Flat Coat population analysis:
some background,
& a guide to the report.
We all have

2 parents

4 grand parents

8 great grand parents

16 great great grand parents

etc...

$2^n$ ancestors

where $n$ = generations back
Furthermore, the resemblance of relatives... means selection will result in the mating of individuals more closely related than average.
BUT - natural selection acts against the detrimental consequences of inbreeding...
It’s all about risk...
What are the risks associated with inbreeding?
Why does inbreeding cause these problems?
Coefficient of inbreeding (COI)

COI is the probability that the 2 copies of a gene are Identical By Descent (IBD)

- **25%** for offspring of a full sib mating or a parent/offspring mating
- **12.5%** for offspring of a half sib mating
- **6.25%** for offspring of 1st cousins
COI = 25.4%
Number of generations is all important

*...(using 3 generations of pedigree only, actual COI may be considerably higher. When using 5 generations of pedigree, COI = 17%)

COI = 0%  *
Rate of inbreeding ($\Delta F$)

$$\text{rate of inbreeding (} \Delta F \text{)} = \text{change in average COI over time} \text{ (or generations)}$$

Usually quoted as the **Effective population size (Ne)**
Genetic drift

- \( f(g) = 0.05 \) (1 in 20 green)
  - \( Pr = 0.06 \) (6/100)

- \( f(g) = 0.15 \) (3 in 20 green)
  - \( Pr = 0.045 \) (45/1,000)

- \( f(g) = 0.30 \) (6 in 20 green)
  - \( Pr = 0.0004 \) (4/10,000)
  - \( Pr = 0.0003 \) (3/10,000)
Inbreeding/drift summary

Inbreeding unavoidable in the long term

COI describes the probability of IBD, and so risk

*Rate* of inbreeding the important measure for breed/population

Inbreeding and drift act on allele frequencies
Featured article: Trends in genetic diversity for all Kennel Club registered pedigree dog breeds

Inbreeding is widely viewed as being harmful to the well-being of individuals and populations. In populations of a limited size, complete avoidance of breeding between individuals with a shared ancestry quickly becomes impossible. Furthermore, selection within dog breeds for desirable traits will inevitably result in the breeding of individuals that resemble each other with respect to the traits under selection. This study reports the general trends in the rate of inbreeding observed through population analyses of all 215 pedigree dog breeds currently recognised by the UK Kennel Club, over the period 1980 to 2014.

Read More...

http://www.cgejournal.org/
Trend of registrations over year of birth (1980-2014) = 21.3 per year (with a 95% confidence interval of 13.01 to 29.59)
Table 1: sire statistics per year

<table>
<thead>
<tr>
<th>year</th>
<th>#born</th>
<th>#dams</th>
<th>#sires</th>
<th>puppies per sire</th>
<th>%puppies sired by most prolific sires</th>
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<td></td>
<td></td>
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</table>
Estimated effective population size= 67.9

NB - this estimate is made using the rate of inbreeding over the whole period 1980-2014
Table 2: trends within 1980-2014

<table>
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<tr>
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<td>1045.2</td>
<td>1298.8</td>
<td>1457.4</td>
<td>1278.6</td>
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<td>Total #sires</td>
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<td>765</td>
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<td>Rate of inbreeding</td>
<td>0.026309</td>
<td>0.012895</td>
<td>0.017143</td>
<td>0.010074</td>
<td>0.001502</td>
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<td>Effective pop size</td>
<td>19.005</td>
<td>38.774</td>
<td>29.167</td>
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<td>144.39</td>
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</table>

![Graph showing trends in mean inbreeding coefficient over years](image-url)
Figure 3: distribution of progeny per sire/dam
Broad trends and interesting examples...
The rate of inbreeding is (generally) slowing...
...although, not in all breeds...
Some rarer breeds are conserving diversity...
...but others are really struggling...
Drastic loss of genetic diversity in some breeds
Effective and actual pop\textsuperscript{n} size appear unrelated.
Possible effect of ‘sub’ populations...
Summary
Thank you – and any questions?

General trend across breeds is an easing in the rate of inbreeding

FCR rate of inbreeding is improving...

...but popular sires are still making large genetic contributions

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