been set up to prevent the inefficiencies involved in each research group trying to build up their own collection of DNA samples. So the archive is a collective database of blood samples that all researchers potentially have access to. So they are keen that if your dogs have to have routine pathology

tests that you request blood is donated to the archive. Apparently, legally, you cannot just ask your vet to take a blood sample specifically for the archive.

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