



ESTIMATED EFFECTIVE POPULATION SIZE RESEARCH Q&A

Pedigree dogs have many advantages because we know their ancestry and can predict the way that they will turn out. This helps us to know how big they will grow, their exercise needs and predict the health problems they might face, enabling breeders to know which DNA tests to give the parents before they are bred from, none of which is available for dogs of mixed ancestry.

“But it also means that they tend to have a more closed gene pool and so we have to manage the rate of inbreeding at sustainable levels to ensure genetic diversity is preserved, as the lower the genetic diversity the greater the risk that certain health conditions will begin to surface.

1) Is an inbred dog guaranteed to be unhealthy?

Any animal that is selectively bred for predictable characteristics (such as temperament, health and size) has a closed population and so will have a higher rate of inbreeding than those that are not. This does not need to be to the detriment of good health.

Using the Co-Efficient of Inbreeding (COI) calculator enables breeders to minimise the degree of inbreeding in future litters and reduce the risk of puppies developing inherited health problems. It is important to note that the inbreeding coefficient is a measure of risk, rather than a direct measure of health. It is possible that two closely related dogs do not have the same autosomal recessive genes, while two seemingly unrelated dogs do - it's all down to chance. Although the COI is not a guarantee of health, it is a measure of risk with a higher COI suggesting a higher risk.

If a breeder DNA tests their dogs they are taking steps to avoid a known risk. By using COI calculators when selecting potential mates, they are reducing the risk of unknown conditions.

2) If inbreeding causes so many problems why don't we just use crossbreeds?

Unfortunately crossbreeds are susceptible to the same health problems as pedigree dogs. As an example, a 'Labradoodle' is the result of a cross between a Labrador and a Poodle. Both of these breeds can be susceptible to hip problems and simply crossing them will only exacerbate the problem and not eradicate it.

When breeding from a pedigree dog there is a predictability of specific breed traits meaning that people can get the right dog for their lifestyle and give a dog a home for life. These predictable traits including behaviour and temperament, care needs, and their health predisposition enabling breeders to know which DNA tests to give the parents so that they can avoid the problems in the next generation, and this is currently not the case with crossbreeds.

Furthermore crossbreeds are susceptible to the same reduction in genetic diversity the more generations are bred from.

3) There are many breeds that have Estimated Effective Population Sizes above the recommended level of 100, but there are also a lot of breeds below this. Is the Kennel Club concerned about this?

The Kennel Club wanted to find out the Estimated Effective Population Size for every breed as this tells us the size of the gene pool and it should ideally be above 100, but we have also found out that the rate of inbreeding is slowing down in many breeds, meaning that the Estimated Effective Population Size can and will improve.

This has happened for many reasons, one of which being that we have been able to embrace the advances in science to develop our Mate Select programme, which enables people to look at the inbreeding coefficient of any particular mating to decide if it is a good idea. This information, and the latest report we have conducted for every single breed in the UK, enables breeders to make the best choices for their dogs and their breed. The rate of inbreeding can also slow down or improve due to other reasons, such as when dogs are brought in from overseas.

We also need to remember that inbreeding coefficients are a measure of risk, they do not necessarily mean there will be a problem in any given puppy or with any given breed. Many of the breeds with high EEPs do not have an unduly high burden of a single gene disease.

The main thing that we need to ensure is that the breeds are healthy and whilst reducing the rate of inbreeding is an important part of this, different factors need to be considered in every mating for the good of the pups and the breed overall. What we are doing is supplying breeders with lots of information so they can carefully calculate which dogs are the best match for one another and so long as this information is used we can ensure breeds and individual pups continue to be healthy.

4) Popular sires are identified in the research as one of the contributors to the loss in genetic diversity. Can the Kennel Club not set a limit on the numbers of puppies/litters a sire can have?

Unfortunately due to the vastly different population sizes, it is impossible to set a threshold on the number of puppies from a single sire across all breeds.

An example of this could be - a Labrador male siring four litters in a year would be siring about 0.1% of all puppies registered that year. Compare that to an Otterhound dog doing the same and the dog would sire virtually all registered puppies that year.

Furthermore, we need to remember that popular sires are popular normally because they have good characteristics in terms of health and temperament. There is nothing wrong with a popular sire producing pups if those pups don't themselves breed as they will be making zero genetic contribution to future generations – for example some Guide Dog sires might produce good progeny and so be selected for more frequent use but the pups are unlikely to ever be bred from - and it means the pups get the best health and temperament possible. It is not the number of progeny, but the number of *breeding* progeny that is most important and we do not know which offspring will be used for breeding at the point of registration.

If a limit is set at a sire producing 100 puppies, but then 10 of the sire's sons produce another 100 each, this is as much of a problem genetically as a sire having 500 progeny.

Directly monitoring contributions is a more effective way of identifying 'popular sires' and the Kennel Club has recently been conducting research in this area so that we can look more closely at genetic contributions. Furthermore, we are working on a 'popular sire' tool to add to our Mate Select service, which will enable those with breeding bitches to see how many times a sire has been used.

5) What is the Kennel Club planning to do about the problem of popular sires?

The Kennel Club advises against over use, particularly of males, for breeding and publishes the number of puppies each dam/sire has produced, as part of MyKC. Anyone can sign up for a MyKC account completely free and look this information up. You can use all of the Mate Select tools within MyKC, including the COI calculators.

The KC is conducting research into directly monitoring the genetic contributions made by individuals to subsequent generations and how best to convey this information to breeders via Mate Select.

6) The Kennel Club says that one answer to improving the rate of loss of genetic diversity is through outcrossing. Has this been done before?

Dogs that have been outcrossed have been registered by the Kennel Club for a long time. Examples include crossing the Irish Red and White and the Irish Setter, inter-variety Belgian Shepherd Dog matings, the Bull Terrier to the Miniature Bull Terrier and the registration of progeny from a Dalmatian/Pointer mating, for a low uric acid (LUA) gene.

7) Why not make outcrossing mandatory for many more breeds?

Outcrossing into the gene pool can have a positive effect but it is not a silver bullet. When you bring a dog in in this way you need to remember that the dog will then be a common ancestor to all dogs with that version of the gene, which will be desirable, so whilst an outcross is a useful tool, it doesn't mean you can stop managing inbreeding.

Furthermore, if you get breeders who favour the dog with the outcrossed characteristics and others who favour those without it you could split the breed in two, reducing genetic variation still further. So we need to work carefully with breeders to ensure our actions are not counterproductive.

8) What process does a breed need to go through to decide if an outcross will be allowed?

If a breed is considering crossing with a different breed, the first step would be to begin discussing this with the health team at the Kennel Club. Any breed considering an outcross programme will need bespoke advice from geneticists to help formulate any breeding strategies. Many breeds concerned about genetic diversity and inbreeding would benefit from simpler strategies such as reducing use of popular sires, using a wider number of males and females from different sub-populations within the breed, and *careful* use of international animals. Breed-specific advice can be sought from the health team at the Kennel Club.

9) Why don't you set a limit on the Co-Efficient of Inbreeding (COI) of dogs that you will register?

It is impossible to set a sensible and consistent threshold for COI due to varying levels of genetic diversity within breeds and differing amounts of pedigree information between dogs. For some breeds, an abundance of pedigree information (enabling detection of distant ancestral relationships) and depleted genetic variation may mean it would be very difficult or impossible to meet a particular threshold. Furthermore, while the COI describes the *risk* of the detrimental effects of inbreeding occurring in an individual, simply seeking to minimise individual COIs is not an effective way to manage the rate of loss of genetic diversity within a breed. For example, imagine an imported and totally unrelated male of a small breed was mated to all UK females of that breed. All puppies will have a COI of zero (as parents are totally unrelated) but they will all be half siblings, and mating of half-siblings results in COI of 12.5% (and the same rate of inbreeding across that generation).

10) I have questions about my breed report, how do I help my breed and what support can I receive or tools can I use to help me with my own breeding lines?

There are a number of tools available on the Kennel Club's Mate Select web pages which may be of assistance, including COI calculators, the health test results finder, and more accurate indicators of genetic risk for hip and elbow score (estimated breeding values – EBVs) for some breeds. You can also email the Kennel Club Health Team at mateselect@thekennelclub.org.uk for information and advice.