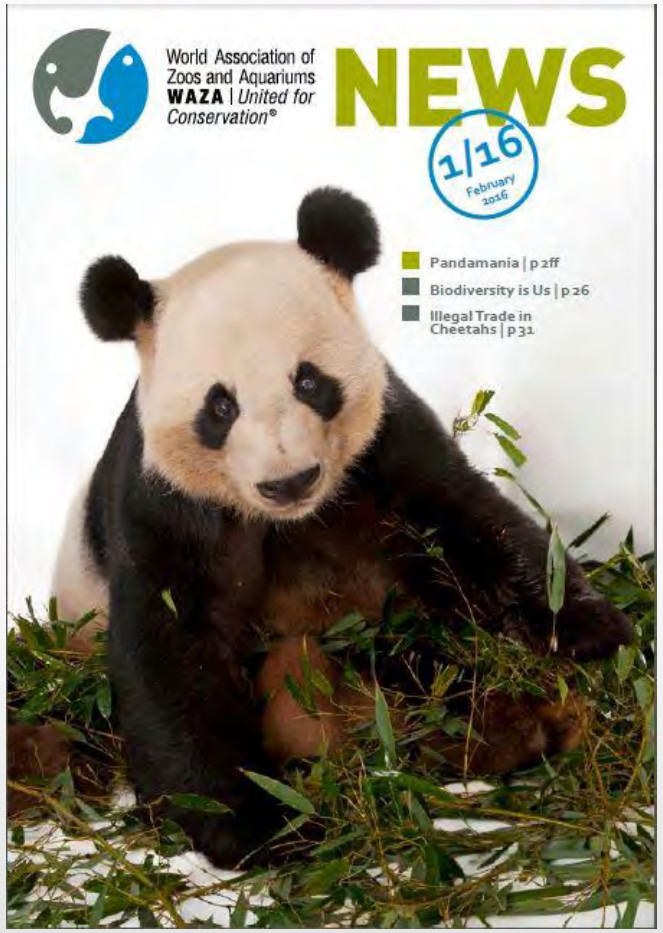
EQUINE BREEDERS SEMINAR

RBST

Rare Breeds Survival Trust

Management of Endangered Breeds of Livestock



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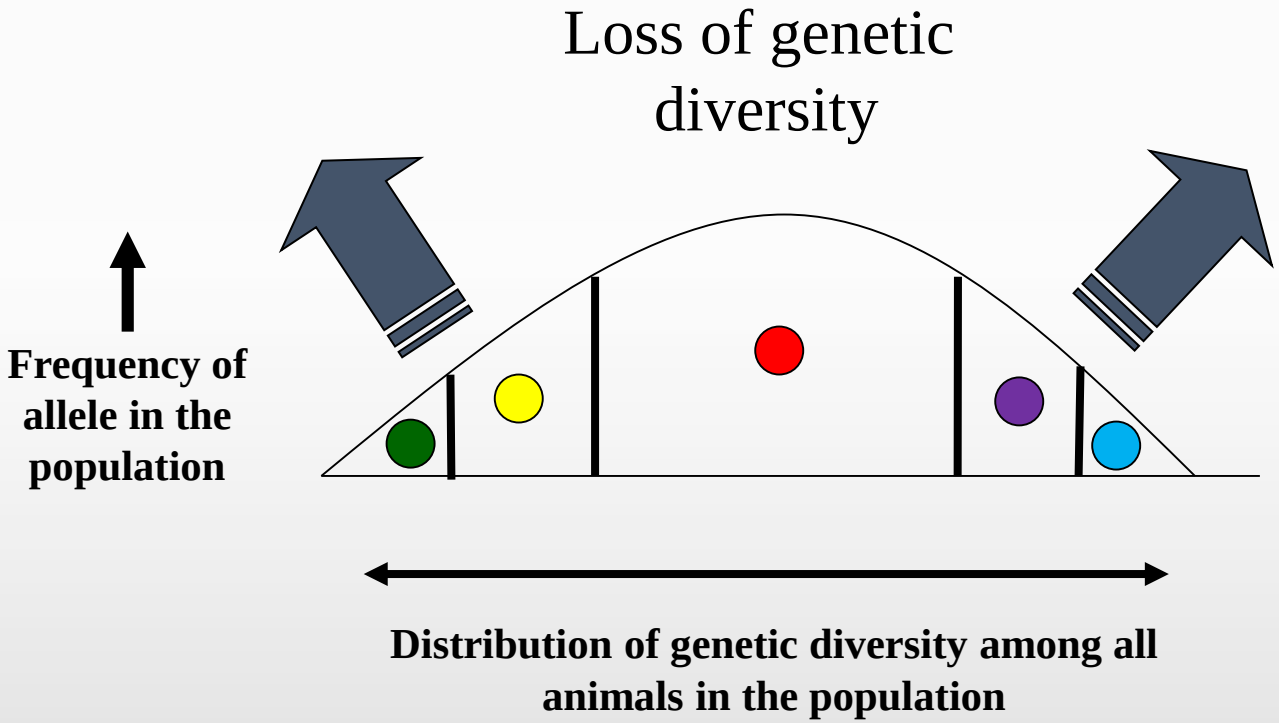
The Problems of Small Populations

- Small populations lose genetic diversity more quickly than large populations
- Genetic drift and the loss of genetic variation
- Inbreeding and inbreeding depression
- Accumulation of deleterious traits and loss of fitness

Genetic Diversity



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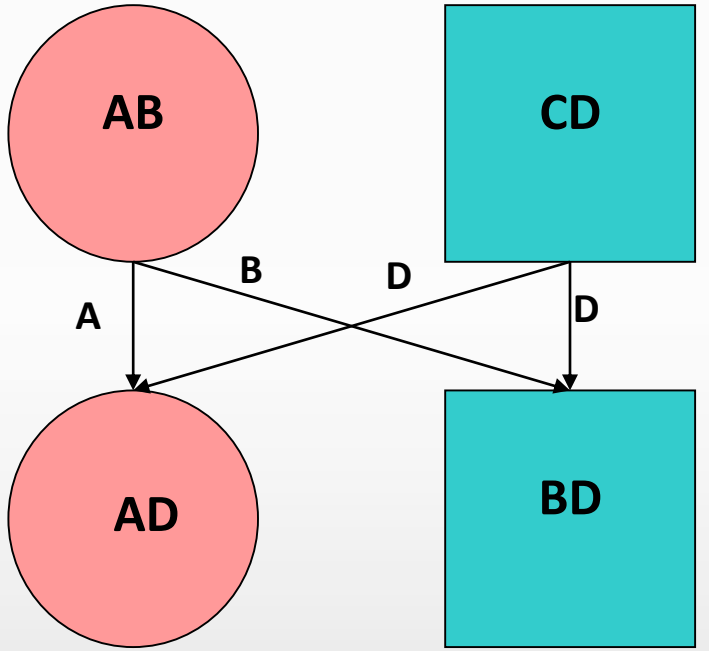
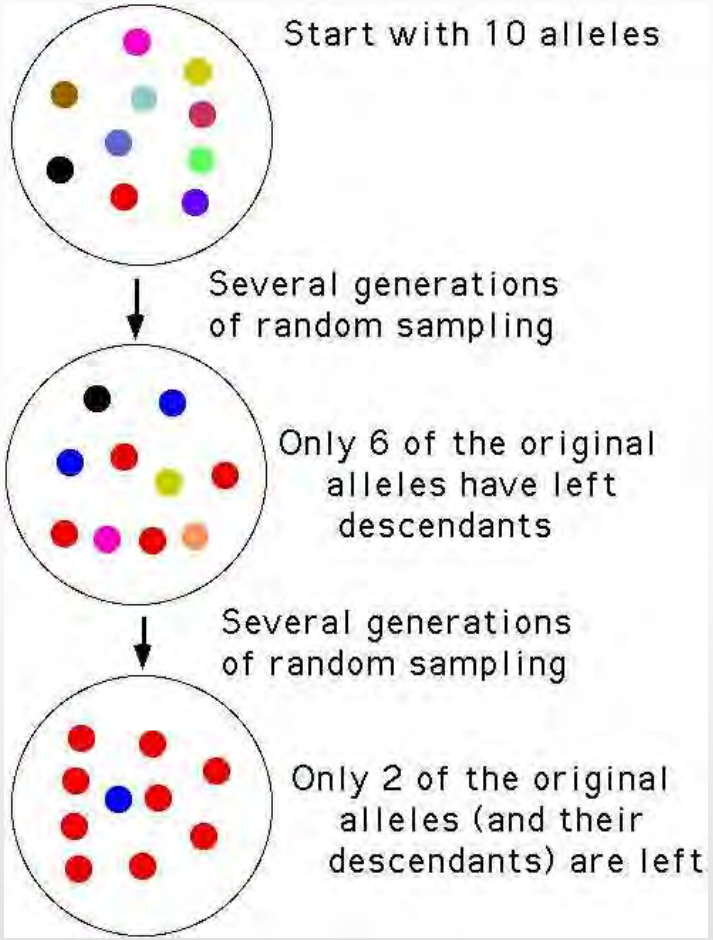
Loss of Gene Diversity by Drift

Unrelated Animals

Allele C is lost



Loss of Genetic Diversity - THE RISKS:



- **Reduced adaptability to environmental change**
  - **loss of disease resistance**
  - **new directions in trait selection**
- **Inbreeding depression**
  - **loss of fertility**
  - **reduction in fitness**

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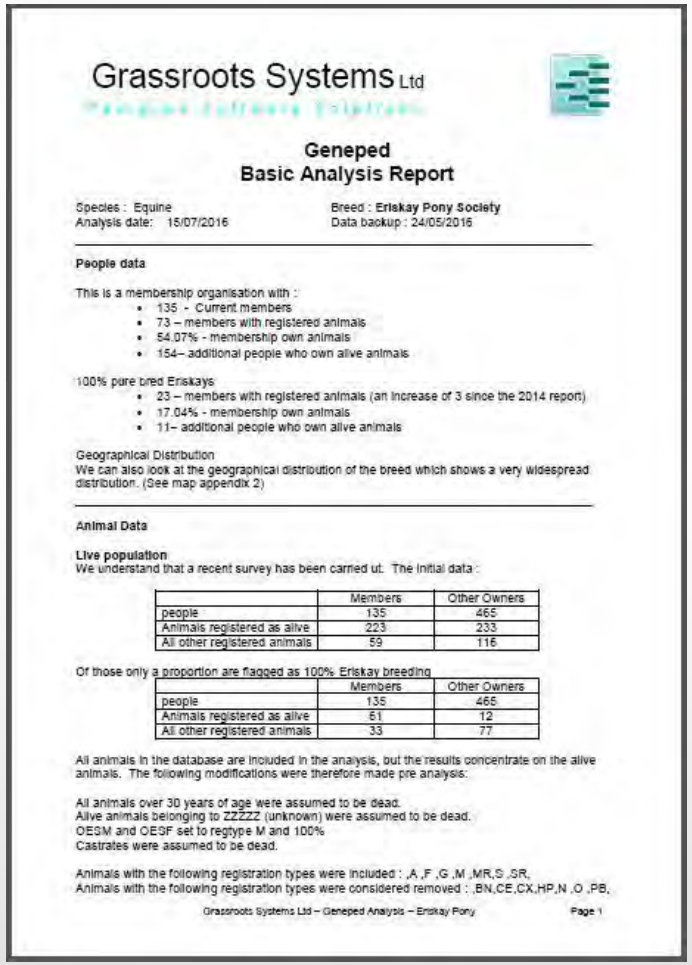
Core Concepts



Grassroots Systems Ltd

Geneped
Basic Analysis Report

Species : Equine
Analysis date: 15/07/2016

Breed : **Eriskay Pony Society**
Data backup : 24/05/2016

People data

This is a membership organisation with :

- 135 - Current members
- 73 – members with registered animals
- 54.07% - membership own animals
- 154– additional people who own alive animals

100% pure bred Eriskays

- 23 – members with registered animals (an increase of 3 since the 2014 report)
- 17.04% - membership own animals
- 11– additional people who own alive animals

Geographical Distribution
We can also look at the geographical distribution of the breed which shows a very widespread distribution. (See map appendix 2)

Animal Data

Live population
We understand that a recent survey has been carried ut. The initial data :

	Members	Other Owners
people	135	465
Animals registered as alive	223	233
All other registered animals	59	116

Of those only a proportion are flagged as 100% Eriskay breeding

	Members	Other Owners
people	135	465
Animals registered as alive	61	12
All other registered animals	33	77

All animals in the database are included in the analysis, but the results concentrate on the alive animals. The following modifications were therefore made pre analysis:

All animals over 30 years of age were assumed to be dead.
Alive animals belonging to ZZZZZ (unknown) were assumed to be dead.
OESM and OESF set to regtype M and 100%
Castrates were assumed to be dead.

Animals with the following registration types were included : ,A ,F ,G ,M ,MR,S ,SR,
Animals with the following registration types were considered removed : ,BN,CE,CX,HP,N ,O ,PB,

Grassroots Systems Ltd – Geneped Analysis – Eriskay Pony Page 1

- Inbreeding
- Mean Kinship
- Effective Population Size

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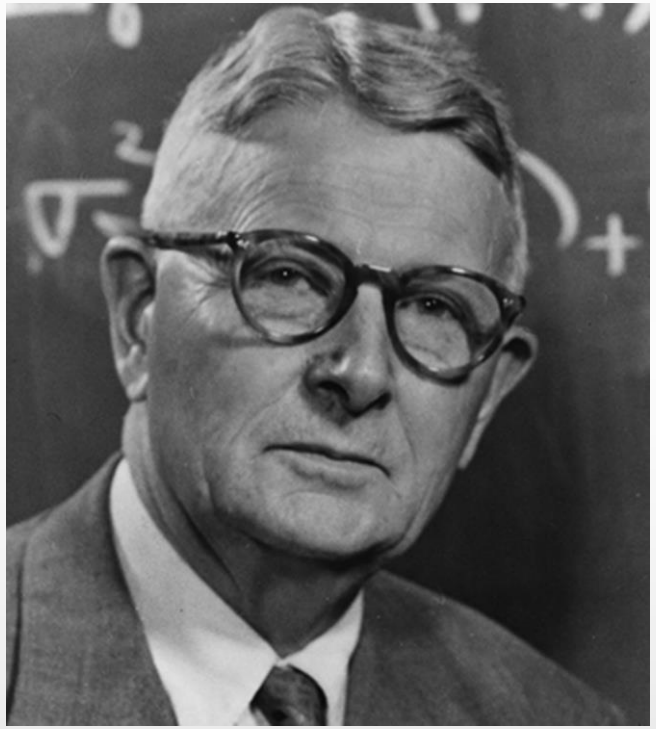
Sewall Wright



"Coefficients of Inbreeding and Relationship" (1921)

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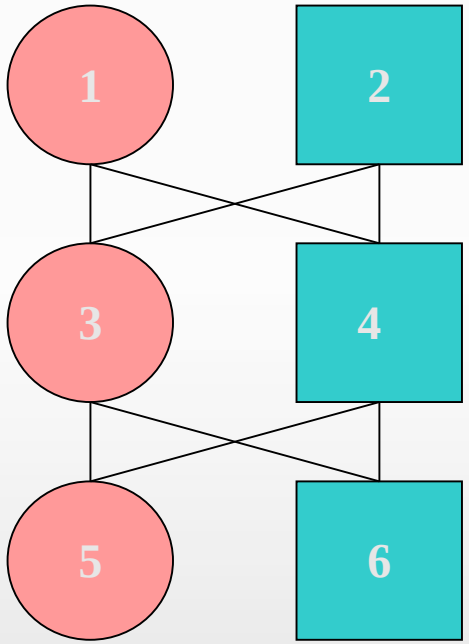
Inbreeding

Unrelated Animals

Non-inbred offspring

Inbred offspring



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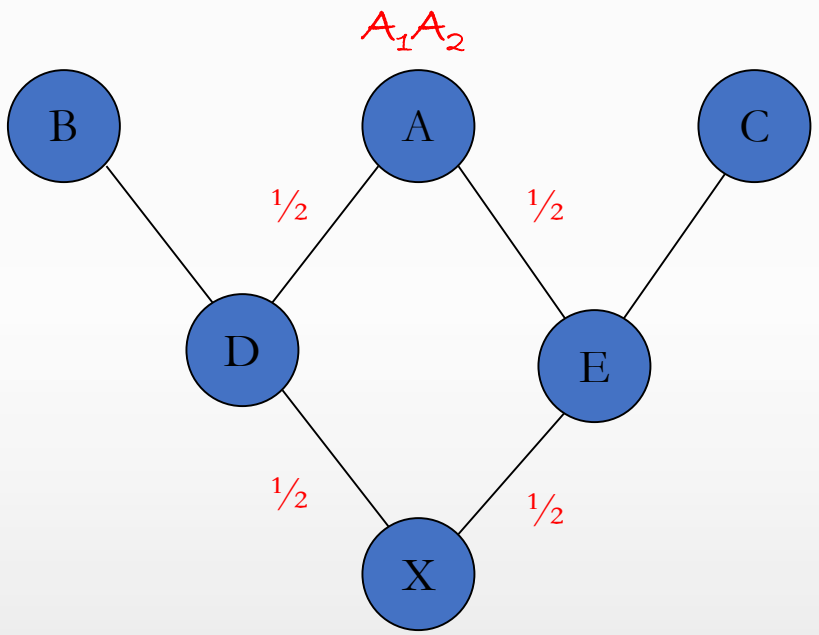
Inbreeding

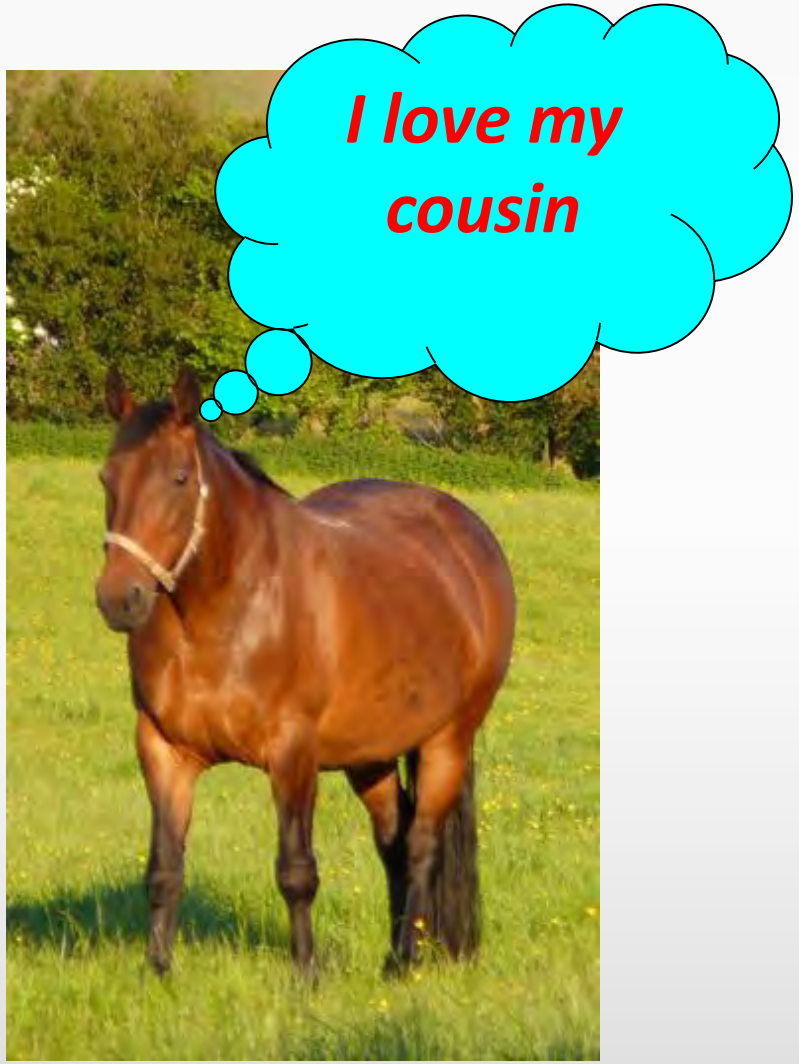
- An individual is inbred if its mother and father share a common ancestor
- The Inbreeding Coefficient (F) of an individual is defined as the probability that for a randomly-chosen neutral locus the two alleles carried by the individual are identical by descent.

Estimating Inbreeding in Pedigrees



- What is inbreeding coefficient of individual X?
- Pr(A_1 transmitted to offspring) = ½
- Pr(X is A_1A_1) = $(½)^4$ = 1/16 = 0.0625
- Pr(X is A_2A_2) = $(½)^4$ = 1/16 = 0.0625
- Pr(X is A_1A_1 or A_2A_2) = $(½)^4 + (½)^4 = (½)^3$ = 1/8 = 0.125

Inbreeding



- Reduces gene diversity (GD)
- Reduces fitness
- Greatly increases probability of expressing deleterious alleles

- Populations with DEEP inbreeding

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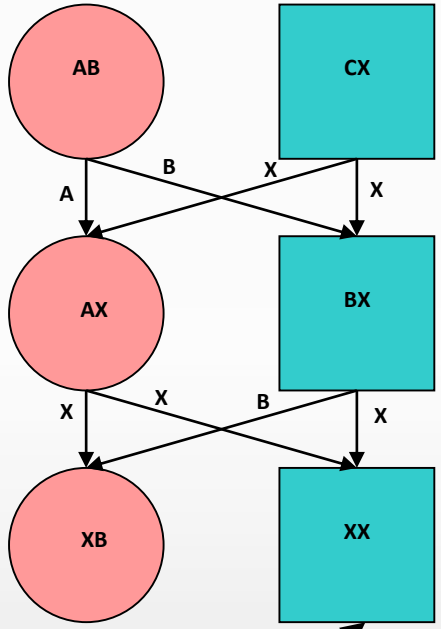
Inbreeding Depression

Unrelated Animals

Non-inbred offspring

Inbred offspring



X is a rare deleterious allele

Following deleterious allele X through a pedigree

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Inbreeding in Other Equine Breeds

Breed	Average Inbreeding	Reference
Andalusian horses	8.48%	(Valera et al., 2005)
North American Standardbreds	8.99%	(MacCluer et al., 1983)
Spanish Arab horses	7.0%	(Cervantes et al., 2008)
Thoroughbreds	12.5%	(Mahon and Cunningham, 1982)
Lipizzan horses	10.81%	(Zechner et al., 2002)
Thoroughbred in France	2.40%	(Moureaux et al., 1996)
Arab in France	7.10%	(Moureaux et al., 1996)
Friesian horses	15.7%	(Sevinga et al., 2004)
South German coldblood horses	2.28%	(Aberle et al., 2004)
Black Forest horses	5.21%	(Aberle et al., 2004)

Inbreeding in the Cleveland Bay

Mean Inbreeding in the Cleveland Bay Horse 1900 to 2016

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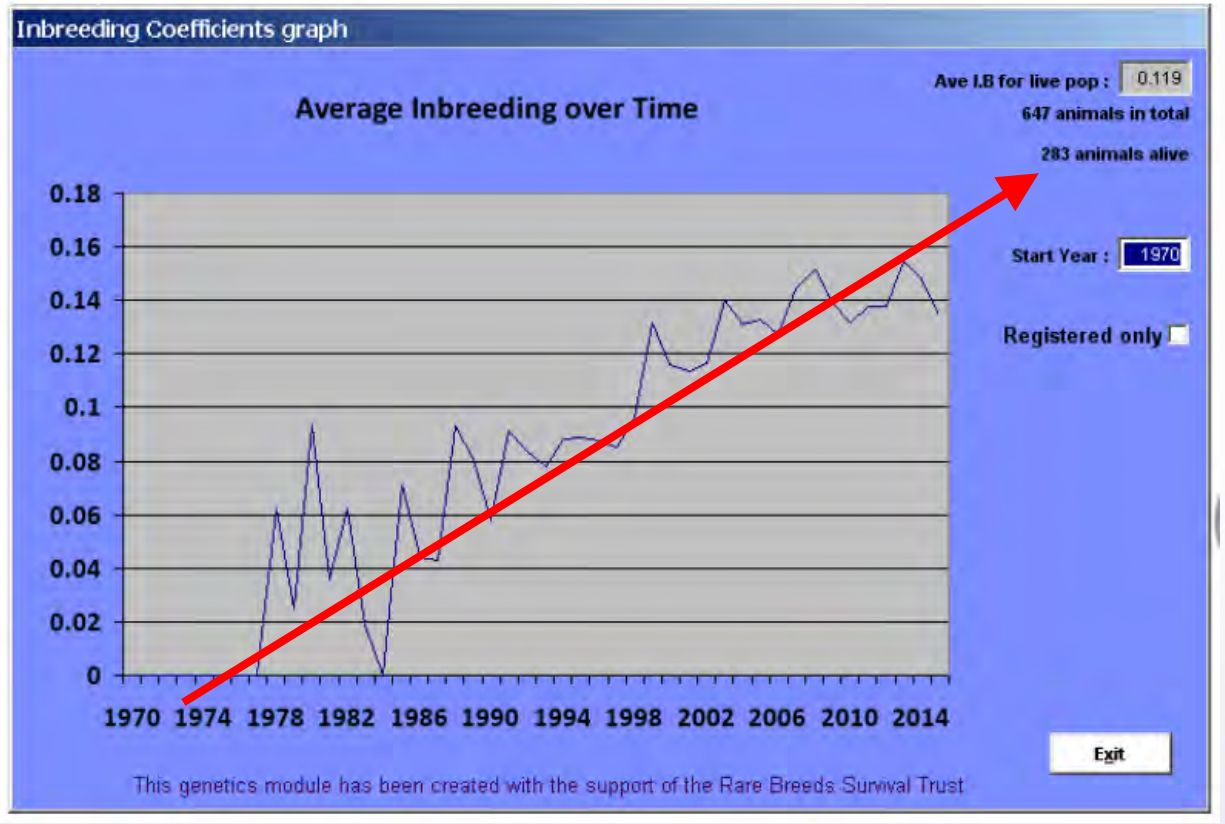
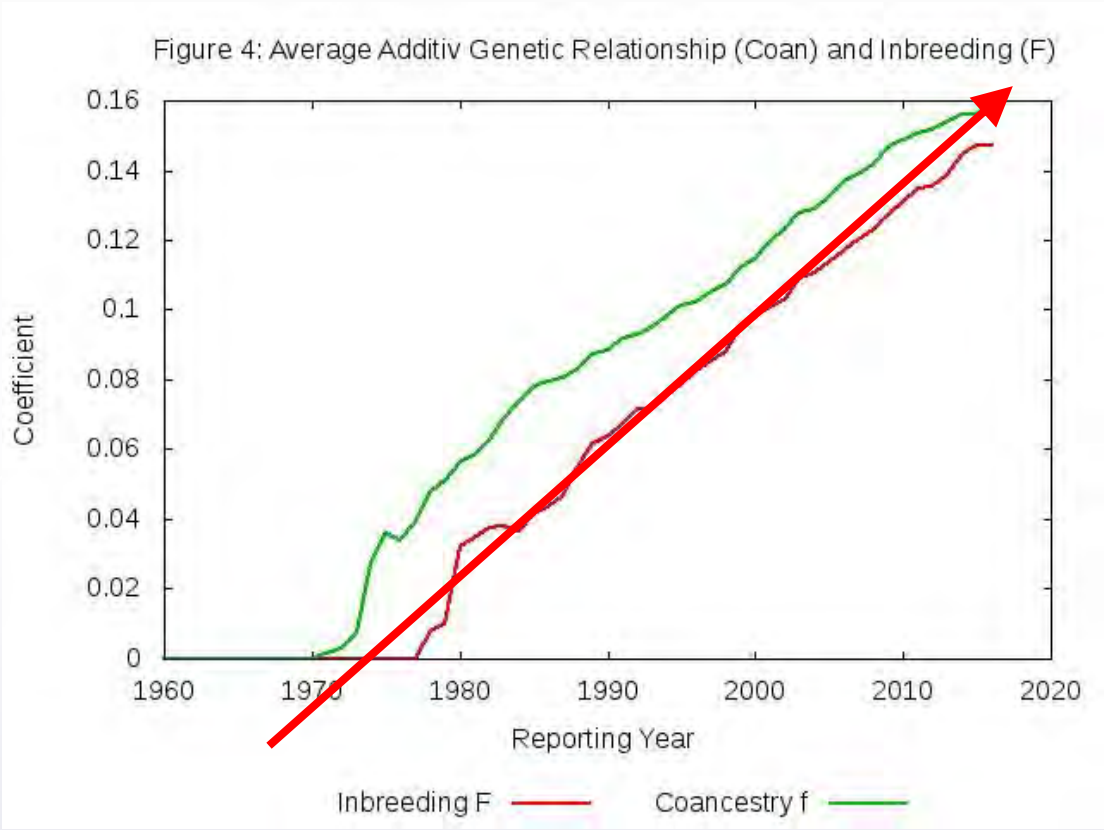
Inbreeding in the Eriskay Pony





Mean Inbreeding in the Eriskay Pony 1960 to 2015

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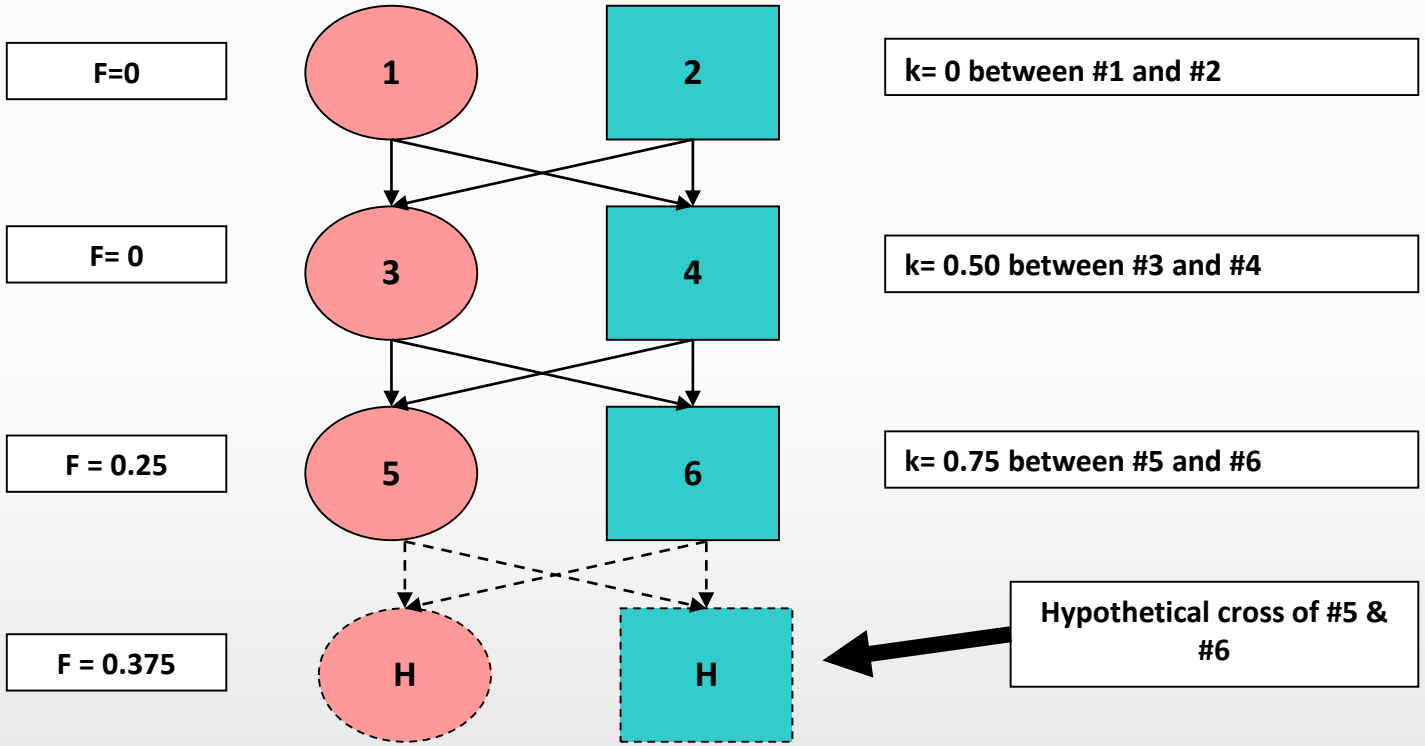
Kinship Coefficient

- Quantifies degree of relationship between two individuals
- Kinship Coefficient is defined as the probability that any two randomly-chosen neutral alleles from the same locus in two individuals will be identical by descent.
- Full siblings are 50% (0.5) related, Parents and Offspring are 50% (0.5) related, half siblings are 25% (0.25) related.

Kinship



Kinship Coefficients of a Simple Pedigree

Mean Kinship

- Mean kinship is defined as the average of the kinship coefficients between an individual and all living individuals in the population.
- Quantifies the relationship of an individual to the rest of the population.
- Indicator of genetic diversity (genetic health of population).
- Individuals with many living close relatives carry alleles that are more common in the population and are therefore less important than individuals with few relatives.

Managing Mean Kinship

- The values range from 0 (animal has no relatives in the mean descendant population) to 1 (the animal is completely related to every animal in the living descendant population).
- The lower the mean kinship of an individual is the more important this animal is for breeding to preserve the genetic diversity of the founders.
- Managing by Mean Kinship increases the contribution of genes from animals carrying rarer genes and decreases those carrying more common ones.

Population Size

- Ideal Populations:
  - Infinitely large
  - Random mating
  - All individuals contribute equally to next generation
  - No overlapping generations
- Real Populations:
  - Restricted size
  - Unequal sex ratios
  - Unequal family sizes
  - Selection
  - Overlapping generations

Effective Population Size (Ne)

- One of the most important parameter in population genetics and conservation biology.
- Translates census sizes of a real population into the size of an idealized population showing the same rate of loss of genetic diversity as the real population under study.
- Several conceptually different types of N_e can be distinguished, but the most commonly used ones are those based on the loss of genetic diversity through inbreeding (inbreeding N_e) and through imbalance of number of parent animals (Census N_e).

Calculating Effective Population Size

- From Rate of Increase In Inbreeding

$$N_e = \frac{1}{2\Delta F}$$

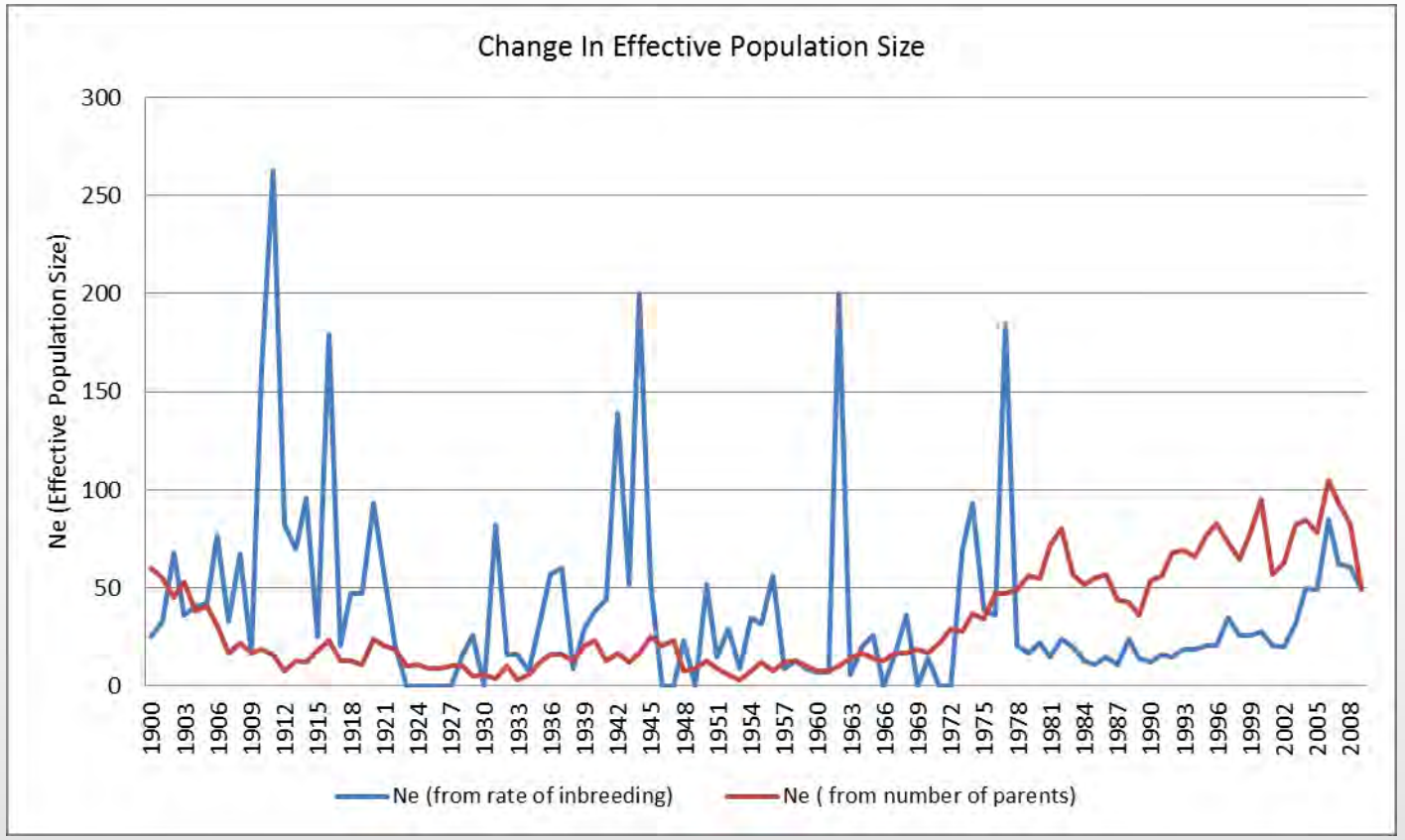
- From Number of Parents

$$N_e = \frac{4N_m N_f}{N_m + N_f}$$

Effective Population Size

- Effective population size (Ne) is the number of individuals that would give rise to the observed or calculated rate of inbreeding (ΔF), if they bred in the manner of the idealized population
- (Falconer & Mackay, 1996).

Change in Effective Population Size



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The Problems of Small Populations

Ne	Increase in inbreeding and portion of genetic variation lost per generation
100	0.5%
50	1%
25	2%
12	4%
6	8%

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The Problems of Unbalanced Sex Ratio

Effect of sex ratio on Ne

Population of census size 100

No. males	No. females	Ne	Accumulating inbreeding/ genetic loss per generation
50	50	100	0.5%
25	75	75	0.7%
10	90	36	1.4%
5	95	19	2.6%
2	98	8	6.5%
1	99	4	12.5%

$$N_e = \frac{4N_m N_f}{N_m + N_f}$$

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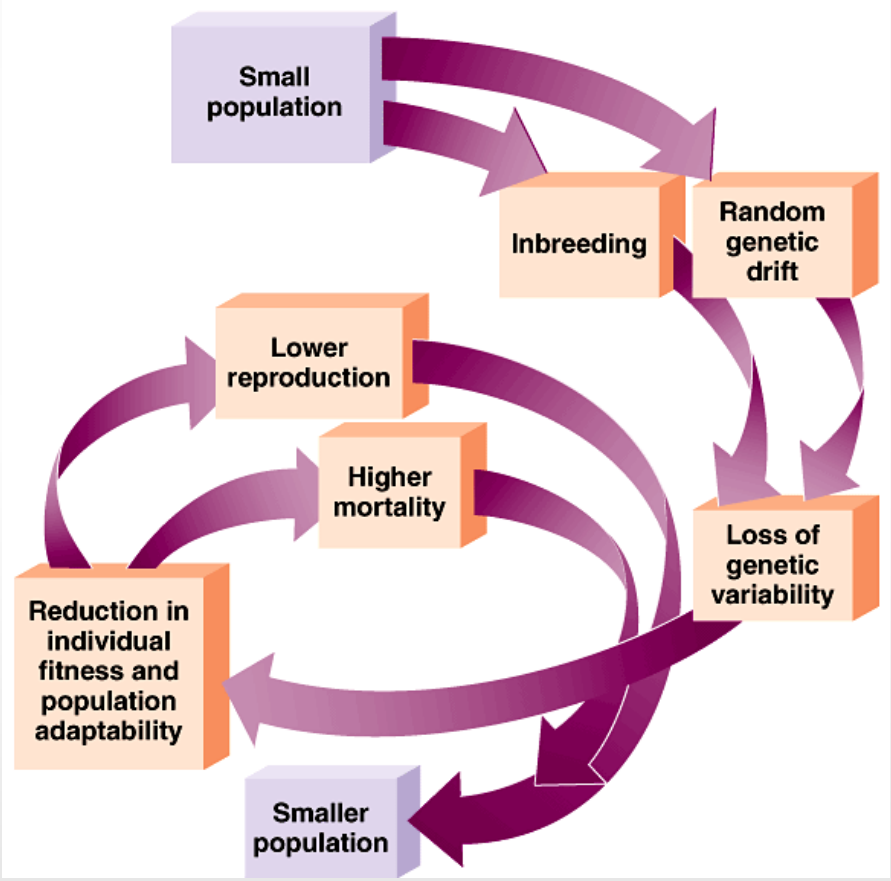
The 50 / 500 Rule

- Ne > 50 necessary for short term survival (avoid inbreeding)
- Ne > 500 needed for long term survival (ability to evolve in changing environments)
- A genetically effective population size of at least 50 individuals is necessary for genetic diversity in the short term and to avoid inbreeding depression.
- An Ne of 500 is needed to avoid serious genetic drift in the long term
- *Franklin 1980*

The Extinction Vortex



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Does The 50 / 500 Rule Need Revising?

There is current debate that suggests
it might be more realistic to judge
Minimum Viable Population Size (MVP)
by a 100 / 1000 rule

Frankham Franklin et al 2014

Choices For Managing Pedigreed Populations

- Divide the population into sub populations and keep them apart
- Random Mating
- Rotational Mating
- Dominant Male

Choices For Managing Pedigreed Populations

- Maximum avoidance of inbreeding.
- Genome Uniqueness.
- Founder importance.
- Minimizing Kinship.
- Of these controlling the rate of increase in inbreeding through managing Mean Kinship remains the No.1 choice.
- *Putnam & Ivy 2014*

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Choices For Managing Pedigreed Populations

- What about genomic methods?
- Molecular Mean Kinship
- As Breed Societies you have a huge resource in the studbook and pedigree based methods.

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Choosing Mates

- Mates are chosen such that matings between individuals with quite different mean kinships are avoided as they limit management options in the future.
- If a valuable individual (low MK) is mated to one of low value (high MK), increasing the contribution of the under-represented individual also increases the contribution of its over represented mate.
- Matings of close relatives is avoided to minimize inbreeding.

Methods Of Breeding To Minimise Mean Kinship

- Encourage matings between animals of broadly similar Mean Kinship values.
- This will prevent the crossing of rare bloodlines – something to be avoided if we are to maintain diversity within the breed
- Because Mean Kinship values change with each batch of registrations the data will need updating on an annual basis.

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What Will Minimising Mean Kinship Do?

- Reduce rate of increase in inbreeding.
- Prevent crossing rare and common genes.
- Maintain genetic diversity.
- Identify genetically important individuals & priority breeders

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Factors To Consider When Selecting Matings:

- Breed from as many Males and Females as possible
- This maximises Effective Population Size
- Avoid overuse of a selected small group of Stallions

1: Merge pedigrees

Step 2 »

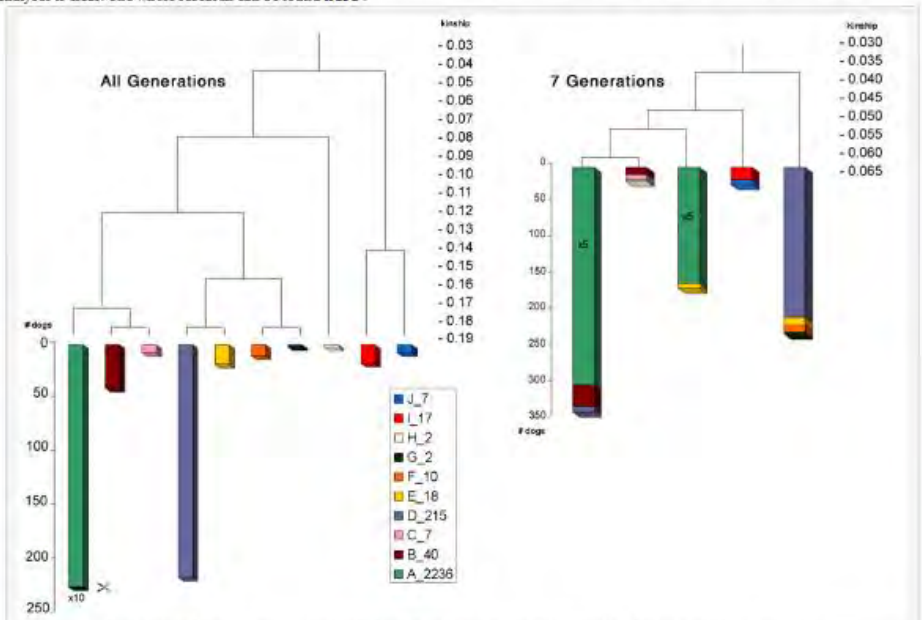
Merge pedigree
Combine all regional pedigree data into one global database table.

If you want to preserve a population, take the first step: make one database table containing all animals worldwide. This effort is more than simply add all records in one file. If several tables exist and there has been exchange of animals, the records need to be connected. There should not be double records, especially for animals that have offspring.
More importantly, connecting all data will avoid animals from being registered without known parents.

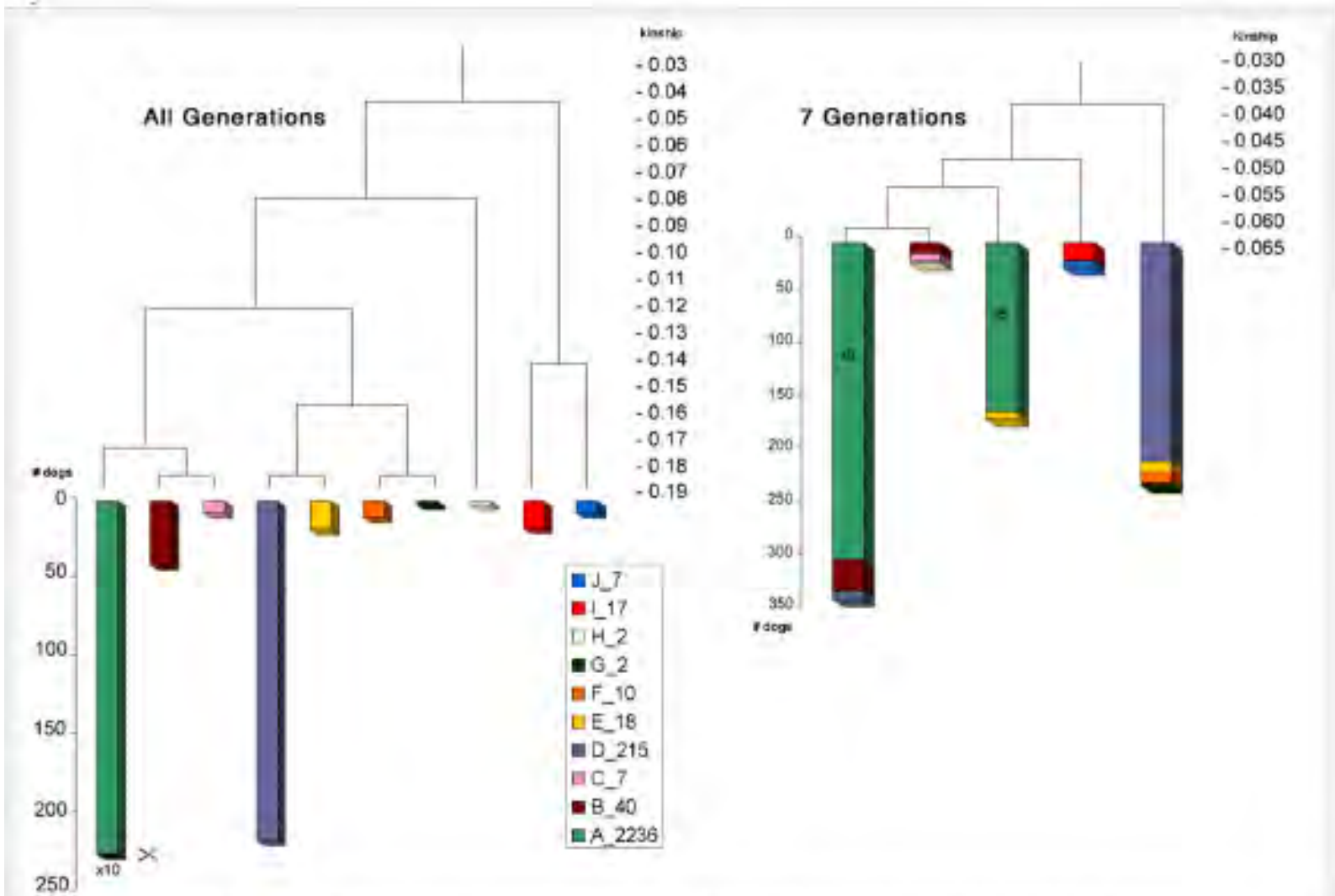
Necessity for the next step
The reason for the first step is to avoid animals with unknown parents. If all parents are known all pedigrees will end up into the original founder individuals (see **Step 2**). If data is not connected there will be gaps in the pedigree with a dramatic result for diversity.

Regional populations
Is it possible to preserve a population on regional level? Of course it is possible to apply the next steps on pedigrees of only one country (often done in domestic breeds) or a continent (often done in species conservation programs, like **EEP** in zoos). The result of this effort towards conservation of the entire population, either breed or species, however is uncertain. It might very well be that the animals that show as genetically important in step 3 are actually abundant when the global population would be analyses. Or worse, animals that do *not* show as important, actually *are* if the entire population is analysed.

Analysis based on incomplete pedigrees
When analysis is based on kinship calculated for 7, 8 or 9 generations, research showed that there was no significant difference. This led to the widespread misapprehension that not all generations are needed to calculate kinship. When kinship was calculated up to the founders, however and therefore all generations were involved, research showed that analysis changed dramatically. The figure below illustrates this difference. Cluster analysis was performed two times on the same populations. There is no need for details here, but the difference between the two analyses is clear. The whole research can be found **here** .



Cluster analysis of the same population based on kinship calculated from all generations compared with kinship calculated for 7 generations.
The most important thing to notice: with an incomplete dataset, the 'image' looks completely different.



Cluster analysis of the same population based on kinship calculated from all generations compared with kinship calculated for 7 generations.

The most important thing to notice: with an incomplete dataset, the 'image' looks completely different.

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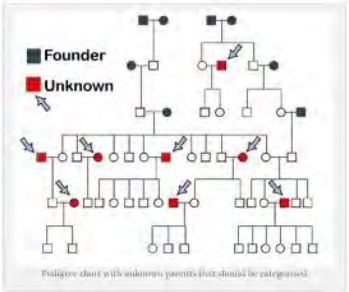
2: Identify Founders

« Step 1 Step 3 »

Identify Founders as well as potential parents for animals without parents registered is the second step. Preferably also record the place or region where founders were collected. This step will complete the dataset and make it ready for analysis. It is necessary to characterise and maximise genetic diversity.



Pedigree chart with unknown parents that should be categorised.

Necessity for the next step
When founders are not identified, and all animals without registered parents are regarded as founders, the genetic diversity might look much higher than it actually is. The tools presented in **step 3** will therefore promote the wrong animals, due to unidentified relations within the population.

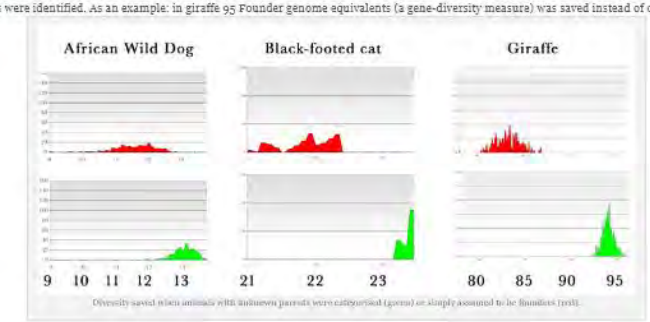
Founders
Founders are simply defined as animals that are unrelated to each other. All pedigree end up in the founder animals. Founders are animals that belonged to the 'source population'. In zoo-populations these are the animals that were caught from the wild. For example, the number of founders of the global captive Red Panda population is 35. In domestic breeds the founders might sometimes be more difficult to identify. However, many dog breeds started with only a few founders, making it easier to identyfy them. For the Icelandic Sheepdog the number of founders was no more than 20. The place of origin of these animals are known for most of these 20 founders.

Two or three categories
All animals *without* parents registered should be assigned to the following categories:
1. Founders (true founders are unrelated to all other founders)
2. Related 'orphans": animals that descent from founders but without known parents
3. Unknown: animals of which there is no idea at all where they came from

Only use "Unknown" if animals have a high chance of being a founder, otherwise don't put an animal into this category.
For founders it is important to get their background story. For wild-caught animals the place of origin is important as well as the (suspected) subspecies of this animal. In breeds, it is also handy to add a note per founder. Moreover, sometimes other breeds are introduced into the population. These animals are also 'founder-animals'.
If possible one should identify possible parents for 'Related orphans'. In step 3 we can make use of that information. In advanced kinship calculation software the probable parents of related orphans are incorporated. Conservation strategies based on these kinship calculations are more effective.

How to categorise animals with unknown parents?
As in the previous step, for this you need to find someone that is experienced in databases. In larger datasets with a high number of parents with unknown parents, it is advisable to 'clean' animals that did not contribute to the current population, before you start identifying founders and probable parents.

Necessity for next step
When founders are not identified than all animals with unknown parents are assumed to be founders when kinship is calculated. Analysis based on incomplete pedigrees might even have negative effect on breeding decisions: it might reduce diversity. In a study of three populations having unregistered parents, the effect of not identifying founders was investigated. The results were published in **my thesis**. An indication of the effect is shown below. The figure shows diversity saved by simulations based on existing pedigrees where animals with unknown parents were not corrected (red area; the upper graph) or corrected by probable parents (green area; the lower graph). Simulations were based on existing pedigrees of three zoo-populations. The diversity saved was much higher in each population when true founders and probable parent for related orphans were identified. As an example: in giraffe 95 Founder genome equivalents (a gene-diversity measure) was saved instead of only 84.



Diversity saved when animals with unknown parents were categorised (green) or simply assumed to be founders (red).

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Breeding for Diversity

A SCIENCE BASED GUIDE

3: Find genetically important animals

« Step 2 Step 4 »

With the pedigree complete and reliable, the importance of each animal in the current population can be calculated. Per animal one should calculate:

1. **optimal contribution** (OC);
2. actual (current) contribution (CC);
3. **mean kinship** (MK).

This will result in a list with each candidate (fertile animal of the current population) and their contributions and mean kinship. Here at the right you find an example of such a list. HouseName is the name of the animal, NOffs is the number of offspring of each animal. Note that the number of offspring differs from the CC (current contribution). There are two reasons: 1) a parent only contributes half; 2) offspring has offspring themselves resulting in an increase of the contribution of the (grand-)parent. MK (mean kinship is a percentage between 0 and 1; while OC is presented in the contribution required from this animal. In this example the current contribution already exceeds the wanted contribution.

HouseName	MK	OC	CC	NOffs
Nyota	0.04		1	0
Nathan	0.04		1.5	1
Matata	0.02	0.57	6.75	8
Panbanisha	0.02	0.13	2.25	2
Lomela ii	0.01	0.94	1	0
Congo ii	0.01	0.94	1	0
Piiske	0.01	0.94	3.5	4
Nn	0.00		1	0
Cheetah	0.00	0.94	1	0

PMx is developed for Zoos

Software

The only software that calculates kinship and is freely available is PMx. **Click here for the website** about PMx. The program is well documented in a manual, which you can download from the same website. PMx was developed to support Zoos in maintaining their populations. PMx does not calculate optimal contributions. There is a need for software that easy to work with and provides the list as described on this page. A tool that would facilitate breeding for diversity. With a relative small investment this could benefit thousands of endangered populations. Please **get in contact** if you want to contribute to such a tool, in one way or another!

« Step 2 Step 4 »

Maintained by At Your Side

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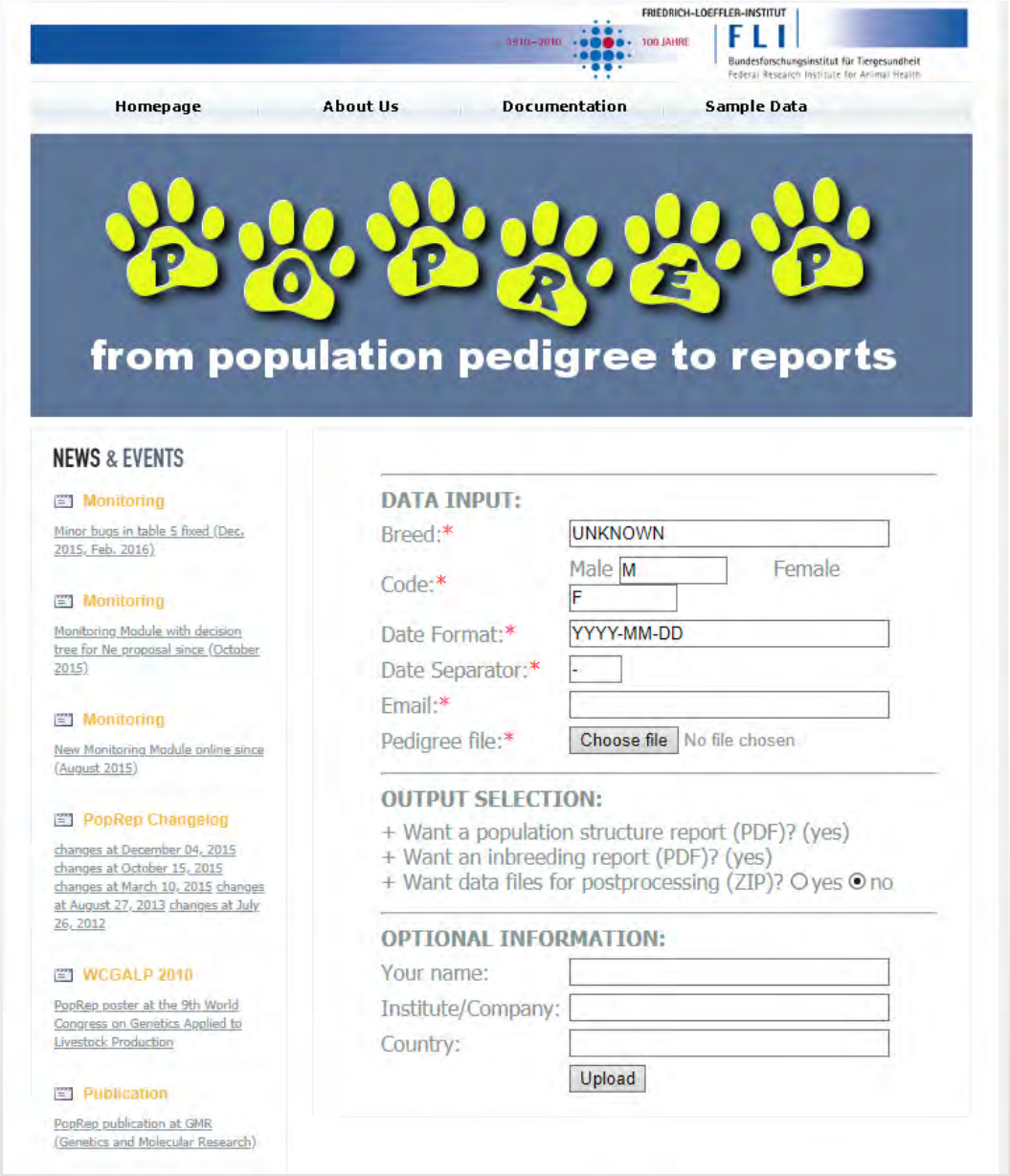

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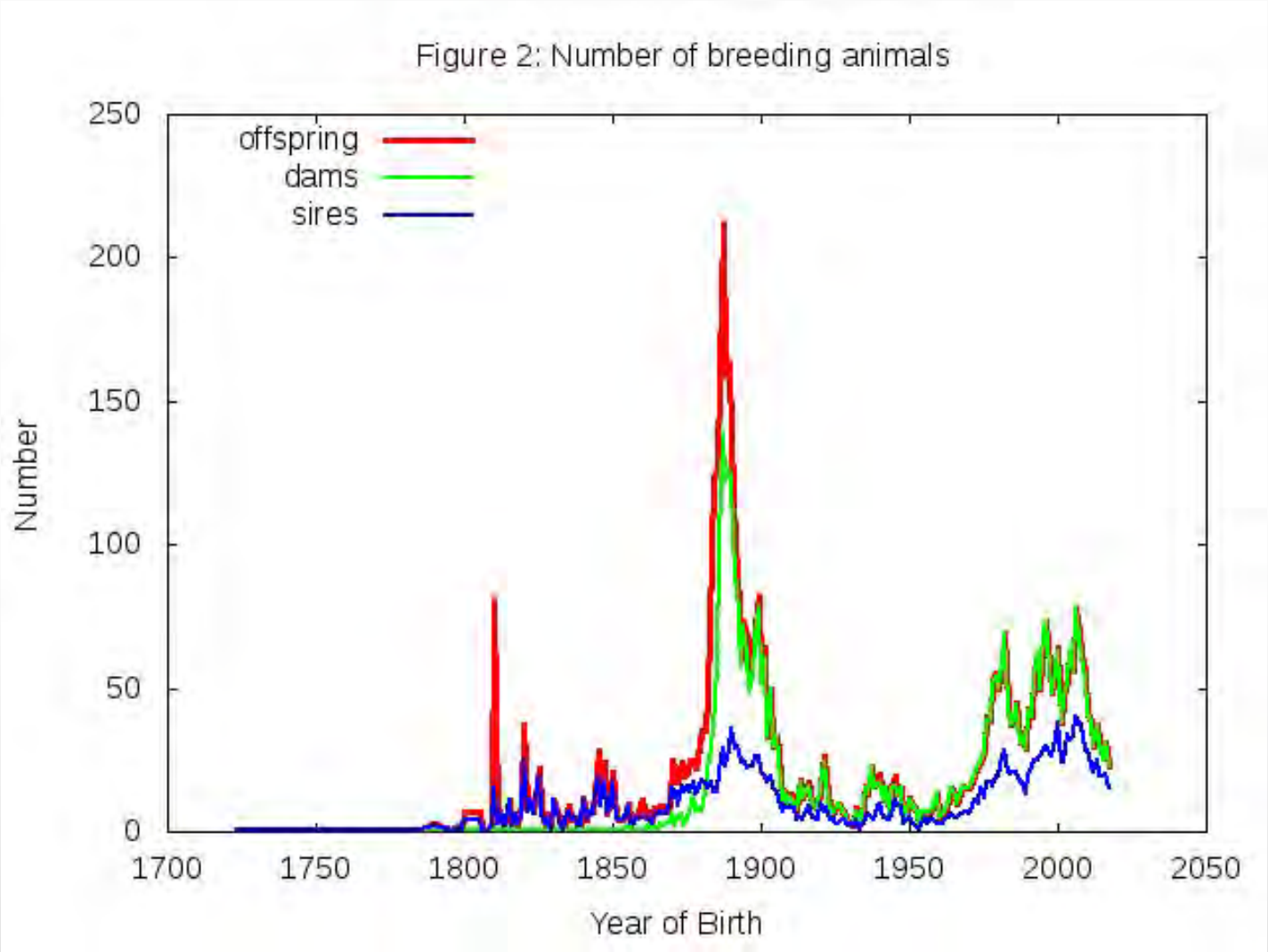
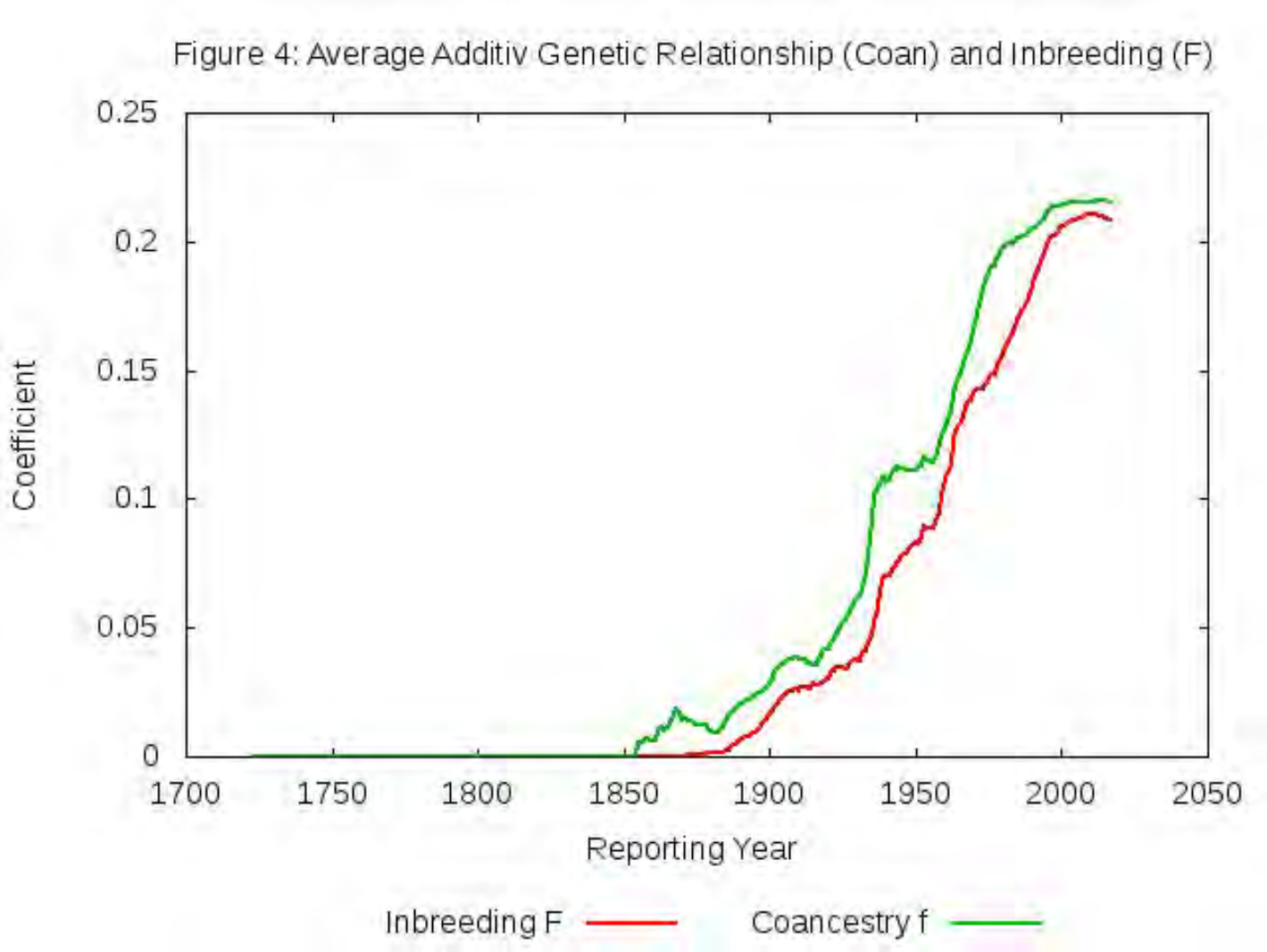
PopReport
A Pedigree Analysis Report

Population: ClevelandBayHorse (Cleveland Bay Horse)
Inputfile: PopRep2018.txt
Initiated by: Andy Dell <andy.dell@btinternet.com>
RBST United Kingdom
Submitted at: 2018-01-22 20:30:19
Started at: 2018-01-22 20:31:01
Finished at: 2018-01-22 20:33:00

Courtesy: Department of Animal Breeding and Genetics
Institute of Farm Animal Genetics (FLI)
Eildert.Groeneveld@fli.de
Höltystrasse 10
D–31535 Mariensee, Germany
http://popreport.tzv.fal.de



Monitor Save Promote



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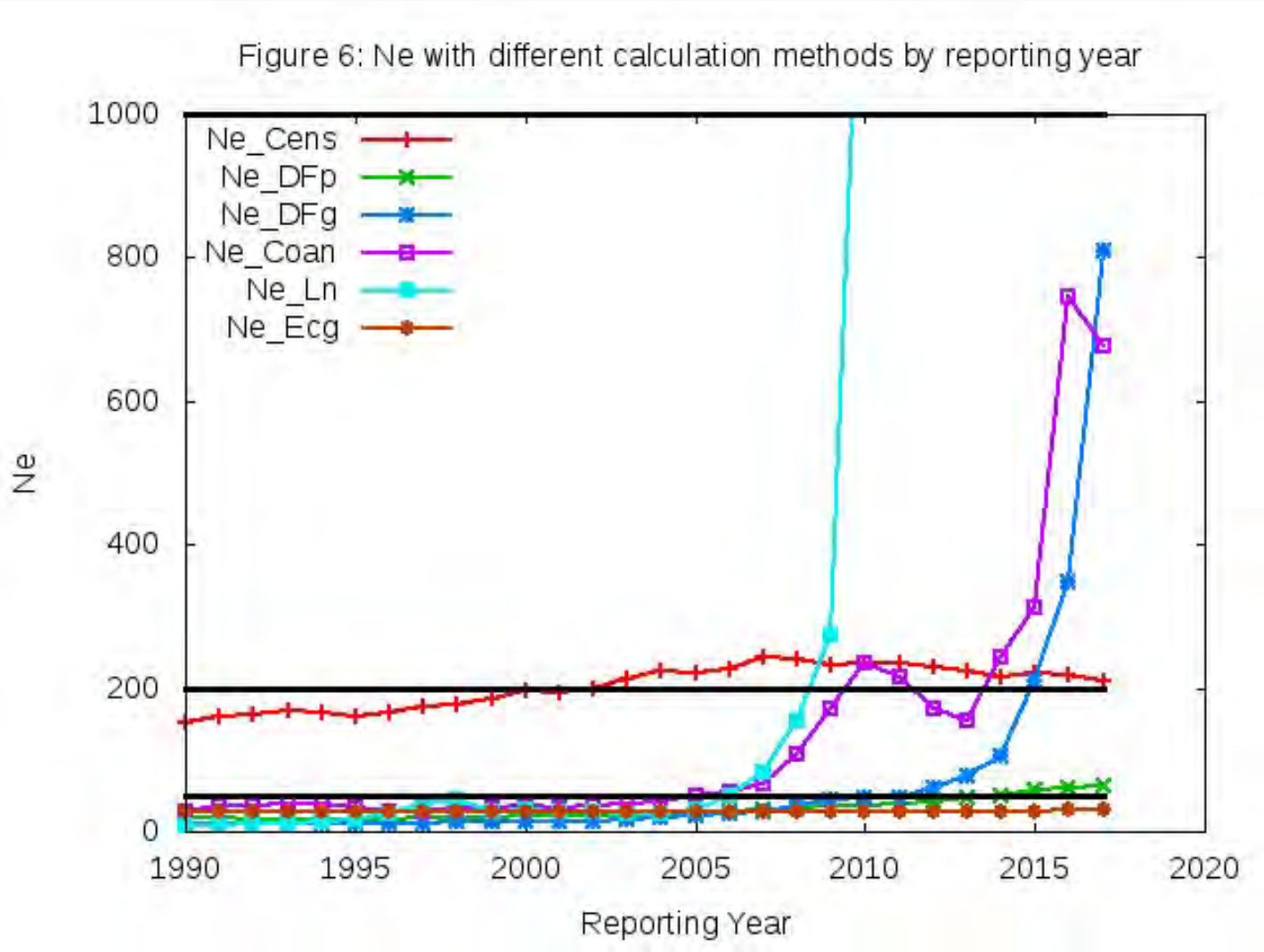

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Table 3: Effective Population Size N_e

N_e-Method	2017	2016	2015	2014	2013	2012	data history
N_e-Cens	210	219	220	216	225	229	2004 – 1992
N_e-ΔF_p	64	60	58	50	47	42	2017 – 1992
N_e-ΔF_g	810	349	210	104	76	60	2017 – 1992
N_e-Coan	676	746	313	244	156	171	2030 – 2005
N_e-Ln	-2896	-118	-40	-46	-48	-68	2017 – 2005
N_e-Ecg	30	30	29	29	29	29	2017 – 1723

Proposed N_e: N_e-$\Delta F_p = 64$

Note: The last year is assumed to have complete data!

Questions

RBST
Rare Breeds Survival Trust

SPARKS

As A Breeding Tool

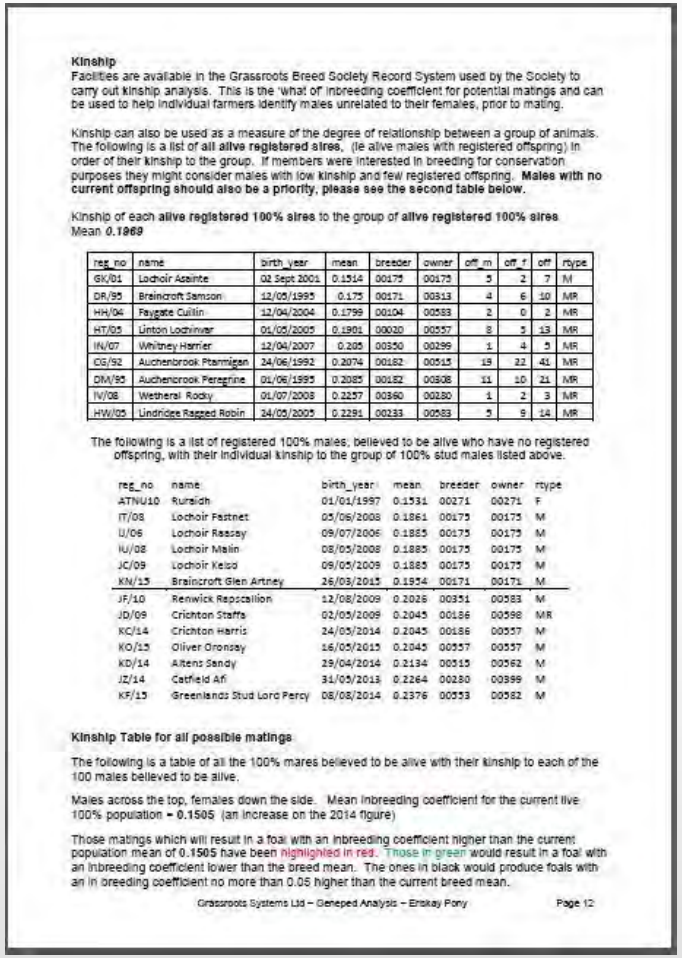
RBST

Rare Breeds Survival Trust

What's Wrong With Random Mating?

Monitor Save Promote

Looking For Practical Solutions



Kinship
Facilities are available in the Grassroots Breed Society Record System used by the Society to carry out kinship analysis. This is the 'what of' inbreeding coefficient for potential matings and can be used to help individual farmers identify males unrelated to their females, prior to mating.

Kinship can also be used as a measure of the degree of relationship between a group of animals. The following is a list of **all alive registered sires**, (ie alive males with registered offspring) in order of their kinship to the group. If members were interested in breeding for conservation purposes they might consider males with low kinship and few registered offspring. **Males with no current offspring should also be a priority, please see the second table below.**

Kinship of each **alive registered 100% sires** to the group of **alive registered 100% sires**
Mean ***0.1969***

reg_no	name	birth_year	mean	breeder	owner	off_m	off_f	off	rtype
GK/01	Lochoir Asainte	02 Sept 2001	0.1514	00175	00175	5	2	7	M
DR/95	Braincroft Samson	12/05/1995	0.175	00171	00313	4	6	10	MR
HH/04	Faygate Cuillin	12/04/2004	0.1799	00104	00583	2	0	2	MR
HT/05	Linton Lochinvar	01/05/2005	0.1901	00020	00557	8	5	13	MR
IN/07	Whitney Harrier	12/04/2007	0.205	00350	00299	1	4	5	MR
CG/92	Auchenbrook Ptarmigan	24/06/1992	0.2074	00182	00515	19	22	41	MR
DM/95	Auchencrook Peregrine	01/06/1995	0.2085	00182	00808	11	10	21	MR
IV/08	Wetheral Rocky	01/07/2008	0.2257	00360	00280	1	2	3	MR
HW/05	Lindrides Ragged Robin	24/05/2005	0.2291	00233	00583	5	9	14	MR

The following is a list of registered 100% males, believed to be alive who have no registered offspring, with their individual kinship to the group of 100% stud males listed above.

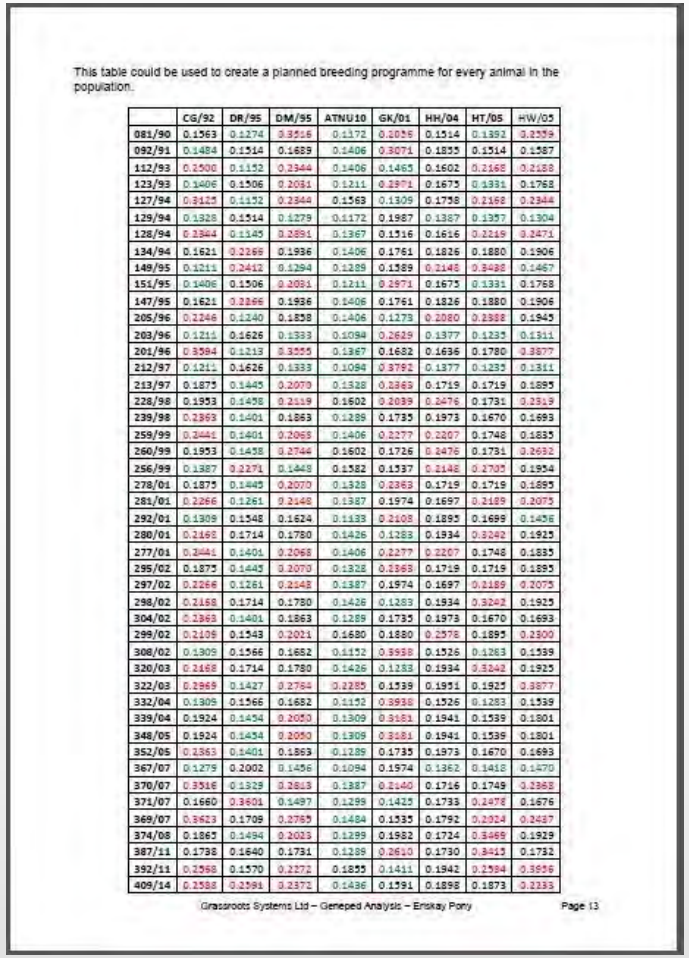
reg_no	name	birth_year	mean	breeder	owner	rtype
ATNU10	Rursidh	01/01/1997	0.1531	00271	00271	F
IT/08	Lochoir Fastnet	05/06/2008	0.1861	00175	00175	M
IJ/06	Lochoir Rassay	09/07/2006	0.1885	00175	00175	M
IU/08	Lochoir Malin	08/05/2008	0.1885	00175	00175	M
JC/09	Lochoir Kelso	09/05/2009	0.1885	00175	00175	M
KN/15	Braincroft Glen Artney	26/03/2015	0.1954	00171	00171	M
JF/10	Renwick Rapscallion	12/08/2009	0.2026	00351	00583	M
JD/09	Crichton Staffa	02/05/2009	0.2045	00186	00598	MR
KC/14	Crichton Harris	24/05/2014	0.2045	00186	00557	M
KO/15	Oliver Oronsay	16/05/2015	0.2045	00557	00557	M
KD/14	Altens Sandy	29/04/2014	0.2134	00315	00562	M
JZ/14	Catfield Afi	31/05/2013	0.2264	00280	00399	M
KF/15	Greenlands Stud Lord Percy	08/08/2014	0.2376	00553	00582	M

Kinship Table for all possible matings

The following is a table of all the 100% mares believed to be alive with their kinship to each of the 100 males believed to be alive.

Males across the top, females down the side. Mean inbreeding coefficient for the current live 100% population = **0.1505** (an increase on the 2014 figure)

Those matings which will result in a foal with an inbreeding coefficient higher than the current population mean of **0.1505** have been highlighted in red. Those in green would result in a foal with an inbreeding coefficient lower than the breed mean. The ones in black would produce foals with an in breeding coefficient no more than 0.05 higher than the current breed mean.



This table could be used to create a planned breeding programme for every animal in the population.

	CG/92	DR/95	DM/95	ATNU10	GK/01	HH/04	HT/05	HW/05
081/90	0.1563	0.1274	0.3516	0.1172	0.1056	0.1514	0.1392	0.2559
092/91	0.1484	0.1514	0.1689	0.1406	0.3071	0.1855	0.1514	0.1587
112/93	0.2500	0.1152	0.2344	0.1406	0.1465	0.1602	0.2168	0.2188
123/93	0.1406	0.1506	0.2031	0.1211	0.2971	0.1675	0.1331	0.1768
127/94	0.3125	0.1152	0.2344	0.1563	0.1309	0.1758	0.2168	0.2344
129/94	0.1328	0.1514	0.1279	0.1172	0.1987	0.1387	0.1357	0.1304
128/94	0.2344	0.1145	0.2891	0.1367	0.1516	0.1616	0.2249	0.2471
134/94	0.1621	0.2266	0.1936	0.1406	0.1761	0.1826	0.1880	0.1906
149/95	0.1211	0.2412	0.1294	0.1289	0.1589	0.2148	0.3488	0.1467
151/95	0.1406	0.1506	0.2031	0.1211	0.2971	0.1675	0.1331	0.1768
147/95	0.1621	0.2266	0.1936	0.1406	0.1761	0.1826	0.1880	0.1906
205/96	0.2246	0.1240	0.1858	0.1406	0.1279	0.2080	0.2388	0.1945
203/96	0.1211	0.1626	0.1333	0.1094	0.2629	0.1377	0.1235	0.1311
201/96	0.3594	0.1213	0.3555	0.1367	0.1682	0.1636	0.1780	0.3877
212/97	0.1211	0.1626	0.1333	0.1094	0.3792	0.1377	0.1235	0.1311
213/97	0.1875	0.1445	0.2070	0.1328	0.2363	0.1719	0.1719	0.1895
228/98	0.1953	0.1456	0.2119	0.1602	0.2039	0.2476	0.1731	0.2319
239/98	0.2363	0.1401	0.1863	0.1289	0.1735	0.1973	0.1670	0.1693
259/99	0.3441	0.1401	0.2068	0.1406	0.2277	0.2207	0.1748	0.1835
260/99	0.1953	0.1456	0.2744	0.1602	0.1726	0.2476	0.1731	0.2632
256/99	0.1387	0.2271	0.1448	0.1582	0.1537	0.2148	0.2705	0.1954
278/01	0.1875	0.1445	0.2070	0.1328	0.2363	0.1719	0.1719	0.1895
281/01	0.2266	0.1261	0.2148	0.1387	0.1974	0.1697	0.2189	0.2075
292/01	0.1309	0.1548	0.1624	0.1133	0.2108	0.1895	0.1699	0.1456
280/01	0.2168	0.1714	0.1780	0.1426	0.1283	0.1934	0.3242	0.1925
277/01	0.3441	0.1401	0.2068	0.1406	0.2277	0.2207	0.1748	0.1835
295/02	0.1875	0.1445	0.2070	0.1328	0.2363	0.1719	0.1719	0.1895
297/02	0.2266	0.1261	0.2148	0.1387	0.1974	0.1697	0.2189	0.2075
298/02	0.2168	0.1714	0.1780	0.1426	0.1283	0.1934	0.3242	0.1925
304/02	0.2363	0.1401	0.1863	0.1289	0.1735	0.1973	0.1670	0.1693
299/02	0.2109	0.1543	0.2021	0.1680	0.1880	0.2578	0.1895	0.2300
308/02	0.1309	0.1566	0.1682	0.1152	0.3938	0.1526	0.1283	0.1539
320/03	0.2168	0.1714	0.1780	0.1426	0.1283	0.1934	0.3242	0.1925
322/03	0.2969	0.1427	0.2764	0.2285	0.1539	0.1951	0.1925	0.3877
332/04	0.1309	0.1566	0.1682	0.1152	0.3938	0.1526	0.1283	0.1539
339/04	0.1924	0.1454	0.2050	0.1309	0.3181	0.1941	0.1539	0.1801
348/05	0.1924	0.1454	0.2050	0.1309	0.3181	0.1941	0.1539	0.1801
352/05	0.2363	0.1401	0.1863	0.1289	0.1735	0.1973	0.1670	0.1693
367/07	0.1279	0.2002	0.1456	0.1094	0.1574	0.1362	0.1418	0.1470
370/07	0.3516	0.1329	0.2813	0.1387	0.2140	0.1716	0.1749	0.2363
371/07	0.1660	0.3601	0.1497	0.1299	0.1425	0.1733	0.1478	0.1676
369/07	0.3623	0.1709	0.2769	0.1484	0.1535	0.1792	0.2024	0.2437
374/08	0.1865	0.1494	0.2023	0.1299	0.1982	0.1724	0.3469	0.1929
387/11	0.1738	0.1640	0.1731	0.1289	0.2610	0.1730	0.3415	0.1732
392/11	0.2598	0.1570	0.2272	0.1855	0.1411	0.1942	0.2584	0.3936
409/14	0.2588	0.2591	0.2372	0.1436	0.1591	0.1898	0.1873	0.2333

Monitor Save Promote

Factors To Consider When Selecting Matings:

- The Mean Kinship of both parents
- The difference in the pair's Mean Kinship.
- The Co-ancestry (inbreeding) Coefficient of potential offspring.

Breeder's Data Sheets

Cleveland Bay Horse Society
Global Kinship Table 2004
For Purebred Mares / Stallions Licensed For Pure Bred Breeding

Mare's Name Carolina Nimbus — Stud Book Number 2013

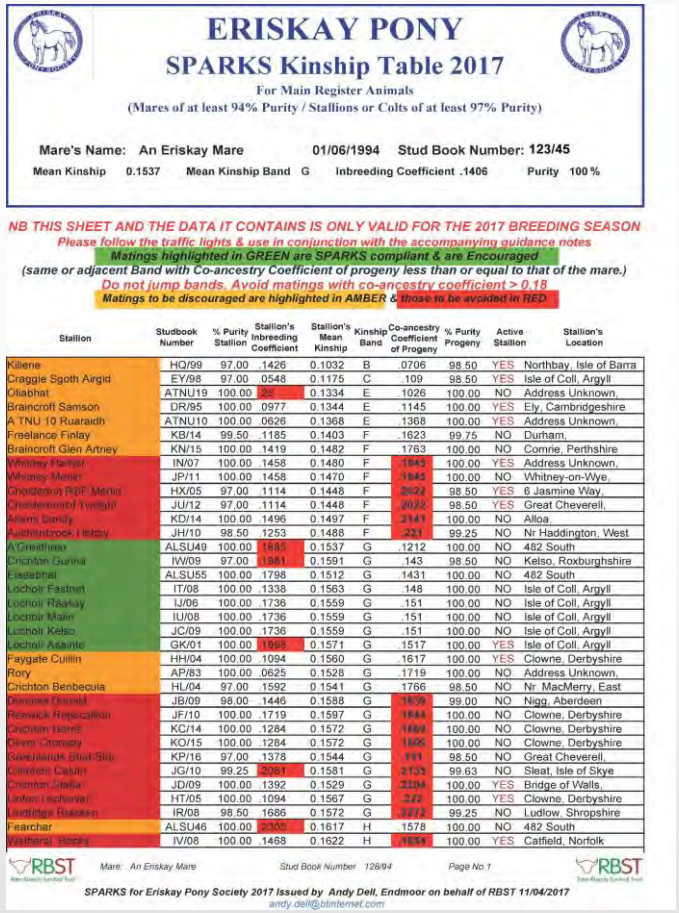
Mean Kinship 0.2356 — Mean Kinship Band F

Stallion		Stallion's Mean Kinship	Kinship Band	Kinship Coeff. Of Progeny	Stallion's Location
Chakola's M'Lord Advocate	M2380A	0.197	B	0.1508	USA
Chakola's M'Lord Beethoven	M2403A	0.1995	B	0.1906	CANADA
Ramblers Renown	M2075	0.1988	B	0.215	USA
Cholderton Chiron	M2496	0.2071	C	0.1992	CANADA
Runswick Liberator	M2442	0.2093	C	0.2007	WALES
Runswick Sultan	M2388	0.2094	C	0.2007	USA
Penrhyn Tsar	M2329	0.2091	C	0.2051	WALES
Idlebour Independence	M117USA	0.2071	C	0.2099	USA
Knaresborough Fusilier	M2478	0.2027	C	0.2103	USA
Wanderer (Aus)	M2131A	0.2068	C	0.2123	USA
Wheelgates Lord Charles	M2104	0.2048	C	0.2206	USA
Thomsett Major	M2100	0.2058	C	0.2386	ENGLAND
Bantry Bere	M2132	0.2179	D	0.1972	ENGLAND
Southbrook Spellbound	M2345	0.2127	D	0.199	ENGLAND
Runswick Special Edition	M2342	0.2197	D	0.1998	ENGLAND
Southbrook Warlord	M2378	0.2174	D	0.2009	ENGLAND
Oakenbank Grenadier	M2326	0.2124	D	0.2046	ENGLAND
Foxhollow(USA) Navigator	M104USA	0.2167	D	0.2047	USA
Cholderton Whitethorn	M2368	0.2171	D	0.2075	ENGLAND
Beaujet	M2314A	0.2118	D	0.2094	USA
Ironwood	M122USA	0.2197	D	0.2119	USA
Laughton Saladin	M2190	0.2125	D	0.2133	WALES
Laughton Templar	M2206	0.2168	D	0.2133	ENGLAND
Penrhyn Aristocrat	M2258	0.2155	D	0.2195	WALES
Forbes Native Statesman	M2365A	0.2119	D	0.2261	USA
Wetherby Barry Crump (NZ)	M2197	0.2159	D	0.2283	AUSTRALIA
Osberton Goliath	M1964	0.2138	D	0.2334	NEW ZEALAND
Ramblers Legacy	M2387	0.2168	D	0.2464	ENGLAND
Ramblers Lorenzo	M2330	0.2165	D	0.2464	USA
Idlebour Yorktown	M103USA	0.2156	D	0.2483	USA
Fryup Marvel	M2086	0.2246	E	0.2146	USA
Whitehouse Statesman	M2080	0.2247	E	0.2167	WALES
Tregoyd Borrower	M2524	0.2206	E	0.2171	USA
Fryup Templer	M2357	0.2237	E	0.2206	HOLLAND
Penrhyn Dictator	M2288	0.2292	E	0.2248	ENGLAND
Penrhyn Executive	M2308	0.2289	E	0.2248	ENGLAND
Penrhyn Bayswater	M2370	0.2224	E	0.2259	USA
Cholderton Yobi	M2423	0.2266	E	0.2273	WALES
Stonebridge Bendigalla	M2431	0.2209	E	0.2273	USA
Tregoyd Topper	M2548	0.226	E	0.2305	ENGLAND

Mare owners are encouraged to use Stallions of the same or an adjacent Kinship Band as the Mare, producing progeny of lower Mean Kinship than both of the parent animals.
Ideally matings should be chosen that produce progeny with lower MK than the average MK of the whole population (i.e. less than 0.223259 in 2004) although this may not always be possible.

NB THIS SHEET AND THE DATA IT CONTAINS IS ONLY VALID FOR THE 2004 BREEDING SEASON

Page No.1 — *Published on behalf of the Breed Committee of the Cleveland Bay Horse Society* Andy Dell , Endmoor. 29/4/2004



ERISKAY PONY
SPARKS Kinship Table 2017
For Main Register Animals
(Mares of at least 94% Purity / Stallions or Colts of at least 97% Purity)

Mare's Name: An Eriskay Mare — 01/06/1994 — Stud Book Number: 123/45

Mean Kinship 0.1537 — Mean Kinship Band G — Inbreeding Coefficient .1406 — Purity 100 %

NB THIS SHEET AND THE DATA IT CONTAINS IS ONLY VALID FOR THE 2017 BREEDING SEASON
Please follow the traffic lights & use in conjunction with the accompanying guidance notes
Matings highlighted in GREEN are SPARKS compliant & are Encouraged
(same or adjacent Band with Co-ancestry Coefficient of progeny less than or equal to that of the mare.)
Do not jump bands. Avoid matings with co-ancestry coefficient > 0.18
Matings to be discouraged are highlighted in AMBER & those to be avoided in RED

Stallion	Studbook Number	% Purity Stallion	Stallion's Inbreeding Coefficient	Stallion's Mean Kinship	Kinship Band	Co-ancestry Coefficient of Progeny	% Purity Progeny	Active Stallion	Stallion's Location
Killene	HQ/99	97.00	.1426	0.1032	B	.0706	98.50	YES	Northbay, Isle of Barra
Craggie Sgoth Airgid	EY/98	97.00	.0548	0.1175	C	.109	98.50	YES	Isle of Coll, Argyll
Oliabhal	ATNU19	100.00	[illegible]	0.1334	E	.1026	100.00	NO	Address Unknown,
Braincroft Samson	DR/95	100.00	.0977	0.1344	E	.1145	100.00	YES	Ely, Cambridgeshire
A TNU 10 Ruaraidh	ATNU10	100.00	.0626	0.1368	E	.1368	100.00	YES	Address Unknown,
Freelance Finlay	KB/14	99.50	.1185	0.1403	F	.1623	99.75	NO	Durham,
Braincroft Glen Artney	KN/15	100.00	.1419	0.1482	F	.1763	100.00	NO	Comrie, Perthshire
Whitney Harlan	IN/07	100.00	.1458	0.1480	F	.1845	100.00	YES	Address Unknown,
Whitney Merlin	JP/11	100.00	.1458	0.1470	F	.1845	100.00	NO	Whitney-on-Wye,
Cholderton RAF Merlin	HX/05	97.00	.1114	0.1448	F	.2022	98.50	YES	6 Jasmine Way,
Cholderton Twilight	JU/12	97.00	.1114	0.1448	F	.2022	98.50	YES	Great Cheverell,
Allens Sandy	KD/14	100.00	.1496	0.1497	F	.2141	100.00	NO	Alloa,
Auchenbrook Hobby	JH/10	98.50	.1253	0.1488	F	.221	99.25	NO	Nr Haddington, West
A'Greidhear	ALSU49	100.00	.1685	0.1537	G	.1212	100.00	NO	482 South
Crichton Gunna	IW/09	97.00	.1981	0.1591	G	.143	98.50	NO	Kelso, Roxburghshire
Eiadabhal	ALSU55	100.00	.1798	0.1512	G	.1431	100.00	NO	482 South
Lochoir Fastnet	IT/08	100.00	.1338	0.1563	G	.148	100.00	NO	Isle of Coll, Argyll
Lochoir Raarsay	IJ/06	100.00	.1736	0.1559	G	.151	100.00	NO	Isle of Coll, Argyll
Lochoir Mailm	IU/08	100.00	.1736	0.1559	G	.151	100.00	NO	Isle of Coll, Argyll
Lochoir Kelso	JC/09	100.00	.1736	0.1559	G	.151	100.00	NO	Isle of Coll, Argyll
Lochoir Aasynto	GK/01	100.00	.1968	0.1571	G	.1517	100.00	YES	Isle of Coll, Argyll
Faygate Cuillin	HH/04	100.00	.1094	0.1560	G	.1617	100.00	YES	Clowne, Derbyshire
Rory	AP/83	100.00	.0625	0.1528	G	.1719	100.00	NO	Address Unknown,
Chichton Benbecula	HL/04	97.00	.1592	0.1541	G	.1766	98.50	NO	Nr. MacMerry, East
Dunnock Donald	JB/09	98.00	.1446	0.1588	G	.1879	99.00	NO	Nigg, Aberdeen
Renwick Repercallion	JF/10	100.00	.1719	0.1597	G	.1844	100.00	NO	Clowne, Derbyshire
Chichton Isaac	KC/14	100.00	.1284	0.1572	G	.1869	100.00	NO	Clowne, Derbyshire
Oliver Cromsby	KO/15	100.00	.1284	0.1572	G	.1869	100.00	NO	Clowne, Derbyshire
Swordlands Stud Sky	KP/16	97.00	.1378	0.1544	G	.191	98.50	NO	Great Cheverell,
Colmore Calum	JG/10	99.25	.2081	0.1581	G	.2135	99.63	NO	Sleat, Isle of Skye
Chichton Stella	JD/09	100.00	.1392	0.1529	G	.2104	100.00	YES	Bridge of Walls,
Linton Lochinvar	HT/05	100.00	.1094	0.1567	G	.222	100.00	YES	Clowne, Derbyshire
Landridge Raasken	IR/08	98.50	.1686	0.1572	G	.2272	99.25	NO	Ludlow, Shropshire
Fearchar	ALSU46	100.00	.2305	0.1617	H	.1578	100.00	NO	482 South
Walthersi Hecky	IV/08	100.00	.1468	0.1622	H	.1859	100.00	YES	Catfield, Norfolk

RBST — Mare: An Eriskay Mare — Stud Book Number 126/94 — Page No.1 — RBST

SPARKS for Eriskay Pony Society 2017 Issued by Andy Dell, Endmoor on behalf of RBST 11/04/2017
andy.dell@btinternet.com

Cleveland Bay Horse Society
SPARKS Kinship Table 2018
For Pure-bred Mares / Stallions Licensed For Pure Bred Breeding

Mare's Name A Kind Of Magic — Stud Book Number 2305

Mean Kinship 0.2283 — Inbreeding Coefficient .2094 — Mean Kinship Band E

NB THIS SHEET AND THE DATA IT CONTAINS IS ONLY VALID FOR THE 2018 BREEDING SEASON
Please follow the traffic lights & use in conjunction with the accompanying guidance notes

Tier 1 Matings highlighted in GREEN are SPARKS compliant & are ENCOURAGED
Tier 2 Matings highlighted in YELLOW are not fully compliant but are the "BEST OF THE REST"
Tier 3 Matings highlighted in ORANGE are not compliant AND jump Bands which is DISCOURAGED
Tier 4 Matings highlighted in RED should be AVOIDED as they are highly inbred (> 0.24)

Stallion	Studbook Number	Stallion's Inbreeding Coefficient	Stallion's Mean Kinship	Kinship Band	Kinship Coefficient of Progeny	Availability	Stallion's Location
Cholderton Cacus	M2495	.156	0.1990	B	.2122	CONTACT OWNER	ENGLAND
Cholderton Ixion	M2661	.1714	0.2062	C	.2004	Live Cover Only	UK
Cholderton Jupiter	M2727	.1832	0.2095	C	.2009	Live Cover Only	UK
Cholderton Boreas	M2485	.2369	0.2094	C	.2118	CONTACT OWNER	ENGLAND
Penrhyn Romulus	M2615	.2298	0.2141	D	.1968	NOT AT PUBLIC STUD	WALES
Cholderton Icarus	M2662	.175	0.2156	D	.2104	Live Cover Only	UK
Wyevale Brayden	M2665	.1988	0.2152	D	.212	Live Cover & Frozen UK	ENGLAND
Poids Victor	M2767	.1908	0.2178	D	.2164	Live Cover Only	UK
Southbrook Spellbound	M2345	.2064	0.2151	D	.4069	FROZEN ONLY	ENGLAND
Highpasture Fellowship	M2589	.2189	0.2202	E	.2028	Live Cover & Frozen UK	WALES
Penrhyn Sextus	M2584	.2431	0.2225	E	.2066	NOT AT PUBLIC STUD	WALES
Fenton	M2531	.2033	0.2201	E	.2067	Live Cover Only	WALES
Willow Troy	M2577	.2058	0.2284	E	.2223	Live Cover Only	ENGLAND
Rosemeadow Springtime	M2770	.2268	0.2266	E	.2235	Live Cover Only	ENGLAND
Stainmore Scotch On The Rocks	M2830	.1996	0.2297	E	.2248	Live Cover Only	ENGLAND
Thomsonbrook Beowulf	M2840	.2136	0.2286	E	.2265	Live Cover & Chilled	UK
Arena Harrington	M2849	.225	0.2269	E	.2268	FROZEN /CHILLED ONLY	UK
Southbrook Warlord	M2375	.1992	0.2251	E	.2296	NOT AT PUBLIC STUD	ENGLAND
Carolina Charlie Boy	M2718	.2591	0.2294	E	.2298	Live Cover Only	UK
Craigiewood Tobermory	M2801	.2126	0.2282	E	.2307	Contact Owner	UK
Jemoon Highwayman	M2824	.232	0.2297	E	.231	Contact Owner	UK
Wyevale Wot A Charmer	M2596	.2199	0.2284	E	.2317	Live Cover & Chilled	UK
Pembridge Justice	M2787	.2353	0.2248	E	.2345	Live Cover Only	WALES
Brackenbrae Sumerled	M2842	.222	0.2241	E	.3165	Live Cover Only	UK
Kirkmoor Wolfsbane Flower	M2782	.2088	0.2260	E	.3347	Live Cover Only	ENGLAND
Hallhouse Gladmere	M2836	.2253	0.2312	F	.2159	Live Cover & Chilled	UK
Barbarian Gigalo	M2795	.2266	0.2315	F	.2169	Contact Owner	ENGLAND
Lindon Principal	M2558	.2263	0.2346	F	.216	CONTACT OWNER	ENGLAND
Penrhyn P.S	M2764	.2122	0.2311	F	.2182	CONTACT OWNER	ENGLAND
Bolton Grove Brandon	M2668	.2172	0.2300	F	.2204	Live Cover Only	ENGLAND
Barbarian Hustler	M2834	.2251	0.2338	F	.2209	Contact Owner	UK
High Park Schoffield	M2487	.2174	0.2381	F	.2216	UK EU USA AUS NZ	ENGLAND
Beamish Fugleman	M2540	.1996	0.2305	F	.2248	Live Cover Only	ENGLAND
Braithwaite Challenger	M2848	.221	0.2326	F	.2265	Contact Owner	UK
Beamish TouchN'Go	M2549	.2399	0.2372	F	.2272	Live Cover Only	ENGLAND
Earlswood Traveller	M2649	.2193	0.2300	F	.2361	Live Cover Only	ENGLAND
Arena Big Ben	M2775	.2135	0.2316	F	.2389	FROZEN UK AUS NZ USA	UK
Cholderton Yobi	M2423	.237	0.2318	F	.2446	UK EU USA AUS NZ	WALES
Thomsonbrook King William	M2737	.2102	0.2321	F	.2461	Live Cover Only	UK
Holmside Applejack	M2736	.2321	0.2397	F	.2496	Live Cover Only	ENGLAND
Blackbrough Kilkenny	M2562	.2208	0.2318	F	.2497	Live Cover Only	UK
Billy's Joint Account	M2822	.2314	0.2351	F	.2518	Contact Owner	UK

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Breeder's Data Sheets

Cleveland Bay Horse Society

SPARKS Kinship Table 2018

For Pure-bred Mares / Stallions Licensed For Pure Bred Breeding

Mare's Name A Kind Of Magic Stud Book Number 2305

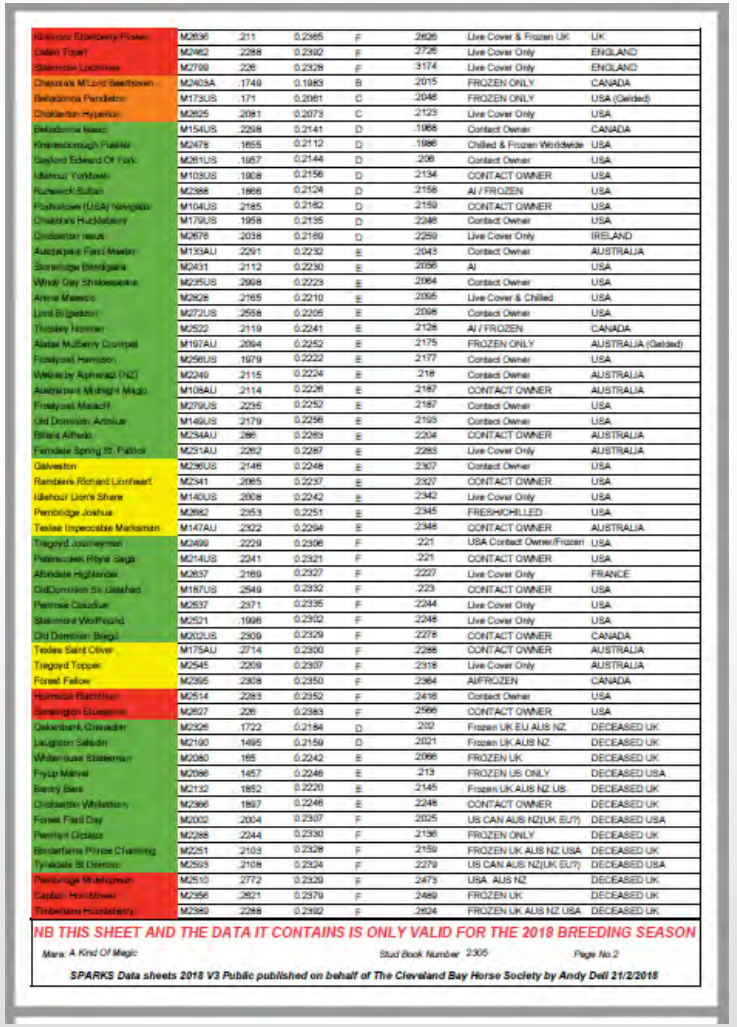
Mean Kinship 0.2283 Inbreeding Coefficient .2094 Mean Kinship Band E

NB THIS SHEET AND THE DATA IT CONTAINS IS ONLY VALID FOR THE 2018 BREEDING SEASON
Please follow the traffic lights & use in conjunction with the accompanying guidance notes

Tier 1 Matings highlighted in GREEN are SPARKS compliant & are ENCOURAGED
Tier 2 Matings highlighted in YELLOW are not fully compliant but are the "BEST OF THE REST"
Tier 3 Matings highlighted in ORANGE are not compliant AND jump Bands which is DISCOURAGED
Tier 4 Matings highlighted in RED should be AVOIDED as they are highly inbred (> 0.24)

Stallion	Studbook Number	Stallion's Inbreeding Coefficient	Stallion's Mean Kinship	Kinship Band	Kinship Coefficient of Progeny	Availability	Stallion's Location
Cholderton Cacus	M2495	.156	0.1990	B	.2122	CONTACT OWNER	ENGLAND
Cholderton Ixion	M2661	.1714	0.2062	C	.2004	Live Cover Only	UK
Cholderton Jupiter	M2727	.1832	0.2095	C	.2009	Live Cover Only	UK
Cholderton Boreas	M2485	.2389	0.2094	C	.2118	CONTACT OWNER	ENGLAND
Penrhyn Romulus	M2615	.2298	0.2141	D	.1968	NOT AT PUBLIC STUD	WALES
Cholderton Icarus	M2662	.175	0.2156	D	.2104	Live Cover Only	UK
Wyevale Brayden	M2665	.1988	0.2152	D	.212	Live Cover & Frozen UK	ENGLAND
Fords Victor	M2767	.1908	0.2178	D	.2164	Live Cover Only	UK
Southbrook Steelbound	M2345	.2064	0.2151	D	.4069	FROZEN ONLY	ENGLAND
Highpasture Fellowship	M2589	.2189	0.2202	E	.2028	Live Cover & Frozen UK	WALES
Penrhyn Sextus	M2584	.2431	0.2225	E	.2066	NOT AT PUBLIC STUD	WALES
Fenton	M2531	.2033	0.2201	E	.2067	Live Cover Only	WALES
Willow Troy	M2577	.2056	0.2284	E	.2223	Live Cover Only	ENGLAND
Rosemeadow Springtime	M2770	.2288	0.2266	E	.2235	Live Cover Only	ENGLAND
Stainmore Scotch On The Rocks	M2830	.1996	0.2297	E	.2248	Live Cover Only	ENGLAND
Thomsonbrook Beowulf	M2840	.2136	0.2286	E	.2255	Live Cover & Chilled	UK
Arena Harrington	M2849	.225	0.2269	E	.2258	FROZEN /CHILLED ONLY	UK
Southbrook Warlord	M2375	.1992	0.2251	E	.2296	NOT AT PUBLIC STUD	ENGLAND
Carolina Charlie Boy	M2718	.2591	0.2294	E	.2298	Live Cover Only	UK
Craiglewood Tobermory	M2801	.2126	0.2282	E	.2307	Contact Owner	UK
Jemoon Highwayman	M2824	.232	0.2297	E	.231	Contact Owner	UK
Wyevale Wot A Charmer	M2596	.2199	0.2284	E	.2317	Live Cover & Chilled	UK
Pembridge Justice	M2787	.2353	0.2248	E	.2345	Live Cover Only	WALES
Brackenbrae Sumerled	M2842	.222	0.2241	E	.3165	Live Cover Only	UK
Kirkmoor Wolfsbane Flower	M2782	.2088	0.2260	E	.3347	Live Cover Only	ENGLAND
Hallhouse Gladmere	M2836	.2253	0.2312	F	.2159	Live Cover & Chilled	UK
Barbarian Gigalo	M2795	.2266	0.2315	F	.2169	Contact Owner	ENGLAND
Lindon Principal	M2558	.2283	0.2346	F	.218	CONTACT OWNER	ENGLAND
Penrhyn P.S	M2764	.2122	0.2311	F	.2182	CONTACT OWNER	ENGLAND
Bolton Grove Brandon	M2668	.2172	0.2300	F	.2204	Live Cover Only	ENGLAND
Barbarian Hustler	M2834	.2251	0.2338	F	.2209	Contact Owner	UK
High Park Schoffield	M2487	.2174	0.2381	F	.2215	UK EU USA AUS NZ	ENGLAND
Beamish Fugleman	M2540	.1996	0.2305	F	.2248	Live Cover Only	ENGLAND
Braithwaite Challenger	M2848	.221	0.2326	F	.2265	Contact Owner	UK
Beamish TouchNGo	M2549	.2399	0.2372	F	.2272	Live Cover Only	ENGLAND
Earlswood Traveller	M2649	.2193	0.2300	F	.2361	Live Cover Only	ENGLAND
Arena Big Ben	M2775	.2135	0.2316	F	.2389	FROZEN UK AUS NZ USA	UK
Cholderton Yobi	M2423	.237	0.2318	F	.2446	UK EU USA AUS NZ	WALES
Thomsonbrook King William	M2737	.2102	0.2321	F	.2461	Live Cover Only	UK
Holmside Applejack	M2736	.2321	0.2397	F	.2496	Live Cover Only	ENGLAND
Blackclough Kilkenny	M2562	.2208	0.2316	F	.2497	Live Cover Only	UK
Billy's Joint Account	M2822	.2314	0.2351	F	.2518	Contact Owner	UK

- Specific to named mare
- For named breeding season only
- Banding of Mares & Stallions
- Co-ancestry of Progeny
- Location of stallion



Kirkmoor Elderberry Flower	M2636	.211	0.2365	F	.2626	Live Cover & Frozen UK	UK
Dolan Tigrel	M2462	.2288	0.2392	F	.2725	Live Cover Only	ENGLAND
Stainmore Lochinvar	M2799	.226	0.2328	F	.3174	Live Cover Only	ENGLAND
Cheshire's MTLuvs Beethoven	M240SA	.1749	0.1983	B	.2015	FROZEN ONLY	CANADA
Bellacomia Pendleton	M173US	.171	0.2081	C	.2048	FROZEN ONLY	USA (Gelded)
Cholderton Hyperion	M2625	.2081	0.2073	C	.2123	Live Cover Only	USA
Bellacomia Isaac	M154US	.2208	0.2141	D	.1968	Contact Owner	CANADA
Kinderscough Flasher	M2478	.1655	0.2112	D	.1886	Chilled & Frozen Worldwide	USA
Gaylord Edward Of York	M261US	.1957	0.2144	D	.206	Contact Owner	USA
Ilkhaus Yorktown	M109US	.1908	0.2156	D	.2134	CONTACT OWNER	USA
Rutwick Sultan	M2388	.1866	0.2124	D	.2158	AI / FROZEN	USA
Fishwicken (USA) Newgate	M104US	.2185	0.2182	D	.2159	CONTACT OWNER	USA
Chalcots Huckleberry	M179US	.1958	0.2135	D	.2248	Contact Owner	USA
Cholderton Isaac	M2676	.2038	0.2169	D	.2259	Live Cover Only	IRELAND
Aussiepaus Fast Master	M139AU	.2291	0.2232	E	.2043	Contact Owner	AUSTRALIA
Stonehedge Brendana	M2431	.2112	0.2230	E	.2056	AI	USA
Windy Gay Shakespeare	M295US	.2068	0.2229	E	.2064	Contact Owner	USA
Arena Maestro	M262B	.2165	0.2210	E	.2065	Live Cover & Chilled	USA
Lord Bigelow	M272US	.2558	0.2205	E	.2098	Contact Owner	USA
Thoxley Norman	M2522	.2119	0.2241	E	.2128	AI / FROZEN	CANADA
Alabat MJBerry Crumpet	M197AU	.2094	0.2252	E	.2175	FROZEN ONLY	AUSTRALIA (Gelded)
Finelywell Hamilton	M256US	.1979	0.2222	E	.2177	Contact Owner	USA
Welcroby Aphrael (NZ)	M224B	.2115	0.2224	E	.218	Contact Owner	AUSTRALIA
Aussiepaus Midnight Magic	M108AU	.2114	0.2226	E	.2187	CONTACT OWNER	AUSTRALIA
Finelywell Malachi	M270US	.2295	0.2252	E	.2187	Contact Owner	USA
Old Dominion Aristus	M149US	.2179	0.2256	E	.2193	Contact Owner	USA
Bilara Alfredo	M294AU	.286	0.2269	E	.2204	CONTACT OWNER	AUSTRALIA
Ferndale Spring St. Patrick	M291AU	.2262	0.2287	E	.2283	Live Cover Only	AUSTRALIA
Galveston	M296US	.2148	0.2248	E	.2307	Contact Owner	USA
Ramblers Richard Lionheart	M2541	.2065	0.2237	E	.2327	CONTACT OWNER	USA
Ilkhaus Lion's Share	M140US	.2008	0.2242	E	.2342	Live Cover Only	USA
Pembridge Joshua	M2682	.2353	0.2251	E	.2345	FRESH/CHILLED	USA
Tedas Impeccable Marksman	M147AU	.2322	0.2294	E	.2348	CONTACT OWNER	AUSTRALIA
Tregoyd Journeyman	M2499	.2229	0.2306	F	.221	USA Contact Owner/Frozen	USA
Peterscreek Royal Sage	M214US	.2241	0.2321	F	.221	CONTACT OWNER	USA
Allondale Highlander	M2637	.2189	0.2327	F	.2227	Live Cover Only	FRANCE
OldDominion Sir Galahad	M187US	.2549	0.2332	F	.223	CONTACT OWNER	USA
Penrose Claudius	M2637	.2371	0.2335	F	.2244	Live Cover Only	USA
Stainmore Wolfhound	M2521	.1996	0.2302	F	.2248	Live Cover Only	USA
Old Dominion Beigi	M262US	.2309	0.2329	F	.2278	CONTACT OWNER	CANADA
Tedas Saint Oliver	M175AU	.2714	0.2300	F	.2288	CONTACT OWNER	AUSTRALIA
Tregoyd Topper	M2545	.2209	0.2307	F	.2318	Live Cover Only	AUSTRALIA
Forest Fellow	M2595	.2308	0.2350	F	.2364	AI/FROZEN	CANADA
Holmside Bambino	M2514	.2283	0.2352	F	.2418	Contact Owner	USA
Stonington Supreme	M2627	.226	0.2383	F	.2566	CONTACT OWNER	USA
Oakenbank Crusader	M292B	.1722	0.2184	D	.202	Frozen UK EU AUS NZ	DECEASED UK
Laugiton Saladin	M2190	.1495	0.2159	D	.2021	Frozen UK AUS NZ	DECEASED UK
Whitenoue Statesman	M2080	.165	0.2242	E	.2068	FROZEN UK	DECEASED UK
Fryup Marvel	M2098	.1457	0.2246	E	.213	FROZEN US ONLY	DECEASED USA
Berry Bere	M2132	.1852	0.2220	E	.2145	Frozen UK AUS NZ US	DECEASED UK
Cholderton Wilkerton	M2966	.1897	0.2248	E	.2248	CONTACT OWNER	DECEASED UK
Forest Fred Day	M2002	.2004	0.2307	F	.2025	US CAN AUS NZ(UK EU?)	DECEASED USA
Penrhyn Octavo	M2288	.2044	0.2330	F	.2136	FROZEN ONLY	DECEASED UK
Binderflame Prince Charming	M225I	.2103	0.2328	F	.2159	FROZEN UK AUS NZ USA	DECEASED UK
Tynedale St Dennis	M250S	.2108	0.2324	F	.2279	US CAN AUS NZ(UK EU?)	DECEASED USA
Pembridge Muleyman	M2510	.2772	0.2329	F	.2473	USA AUS NZ	DECEASED UK
Captain Hornblower	M2956	.2621	0.2379	F	.2489	FROZEN UK	DECEASED UK
Timberlane Huckleberry	M2989	.2268	0.2392	F	.2624	FROZEN UK AUS NZ USA	DECEASED UK

NB THIS SHEET AND THE DATA IT CONTAINS IS ONLY VALID FOR THE 2018 BREEDING SEASON

Mare: A Kind Of Magic Stud Book Number 2305 Page No.2

SPARKS Data sheets 2018 V3 Public published on behalf of The Cleveland Bay Horse Society by Andy Dell 21/2/2018

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The Datasheets Help To Identify

Cleveland Bay Horse Society

SPARKS Kinship Table 2018

For Pure-bred Mares / Stallions Licensed For Pure Bred Breeding

Mare's Name A Kind Of Magic Stud Book Number 2305

Mean Kinship 0.2283 Inbreeding Coefficient .2094 Mean Kinship Band E

NB THIS SHEET AND THE DATA IT CONTAINS IS ONLY VALID FOR THE 2018 BREEDING SEASON

Please follow the traffic lights & use in conjunction with the accompanying guidance notes

Tier 1 Matings highlighted in GREEN are SPARKS compliant & are ENCOURAGED

Tier 2 Matings highlighted in YELLOW are not fully compliant but are the "BEST OF THE REST"

Tier 3 Matings highlighted in ORANGE are not compliant AND jump Bands which is DISCOURAGED

Tier 4 Matings highlighted in RED should be AVOIDED as they are highly inbred (> 0.24)

Stallion	Studbook Number	Stallion's Inbreeding Coefficient	Stallion's Mean Kinship	Kinship Band	Kinship Coefficient of Progeny	Availability	Stallion's Location
Cholderton Cacus	M2495	.156	0.1990	B	.2122	CONTACT OWNER	ENGLAND
Cholderton Ixion	M2661	.1714	0.2062	C	.2004	Live Cover Only	UK
Cholderton Jupiter	M2727	.1832	0.2095	C	.2009	Live Cover Only	UK
Cholderton Boreas	M2485	.2389	0.2094	C	.2118	CONTACT OWNER	ENGLAND
Penrhyn Romulus	M2615	.2298	0.2141	D	.1968	NOT AT PUBLIC STUD	WALES
Cholderton Icarus	M2662	.175	0.2156	D	.2104	Live Cover Only	UK
Wyevale Brayden	M2665	.1988	0.2152	D	.212	Live Cover & Frozen UK	ENGLAND
Fords Victor	M2767	.1908	0.2178	D	.2164	Live Cover Only	UK
Southbrook Spellbound	M2345	.2084	0.2151	D	.4069	FROZEN ONLY	ENGLAND
Highgatsife Fellowship	M2589	.2189	0.2202	E	.2028	Live Cover & Frozen UK	WALES
Penrhyn Sextus	M2584	.2431	0.2225	E	.2066	NOT AT PUBLIC STUD	WALES
Fenton	M2531	.2033	0.2201	E	.2067	Live Cover Only	WALES
Willow Troy	M2577	.2058	0.2284	E	.2223	Live Cover Only	ENGLAND
Rosemeadow Springtime	M2770	.2288	0.2266	E	.2235	Live Cover Only	ENGLAND
Glanmore Scotch On The Rocks	M2630	.1996	0.2297	E	.2248	Live Cover Only	ENGLAND
Thomsonbrook Beowulf	M2640	.2136	0.2286	E	.2255	Live Cover & Chilled	UK
Arena Harrington	M2649	.225	0.2269	E	.2258	FROZEN /CHILLED ONLY	UK
Southbrook Warlord	M2375	.1992	0.2251	E	.2296	NOT AT PUBLIC STUD	ENGLAND
Carolina Charlie Boy	M2718	.2591	0.2294	E	.2298	Live Cover Only	UK
Craiglewood Tobermory	M2601	.2126	0.2282	E	.2307	Contact Owner	UK
Jemoon Highwayman	M2624	.232	0.2297	E	.231	Contact Owner	UK
Wyevale Wot A Charmer	M2596	.2199	0.2284	E	.2317	Live Cover & Chilled	UK
Pembridge Justice	M2787	.2353	0.2248	E	.2345	Live Cover Only	WALES
Brackenbrae Sunerstar	M2842	.222	0.2241	E	.3165	Live Cover Only	UK
Kilmoor Wolfsbane Flower	M2782	.2068	0.2260	E	.3347	Live Cover Only	ENGLAND
Hallhouse Gladmere	M2836	.2253	0.2312	F	.2159	Live Cover & Chilled	UK
Barbarian Gigolo	M2795	.2266	0.2315	F	.2169	Contact Owner	ENGLAND
Lindon Principal	M2558	.2283	0.2346	F	.218	CONTACT OWNER	ENGLAND
Penrhyn P.S	M2764	.2122	0.2311	F	.2182	CONTACT OWNER	ENGLAND
Bolton Grove Brandon	M2668	.2172	0.2300	F	.2204	Live Cover Only	ENGLAND
Barbarian Hobbler	M2834	.2251	0.2338	F	.2209	Contact Owner	UK
High Park Schoffield	M2487	.2174	0.2381	F	.2216	UK EU USA AUS NZ	ENGLAND
Beamish Fuglerian	M2540	.1996	0.2305	F	.2248	Live Cover Only	ENGLAND
Braithwaite Challenger	M2648	.221	0.2326	F	.2265	Contact Owner	UK
Beamish TouchNGo	M2549	.2399	0.2372	F	.2272	Live Cover Only	ENGLAND
Earlswood Traveller	M2649	.2193	0.2300	F	.2361	Live Cover Only	ENGLAND
Arena Big Ben	M2775	.2135	0.2316	F	.2389	FROZEN UK AUS NZ USA	UK
Cholderton Yobi	M2423	.237	0.2318	F	.2446	UK EU USA AUS NZ	WALES
Thomsonbrook King William	M2737	.2102	0.2321	F	.2461	Live Cover Only	UK
Helmsdale Appejack	M2736	.2321	0.2397	F	.2496	Live Cover Only	ENGLAND
Blackdough Kilkenny	M2582	.2208	0.2318	F	.2497	Live Cover Only	UK
Billy's Joint Account	M2822	.2314	0.2351	F	.2518	Contact Owner	UK

- Matings to be encouraged
- Best of the Rest Matings
- Matings to be discouraged
- Matings to avoid at all costs!

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Matings to be Encouraged

- Matings between animals of similar Mean Kinship (same or adjacent Band)
- Matings with progeny of lower Co-ancestry Coefficient than the Mean Kinship of the mare
- Matings giving progeny with co-ancestry < average inbreeding in population

Best of the Rest Matings

- Matings between animals of similar Mean Kinship (same or adjacent Band)
- Matings with progeny of higher Co-ancestry Coefficient than the Mean Kinship of the mare (but less than a breed specific threshold)
- These are the preferred matings if a fully compliant mating is not possible.

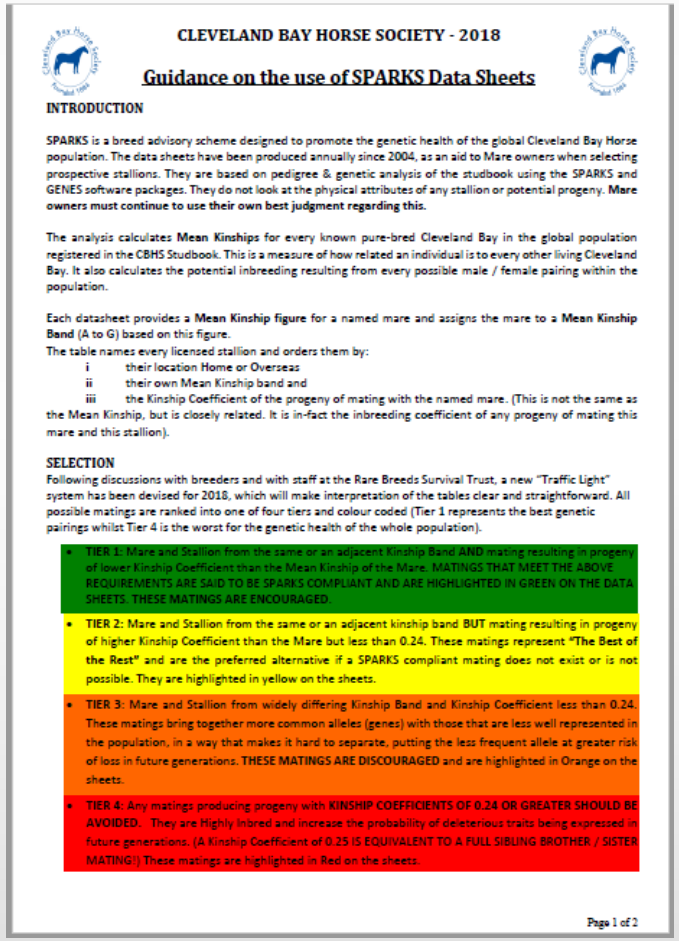
Matings to be Discouraged

- Matings between animals of significantly different Mean Kinship
- Matings with progeny of higher Co-ancestry than both of the parents
- Co-ancestry still less than breed determined threshold.
- These matings bring together more common alleles (genes) with those that are less well represented in the population, in a way that makes it hard to separate, putting the less frequent allele at greater risk of loss in future generations.

Matings to be Avoided

- Matings between animals of extremely different Mean Kinship as this will bring together common and rare alleles
- Matings giving progeny of Co-ancestry > breed determined threshold (CB > 0.24 / Eriskay > 0.18)
- Progeny from these matings are highly inbred and increase the probability of deleterious traits being expressed in future generations

Guidance Sheet



CLEVELAND BAY HORSE SOCIETY - 2018

Guidance on the use of SPARKS Data Sheets

INTRODUCTION

SPARKS is a breed advisory scheme designed to promote the genetic health of the global Cleveland Bay Horse population. The data sheets have been produced annually since 2004, as an aid to Mare owners when selecting prospective stallions. They are based on pedigree & genetic analysis of the studbook using the SPARKS and GENES software packages. They do not look at the physical attributes of any stallion or potential progeny. **Mare owners must continue to use their own best judgment regarding this.**

The analysis calculates **Mean Kinships** for every known pure-bred Cleveland Bay in the global population registered in the CBHS Studbook. This is a measure of how related an individual is to every other living Cleveland Bay. It also calculates the potential inbreeding resulting from every possible male / female pairing within the population.

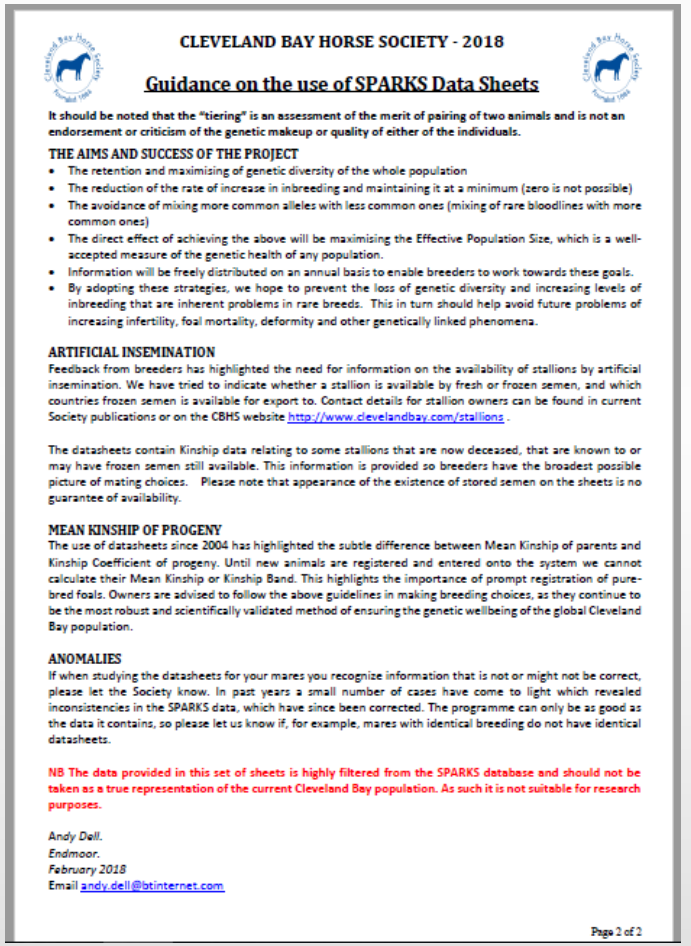
Each datasheet provides a **Mean Kinship figure** for a named mare and assigns the mare to a **Mean Kinship Band** (A to G) based on this figure.
The table names every licensed stallion and orders them by:

i. their location Home or Overseas
ii. their own Mean Kinship band and
iii. the Kinship Coefficient of the progeny of mating with the named mare. (This is not the same as the Mean Kinship, but is closely related. It is in-fact the inbreeding coefficient of any progeny of mating this mare and this stallion).

SELECTION

Following discussions with breeders and with staff at the Rare Breeds Survival Trust, a new "Traffic Light" system has been devised for 2018, which will make interpretation of the tables clear and straightforward. All possible matings are ranked into one of four tiers and colour coded (Tier 1 represents the best genetic pairings whilst Tier 4 is the worst for the genetic health of the whole population).

- **TIER 1:** Mare and Stallion from the same or an adjacent Kinship Band **AND** mating resulting in progeny of lower Kinship Coefficient than the Mean Kinship of the Mare. MATINGS THAT MEET THE ABOVE REQUIREMENTS ARE SAID TO BE SPARKS COMPLIANT AND ARE HIGHLIGHTED IN GREEN ON THE DATA SHEETS. THESE MATINGS ARE ENCOURAGED.
- **TIER 2:** Mare and Stallion from the same or an adjacent kinship band **BUT** mating resulting in progeny of higher Kinship Coefficient than the Mare but less than 0.24. These matings represent **"The Best of the Rest"** and are the preferred alternative if a SPARKS compliant mating does not exist or is not possible. They are highlighted in yellow on the sheets.
- **TIER 3:** Mare and Stallion from widely differing Kinship Band and Kinship Coefficient less than 0.24. These matings bring together more common alleles (genes) with those that are less well represented in the population, in a way that makes it hard to separate, putting the less frequent allele at greater risk of loss in future generations. **THESE MATINGS ARE DISCOURAGED** and are highlighted in Orange on the sheets.
- **TIER 4:** Any matings producing progeny with **KINSHIP COEFFICIENTS OF 0.24 OR GREATER SHOULD BE AVOIDED.** They are Highly Inbred and increase the probability of deleterious traits being expressed in future generations. (A Kinship Coefficient of 0.25 IS EQUIVALENT TO A FULL SIBLING BROTHER / SISTER MATING!) These matings are highlighted in Red on the sheets.



CLEVELAND BAY HORSE SOCIETY - 2018

Guidance on the use of SPARKS Data Sheets

It should be noted that the "tiering" is an assessment of the merit of pairing of two animals and is not an endorsement or criticism of the genetic makeup or quality of either of the individuals.

THE AIMS AND SUCCESS OF THE PROJECT

- The retention and maximising of genetic diversity of the whole population
- The reduction of the rate of increase in inbreeding and maintaining it at a minimum (zero is not possible)
- The avoidance of mixing more common alleles with less common ones (mixing of rare bloodlines with more common ones)
- The direct effect of achieving the above will be maximising the Effective Population Size, which is a well-accepted measure of the genetic health of any population.
- Information will be freely distributed on an annual basis to enable breeders to work towards these goals.
- By adopting these strategies, we hope to prevent the loss of genetic diversity and increasing levels of inbreeding that are inherent problems in rare breeds. This in turn should help avoid future problems of increasing infertility, foal mortality, deformity and other genetically linked phenomena.

ARTIFICIAL INSEMINATION

Feedback from breeders has highlighted the need for information on the availability of stallions by artificial insemination. We have tried to indicate whether a stallion is available by fresh or frozen semen, and which countries frozen semen is available for export to. Contact details for stallion owners can be found in current Society publications or on the CBHS website http://www.clevelandbay.com/stallions .

The datasheets contain Kinship data relating to some stallions that are now deceased, that are known to or may have frozen semen still available. This information is provided so breeders have the broadest possible picture of mating choices. Please note that appearance of the existence of stored semen on the sheets is no guarantee of availability.

MEAN KINSHIP OF PROGENY

The use of datasheets since 2004 has highlighted the subtle difference between Mean Kinship of parents and Kinship Coefficient of progeny. Until new animals are registered and entered onto the system we cannot calculate their Mean Kinship or Kinship Band. This highlights the importance of prompt registration of pure-bred foals. Owners are advised to follow the above guidelines in making breeding choices, as they continue to be the most robust and scientifically validated method of ensuring the genetic wellbeing of the global Cleveland Bay population.

ANOMALIES

If when studying the datasheets for your mares you recognize information that is not or might not be correct, please let the Society know. In past years a small number of cases have come to light which revealed inconsistencies in the SPARKS data, which have since been corrected. The programme can only be as good as the data it contains, so please let us know if, for example, mares with identical breeding do not have identical datasheets.

NB The data provided in this set of sheets is highly filtered from the SPARKS database and should not be taken as a true representation of the current Cleveland Bay population. As such it is not suitable for research purposes.

Andy Dell.
Endmoor.
February 2018
Email andy.dell@btinternet.com

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A Worked Example

Cleveland Bay Horse Society

SPARKS Kinship Table 2018

For Pure-bred Mares / Stallions Licensed For Pure Bred Breeding

Mare's Name Ormelies Secret Beauty Stud Book Number 2635

Mean Kinship 0.2267 Inbreeding Coefficient .2397 Mean Kinship Band E

NB THIS SHEET AND THE DATA IT CONTAINS IS ONLY VALID FOR THE 2018 BREEDING SEASON
Please follow the traffic lights & use in conjunction with the accompanying guidance notes

Tier 1 Matings highlighted in GREEN are SPARKS compliant & are ENCOURAGED
Tier 2 Matings highlighted in YELLOW are not fully compliant but are the "BEST OF THE REST"
Tier 3 Matings highlighted in ORANGE are not compliant AND jump Bands which is DISCOURAGED
Tier 4 Matings highlighted in RED should be AVOIDED as they are highly inbred (> 0.24)

Stallion	Studbook Number	Stallion's Inbreeding Coefficient	Stallion's Mean Kinship	Kinship Band	Kinship Coefficient of Progeny	Availability	Stallion's Location
Cholderton Cacus	M2485	188	0.1990	B	1842	CONTACT OWNER	ENGLAND
Cholderton Brevis	M2485	2389	0.2094	C	1918	CONTACT OWNER	ENGLAND
Cholderton Jupiter	M2727	1832	0.2085	C	2014	Live Cover Only	UK
Cholderton Nero	M2661	1714	0.2062	C	2452	Live Cover Only	UK
Southbrook Spellbound	M2345	2084	0.2151	D	2078	FROZEN ONLY	ENGLAND
Fields Vance	M2767	1908	0.2178	D	2132	Live Cover Only	UK
Penrhyn Romulus	M2615	2286	0.2141	D	2352	NOT AT PUBLIC STUD	WALES
Cholderton Josiah	M2662	175	0.2156	D	2476	Live Cover Only	UK
Wemse Rhuvian	M2685	1988	0.2152	D	2911	Live Cover & Frozen UK	ENGLAND
Pembridge Justice	M2787	2353	0.2248	E	2054	Live Cover Only	WALES
Rosenkeadon Springtime	M2770	2268	0.2268	E	2069	Live Cover Only	ENGLAND
Willow Troy	M2577	2058	0.2284	E	2124	Live Cover Only	ENGLAND
Kirkmoor Wolfsbane Flower	M2782	2088	0.2260	E	2172	Live Cover Only	ENGLAND
Brackenbrae Surrealist	M2942	222	0.2241	E	2174	Live Cover Only	UK
Southbrook Warlord	M2375	1992	0.2251	E	2175	NOT AT PUBLIC STUD	ENGLAND
Clawmore Scotch On The Rocks	M2930	1996	0.2297	E	2177	Live Cover Only	ENGLAND
Highpasture Fellowship	M2589	2188	0.2202	E	2216	Live Cover & Frozen UK	WALES
Fenton	M2531	2033	0.2201	E	2227	Live Cover Only	WALES
Jemcon Highwayman	M2824	232	0.2287	E	2267	Contact Owner	UK
Craigewood Tobermory	M2801	2126	0.2262	E	228	Contact Owner	UK
Carolina Charlie Boy	M2718	2581	0.2284	E	2368	Live Cover Only	UK
Penrhyn Smiley	M2584	2431	0.2225	E	2424	NOT AT PUBLIC STUD	WALES
Arena Momotaro	M2849	226	0.2269	E	249	FROZEN /CHILLED ONLY	UK
Clawmore Kenneth	M2840	2136	0.2286	E	3218	Live Cover & Chilled	UK
Marsett Mist & Charmer	M2598	2189	0.2284	E	4248	Live Cover & Chilled	UK
Cholderton Tobi	M2423	237	0.2318	F	209	UK EU USA AUS NZ	WALES
Thomondbrook King William	M2737	2102	0.2321	F	217	Live Cover Only	UK
Beamish Fugleman	M2548	1896	0.2305	F	2177	Live Cover Only	ENGLAND
Blackcrough Kilkenny	M2582	2208	0.2318	F	219	Live Cover Only	UK
Barbarian Hustler	M2934	2251	0.2339	F	2237	Contact Owner	UK
Holmcote Applejack	M2736	2321	0.2397	F	2262	Live Cover Only	ENGLAND
Braithwaite Challenger	M2648	221	0.2326	F	2264	Contact Owner	UK
Kirkmoor Elderberry Flower	M2636	211	0.2365	F	2267	Live Cover & Frozen UK	UK
Billy's Joint Account	M2822	2314	0.2351	F	2278	Contact Owner	UK
Arena Big Ben	M2775	2135	0.2316	F	229	FROZEN UK AUS NZ USA	UK
Earlswood Traveller	M2649	2193	0.2300	F	2285	Live Cover Only	ENGLAND
Penrhyn P.S.	M2764	2122	0.2311	F	2285	CONTACT OWNER	ENGLAND
Rotton Grove Brandon	M2669	2172	0.2300	F	2308	Live Cover Only	ENGLAND
High Park Schoffield	M2487	2174	0.2361	F	2313	UK EU USA AUS NZ	ENGLAND
Oaten Tops1	M2462	2288	0.2392	F	2344	Live Cover Only	ENGLAND
Barbarian Gigalo	M2795	2266	0.2315	F	235	Contact Owner	ENGLAND
Stanmore Lochinvar	M2799	226	0.2328	F	2368	Live Cover Only	ENGLAND

[redacted]	M2836	.2253	0.2312	F	.2434	Live Cover & Chilled	UK
[redacted]	M2558	.2283	0.2346	F	.2685	CONTACT OWNER	ENGLAND
[redacted]	M2549	.2399	0.2372	F	.2723	Live Cover Only	ENGLAND
Chakola's M'Lord Beethoven	M2403A	.1749	0.1983	B	.204	FROZEN ONLY	CANADA
Cholderton Hyperion	M2625	.2081	0.2073	C	.1918	Live Cover Only	USA
Belladonna Pendleton	M173US	.171	0.2061	C	.2012	FROZEN ONLY	USA (Gelded)
Cholderton Issus	M2676	.2038	0.2169	D	.1982	Live Cover Only	IRELAND
Idelbon Yorktown	M103US	.1908	0.2156	D	.2032	CONTACT OWNER	USA
Runswick Sutton	M238B	.1866	0.2124	D	.2069	AI / FROZEN	USA
Chakola's Huckleberry	M179US	.1958	0.2135	D	.2078	Contact Owner	USA
Gaylord Edward Of York	M261US	.1957	0.2144	D	.2084	Contact Owner	USA
Knaresborough Fusilier	M247B	.1855	0.2112	D	.2119	Chilled & Frozen Worldwide	USA
Foxhollows (USA) Navigator	M104US	.2185	0.2162	D	.223	CONTACT OWNER	USA
Belladonna Isaac	M154US	.2298	0.2141	D	.2352	Contact Owner	CANADA
Pembridge Joshua	M268Z	.2353	0.2251	E	.2054	FRESH/CHILLED	USA
Lord Biggadoon	M272US	.2558	0.2205	E	.2063	Contact Owner	USA
Frostyoak Hampton	M256US	.1979	0.2222	E	.2103	Contact Owner	USA
Old Dominion Antonius	M149US	.2179	0.2256	E	.2106	Contact Owner	USA
Australpark Midnight Magic	M108AU	.2114	0.2226	E	.2117	CONTACT OWNER	AUSTRALIA
Bambiers Richard Lionhead	M234I	.2065	0.2237	E	.2124	CONTACT OWNER	USA
Frostyoak Malachi	M279US	.2235	0.2252	E	.2128	Contact Owner	USA
Alaska Mulberry Crumpet	M197AU	.2094	0.2252	E	.2136	FROZEN ONLY	AUSTRALIA (Gelded)
Idelbour Lion's Share	M140US	.2008	0.2242	E	.2141	Live Cover Only	USA
Arena Maestro	M282B	.2165	0.2210	E	.2156	Live Cover & Chilled	USA
Irondale Spring St. Patrick	M231AU	.2262	0.2267	E	.2159	Live Cover Only	AUSTRALIA
Thickley Norman	M252Z	.2119	0.2241	E	.2167	AI / FROZEN	CANADA
Galveston	M236US	.2146	0.2248	E	.2205	Contact Owner	USA
Wetherby Alchemist (NZ)	M224I	.2115	0.2224	E	.2263	Contact Owner	AUSTRALIA
Billara Alfredo	M234AU	.286	0.2263	E	.2265	CONTACT OWNER	AUSTRALIA
Australpark Field Master	M133AU	.2291	0.2232	E	.23	Contact Owner	AUSTRALIA
Windy Day Shakespeare	M235US	.2998	0.2223	E	.2351	Contact Owner	USA
Texlea Impeccable Marksman	M147AU	.2322	0.2294	E	.2396	CONTACT OWNER	AUSTRALIA
[redacted]	M243I	.2112	0.2230	E	.2631	AI	USA
Tregoyd Ironheyman	M249Y	.2229	0.2306	F	.2046	USA Contact Owner/Frozen	USA
Tregoyd Topper	M254S	.2209	0.2307	F	.2083	Live Cover Only	AUSTRALIA
OldDominion Sir Galahad	M187US	.2549	0.2332	F	.2113	CONTACT OWNER	USA
Old Dominion Brego	M202US	.2309	0.2329	F	.2136	CONTACT OWNER	CANADA
Stalmore Wolfhound	M252I	.1996	0.2302	F	.2177	Live Cover Only	USA
Pemrose Claudius	M253Z	.2371	0.2335	F	.2184	Live Cover Only	USA
Arndale Highlander	M283Z	.2169	0.2327	F	.2194	Live Cover Only	FRANCE
Bensington Bluestone	M282Z	.226	0.2383	F	.2195	CONTACT OWNER	USA
Texlea Saint Oliver	M175AU	.2714	0.2300	F	.2331	CONTACT OWNER	AUSTRALIA
Peterscreek Royal Saga	M214US	.2241	0.2321	F	.2381	CONTACT OWNER	USA
[redacted]	M239S	.2308	0.2350	F	.2431	AI/FROZEN	CANADA
Laughton Salem	M219O	.1495	0.2159	D	.216	Frozen UK AUS NZ	DECEASED UK
[redacted]	M232S	.1722	0.2184	D	.3061	Frozen UK EU AUS NZ	DECEASED UK
Cholderton Whitesnow	M236S	.1897	0.2246	E	.2013	CONTACT OWNER	DECEASED UK
Benny Bear	M213Z	.1852	0.2220	E	.2074	Frozen UK AUS NZ US	DECEASED UK
Whitehouse Statesman	M208O	.165	0.2242	E	.232	FROZEN UK	DECEASED UK
Fryup Marvel	M208S	.1457	0.2246	E	.2373	FROZEN US ONLY	DECEASED USA
Pembridge Midshipman	M251O	.2772	0.2329	F	.2164	USA AUS NZ	DECEASED UK
Tyneside St Dominic	M259S	.2198	0.2324	F	.2244	US CAN AUS NZ(UK EU?)	DECEASED USA
Timberlane Huckleberry	M238S	.2288	0.2392	F	.2392	FROZEN UK AUS NZ USA	DECEASED UK
[redacted]	M235S	.2621	0.2379	F	.2431	FROZEN UK	DECEASED UK
[redacted]	M290Z	.2004	0.2307	F	.2473	US CAN AUS NZ(UK EU?)	DECEASED USA
[redacted]	M228S	.2244	0.2330	F	.254	FROZEN ONLY	DECEASED UK
[redacted]	M225I	.2103	0.2328	F	.3191	FROZEN UK AUS NZ USA	DECEASED UK

NB THIS SHEET AND THE DATA IT CONTAINS IS ONLY VALID FOR THE 2018 BREEDING SEASON
Please follow the traffic lights & use in conjunction with the accompanying guidance notes

Mare: Ormelies Secret Beauty *Stud Book Number 2635* *Page No.2*

SPARKS Data sheets 2018 V2b Public published on behalf of The Cleveland Bay Horse Society by Andy Dell 20/2/2018

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One Mare - One Sheet

Cleveland Bay Horse Society

SPARKS Kinship Table 2018

For Pure-bred Mares / Stallions Licensed For Pure Bred Breeding

Mare's Name Ormelies Secret Beauty Stud Book Number 2635

Mean Kinship 0.2267 Inbreeding Coefficient .2397 Mean Kinship Band E

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Tier 3 Matings highlighted in ORANGE are not compliant AND jump Bands which is DISCOURAGED

Tier 4 Matings highlighted in RED should be AVOIDED as they are highly inbred (> 0.24)

Stallion	Studbook Number	Stallion's Inbreeding Coefficient	Stallion's Mean Kinship	Kinship Band	Kinship Coefficient of Progeny	Availability	Stallion's Location

- Identify the Mare's Mean Kinship and the band this places her in.
- This mare is in Band E
- Identify Stallions from the same or an adjacent banding
- In this case Bands D to F

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Follow The Traffic Light Scheme

Cleveland Bay Horse Society
SPARKS Kinship Table 2018
For Pure-bred Mares / Stallions Licensed For Pure Bred Breeding

Mare's Name Ormelies Secret Beauty Stud Book Number 2635

Mean Kinship 0.2267 Inbreeding Coefficient .2397 Mean Kinship Band E

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Stallion	Studbook Number	Stallion's Inbreeding Coefficient	Stallion's Mean Kinship	Kinship Band	Kinship Coefficient of Progeny	Availability	Stallion's Location
[illegible]	M2495	.156	0.1990	B	.1842	CONTACT OWNER	ENGLAND
[illegible]	M2485	.2389	0.2094	C	.1918	CONTACT OWNER	ENGLAND
Cholderton Jupiter	M2727	.1832	0.2095	C	.2014	Live Cover Only	UK
[illegible]	M2661	.1714	0.2082	C	.2452	Live Cover Only	UK
[illegible]	M2345	.2084	0.2151	D	.2078	FROZEN ONLY	ENGLAND
[illegible]	M2767	.1908	0.2179	D	.2132	Live Cover Only	UK
Penrhyn Romulus	M2615	.2288	0.2141	D	.2352	NOT AT PUBLIC STUD	WALES
[illegible]	M2662	.175	0.2156	D	.2476	Live Cover Only	UK
[illegible]	M2665	.1888	0.2152	D	.2811	Live Cover & Frozen UK	ENGLAND
[illegible]	M2787	.2353	0.2248	E	.2054	Live Cover Only	WALES
[illegible]	M2770	.2288	0.2288	E	.2069	Live Cover Only	ENGLAND
Willow Troy	M2577	.2058	0.2284	E	.2124	Live Cover Only	ENGLAND
[illegible]	M2782	.2088	0.2280	E	.2172	Live Cover Only	ENGLAND
[illegible]	M2842	.222	0.2241	E	.2174	Live Cover Only	UK
[illegible]	M2375	.1992	0.2251	E	.2175	NOT AT PUBLIC STUD	ENGLAND
Stainmore Scotch On The Rocks	M2830	.1998	0.2297	E	.2177	Live Cover Only	ENGLAND
[illegible]	M2589	.2189	0.2202	E	.2216	Live Cover & Frozen UK	WALES
[illegible]	M2531	.2033	0.2201	E	.2227	Live Cover Only	WALES
[illegible]	M2824	.232	0.2297	E	.2257	Contact Owner	UK
[illegible]	M2801	.2128	0.2282	E	.226	Contact Owner	UK
Carolina Charlie Boy	M2718	.2591	0.2294	E	.2368	Live Cover Only	UK
[illegible]	M2564	.2431	0.2225	E	.2424	NOT AT PUBLIC STUD	WALES
[illegible]	M2649	.225	0.2269	E	.249	FROZEN /CHILLED ONLY	UK
[illegible]	M2640	.2138	0.2286	E	.3218	Live Cover & Chilled	UK
[illegible]	M2598	.2199	0.2284	E	.4249	Live Cover & Chilled	UK
[illegible]	M2423	.237	0.2318	F	.209	UK EU USA AUS NZ	WALES
[illegible]	M2737	.2102	0.2321	F	.217	Live Cover Only	UK
[illegible]	M2540	.1998	0.2305	F	.2177	Live Cover Only	ENGLAND
[illegible]	M2582	.2208	0.2318	F	.219	Live Cover Only	UK
[illegible]	M2834	.2251	0.2338	F	.2237	Contact Owner	UK
[illegible]	M2736	.2321	0.2397	F	.2252	Live Cover Only	ENGLAND
[illegible]	M2848	.221	0.2326	F	.2254	Contact Owner	UK
Kirkmoor Elderberry Flower	M2636	.211	0.2365	F	.2267	Live Cover & Frozen UK	UK
Billy's Joint Account	M2822	.2314	0.2351	F	.2278	Contact Owner	UK
Arena Big Ben	M2775	.2135	0.2318	F	.229	FROZEN UK AUS NZ USA	UK
Earlswood Traveller	M2848	.2193	0.2300	F	.2285	Live Cover Only	ENGLAND
Penrhyn P.S.	M2784	.2122	0.2311	F	.2295	CONTACT OWNER	ENGLAND
Batton Grove Brandon	M2868	.2172	0.2300	F	.2308	Live Cover Only	ENGLAND
High Park Schofield	M2487	.2174	0.2381	F	.2313	UK EU USA AUS NZ	ENGLAND
Oaten Topsl	M2482	.2288	0.2392	F	.2344	Live Cover Only	ENGLAND
Barbarian Gigan	M2795	.2266	0.2315	F	.235	Contact Owner	ENGLAND
Stainmore Lochinvar	M2799	.226	0.2328	F	.2368	Live Cover Only	ENGLAND

Matings to be Encouraged

Best of the Rest Matings

Matings to be Discouraged

Matings to be Avoided

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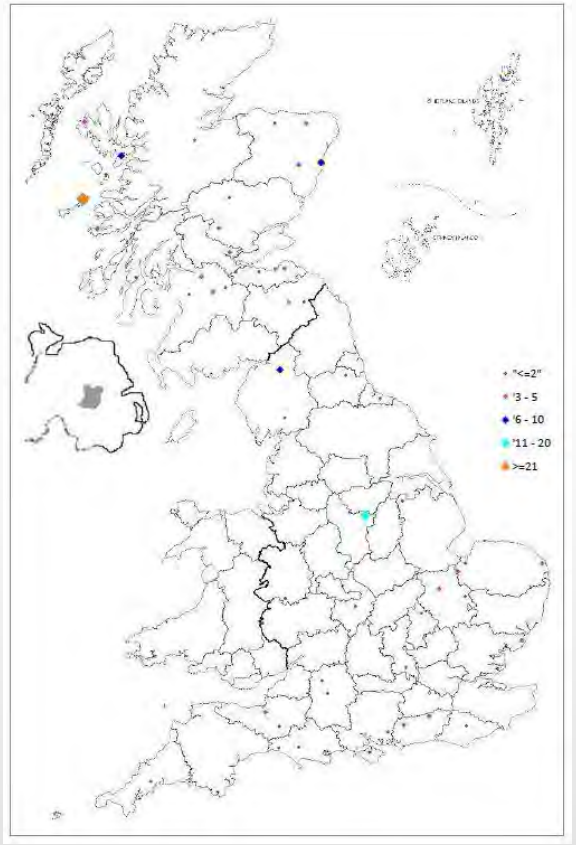
Obstacles to Compliant Matings



- Geography
- Travelling Distance
- Isolated Herds
- Travelling Grants
- Colt Retention Scheme
- Semen Collection/ AI ?

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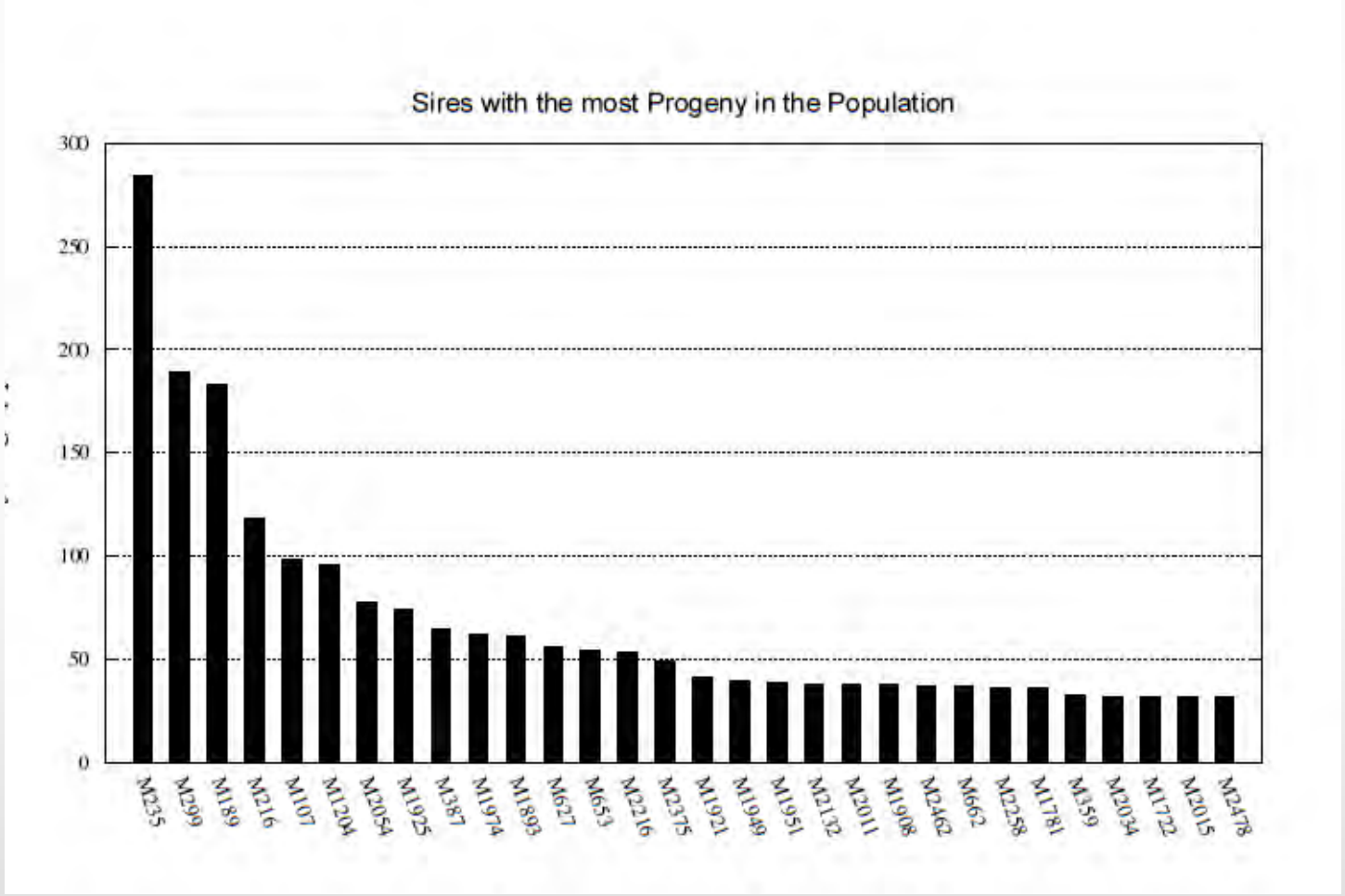
Breed From As Many Males As Possible



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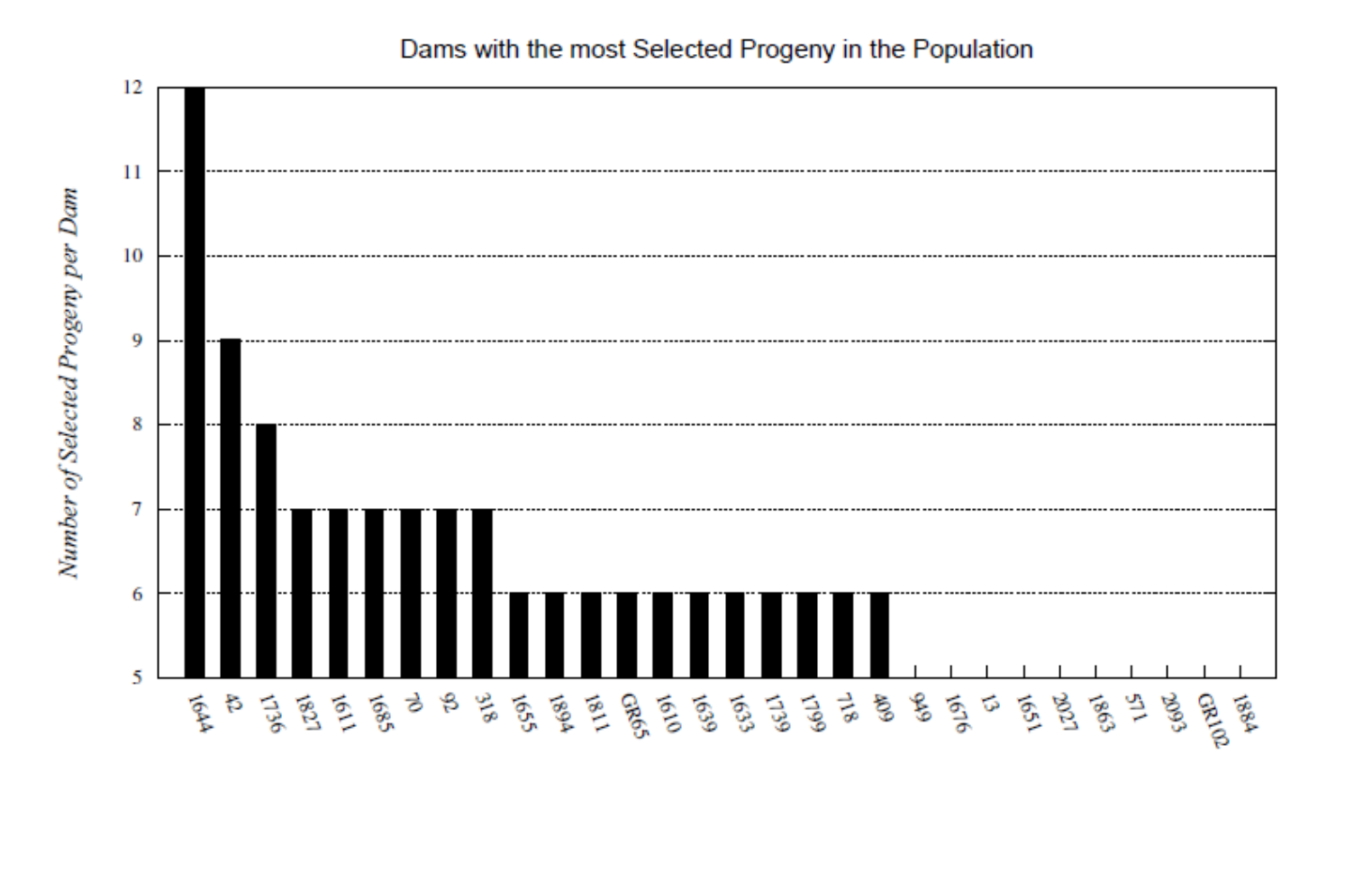
Breed From As Many Females As Possible



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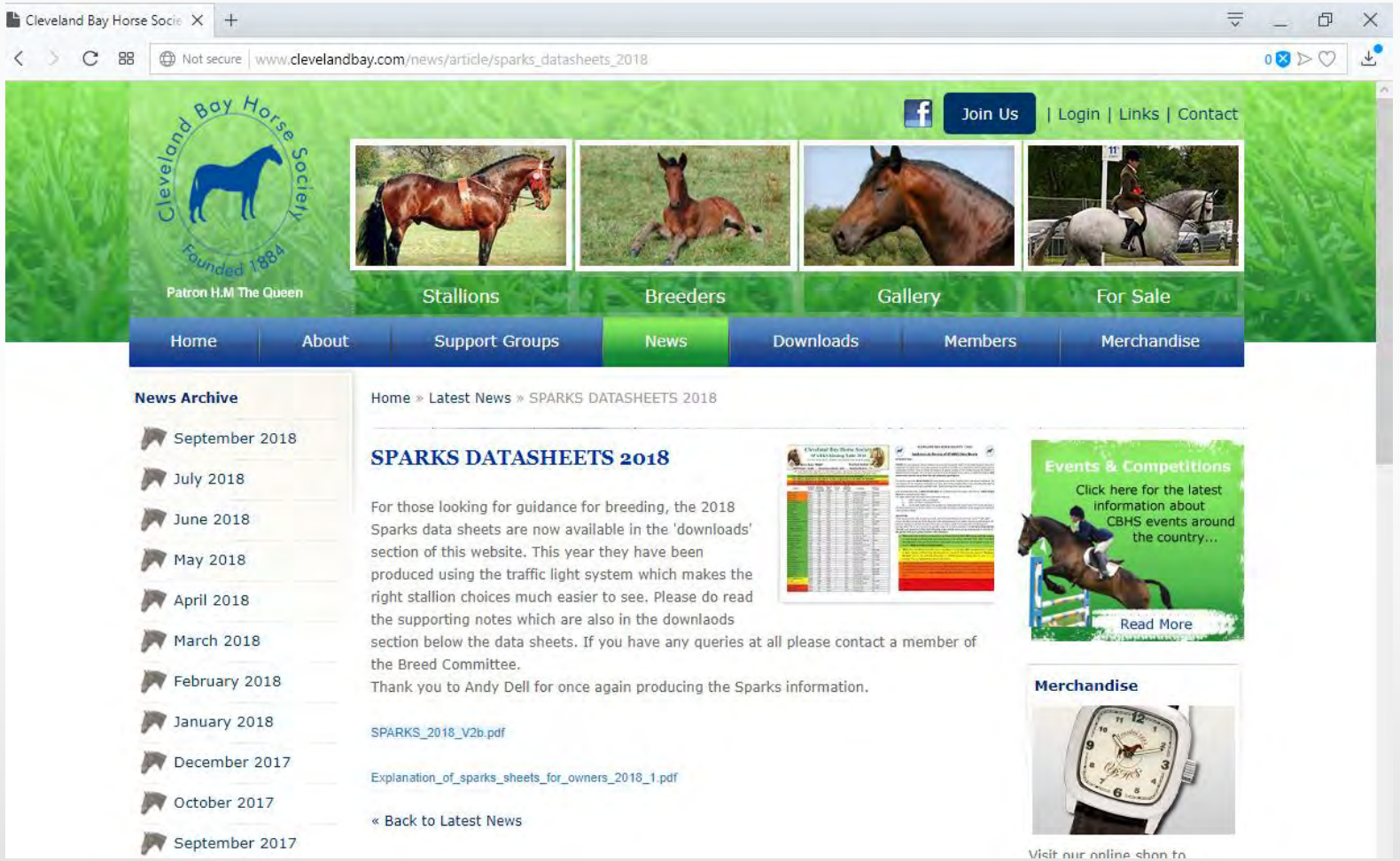
Distribution Of Datasheets



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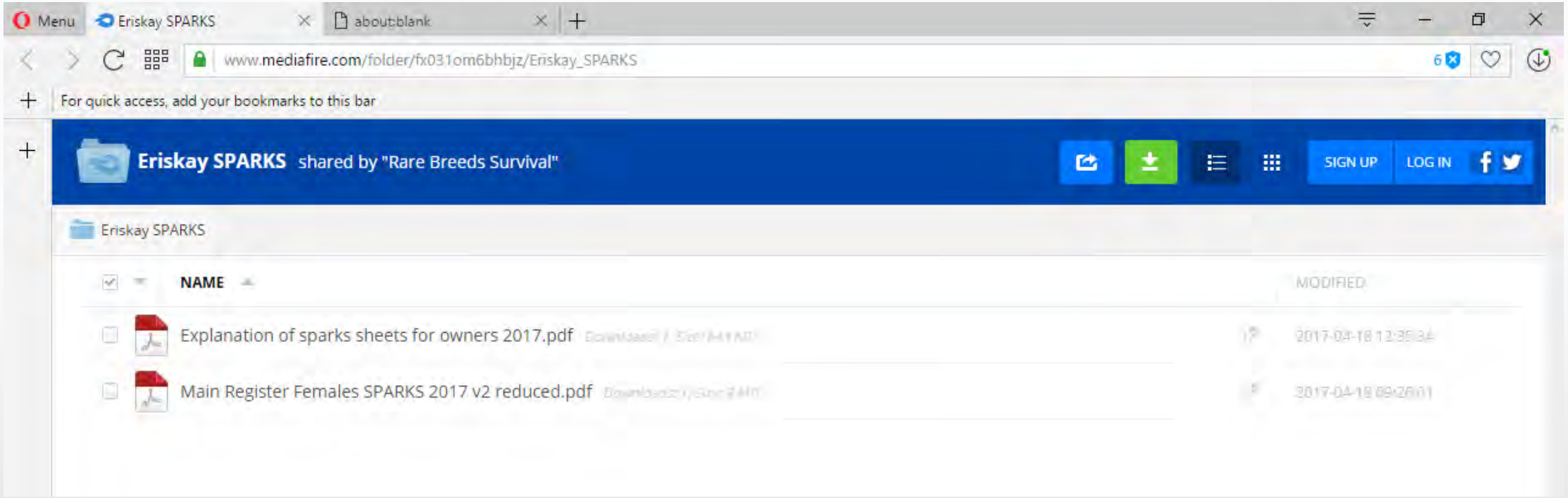
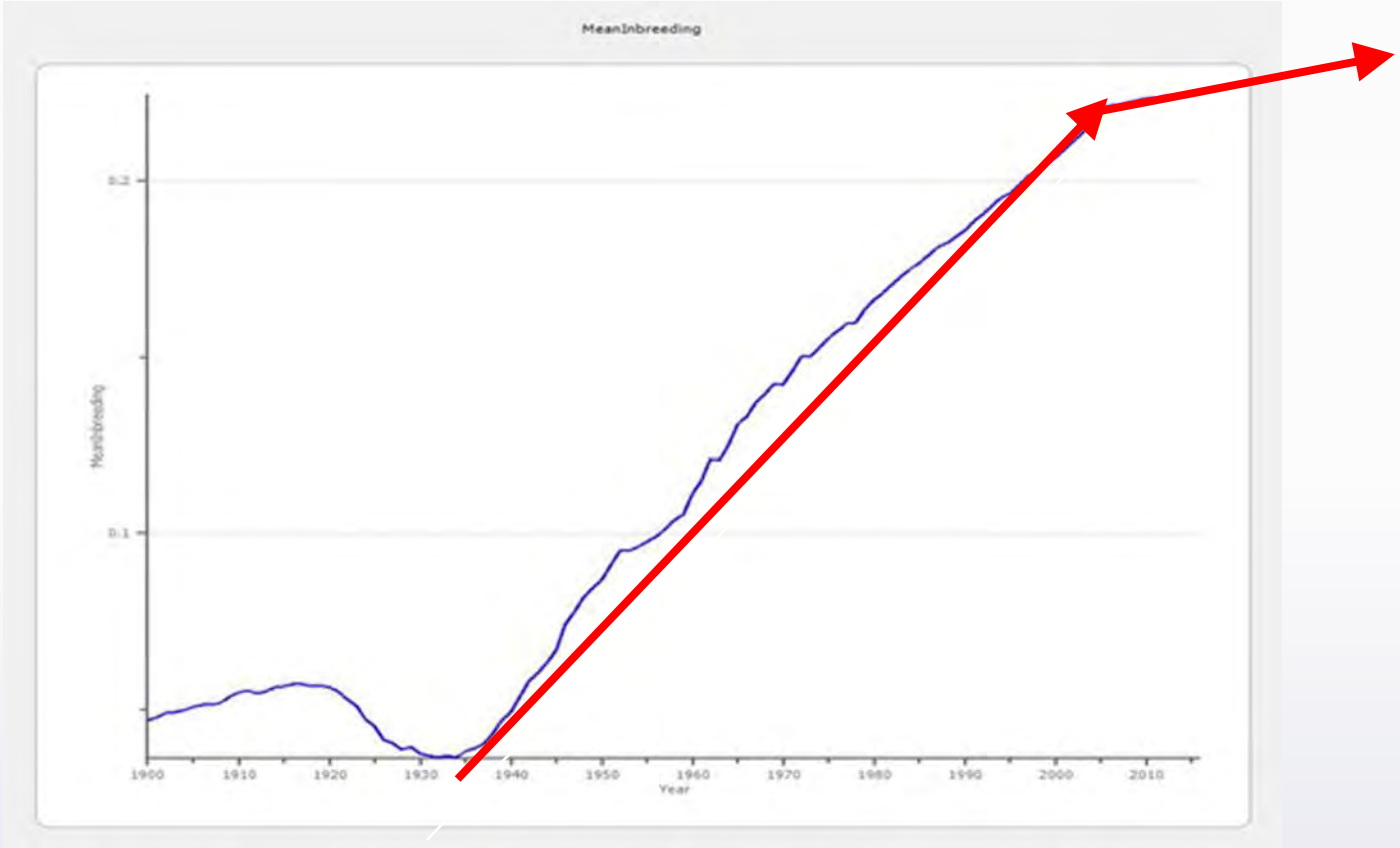
Distribution Of Datasheets

https://www.mediafire.com/**********



Monitor Save Promote

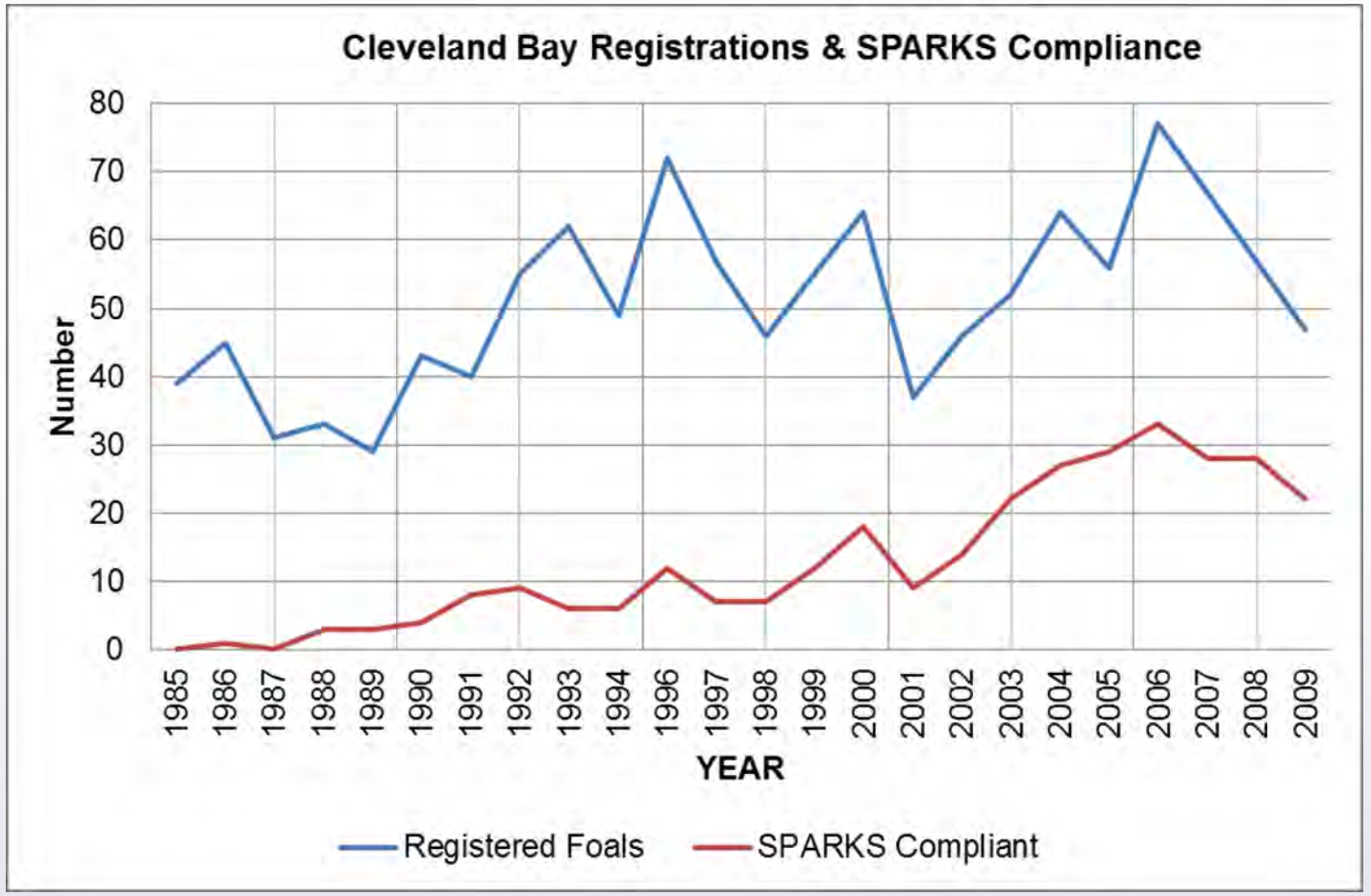
Monitoring Changing Inbreeding



Mean Inbreeding in the Cleveland Bay Horse 1900 to 2017

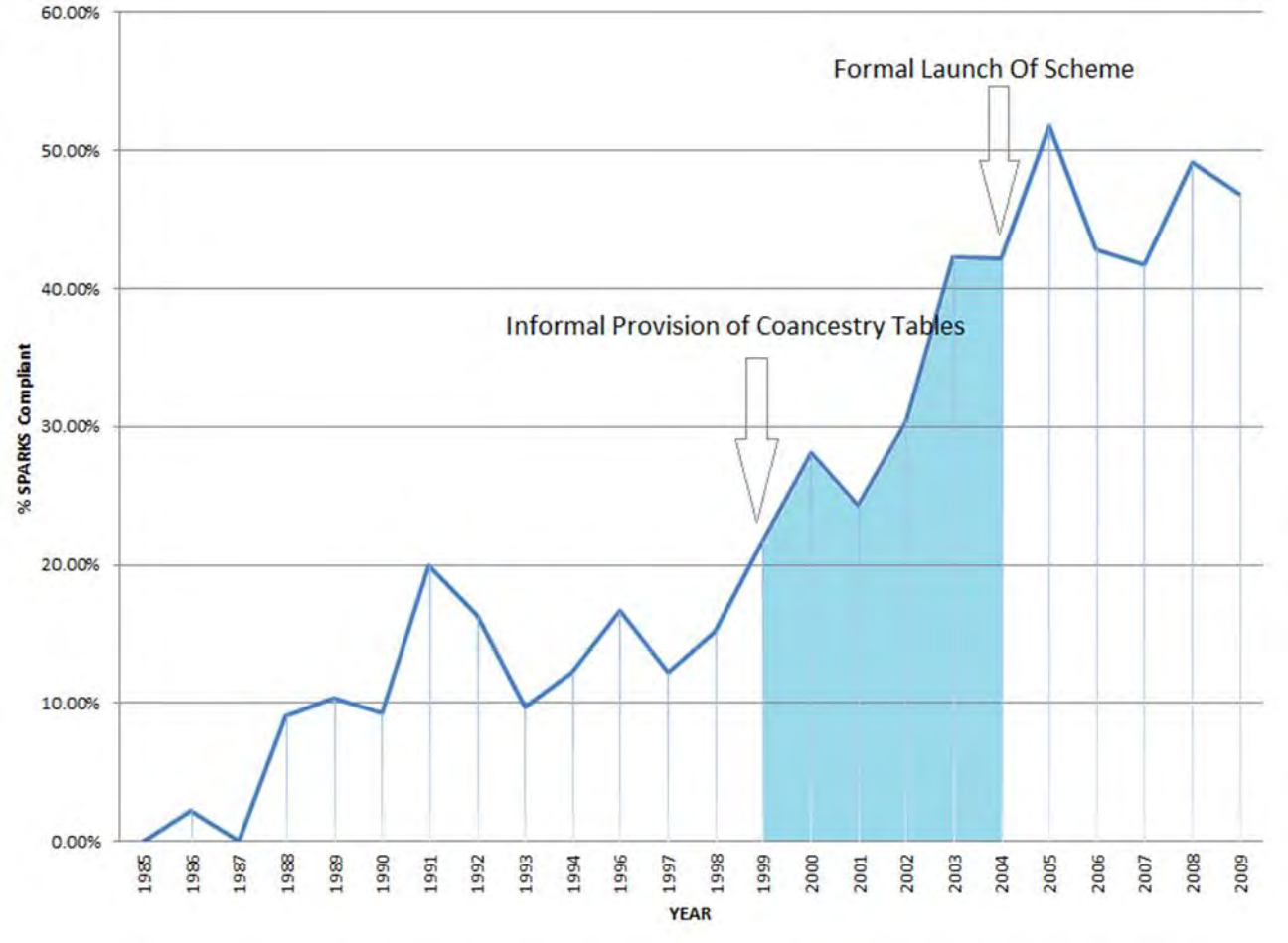
Monitor Save Promote

SPARKS Compliance



Monitor Save Promote

SPARKS Compliance



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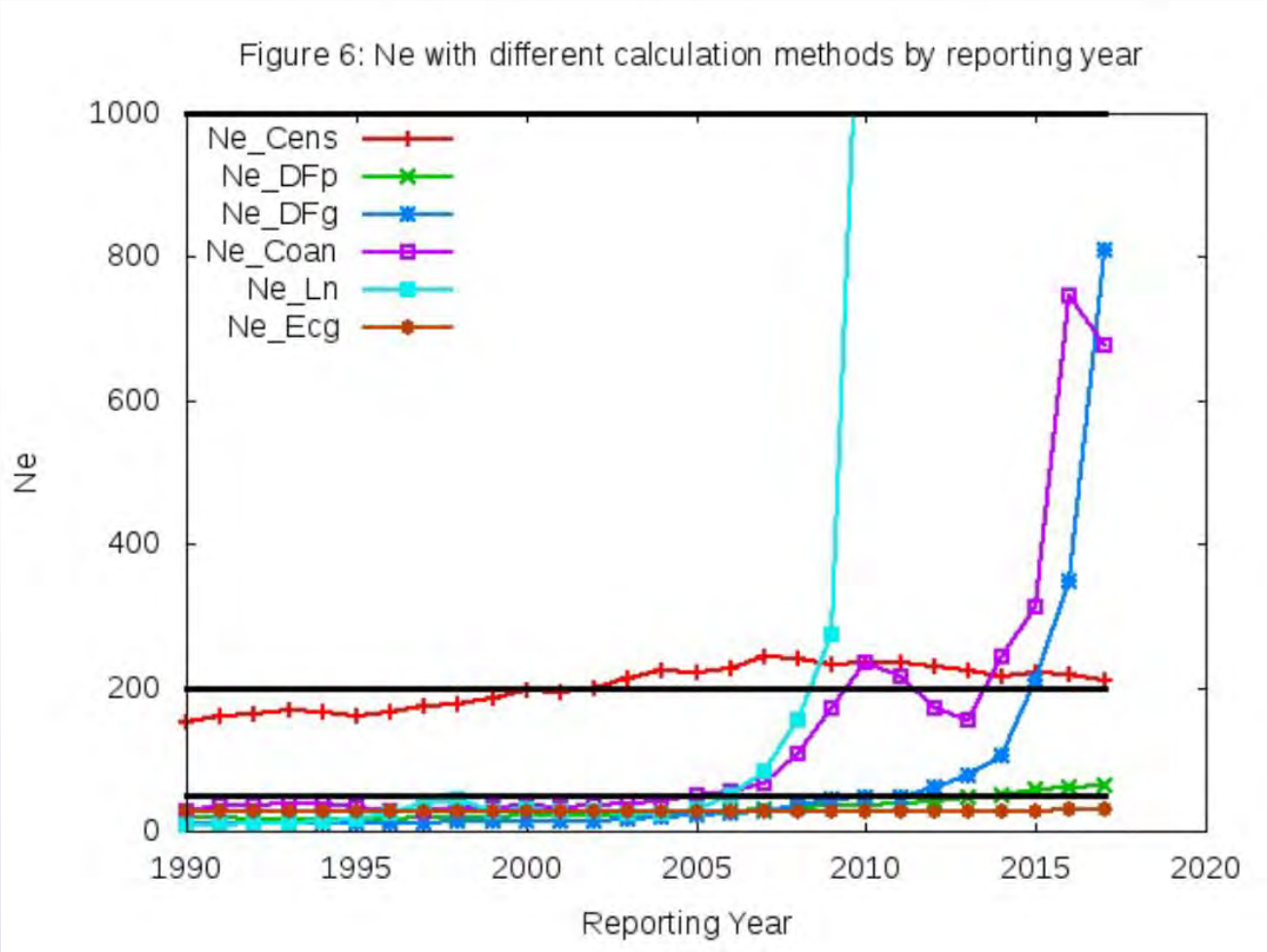
Monitoring Changing Inbreeding

- Rate of increase in Inbreeding and Mean Kinship need bringing down slowly over a number of years (generations).
- It will never be zero (unless you bring in animals from outside the studbook).
- Trying to do it quickly will get short term decrease then revert back to even greater rate than before.
- This will cap the maximum possible reduction and limit options for the future.
- (That's why we do it through managing MK not directly)

Changing Effective Population Size



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The Future

- MK is dynamic as population changes
- 2018 sheets only valid for 2018 season
- Annual Updates after new registrations
- 2019 sheets will be available after January registrations for CBHS & Eriskay Pony Society

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Breeding for The Future Of Rare Breeds

- Encourage all Societies to think in terms of detailed breed analysis and breed advisory schemes such as SPARKS.
- This gives breeders an additional tool in the toolbox.
- To encourage owners of low banded mares to breed to preferred stallions.

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Encouraging Breeding From Animals Of Low Mean Kinship

- Animals with particularly low MK's are priority breeders
- They are carriers of rarer alleles
- Low MK Stallions are a priority for Gene Banking
- Incentive schemes

Monitor Save Promote

Breeding for The Future Of Rare Equine Breeds

- Uncoordinated breeding leads to unsustainable accumulation of inbreeding
- This has a direct and negative influence on Effective Population Size
- We have a joint responsibility to do something before it is too late
- The more Societies and Breeders that adopt SPARKS type schemes the more secure will be the Global Populations.
- Ignorance is no longer an excuse!

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Breeding for The Future Of All Rare Breeds

- Behind the scenes RBST is working to make similar advice available to ALL breeds of livestock

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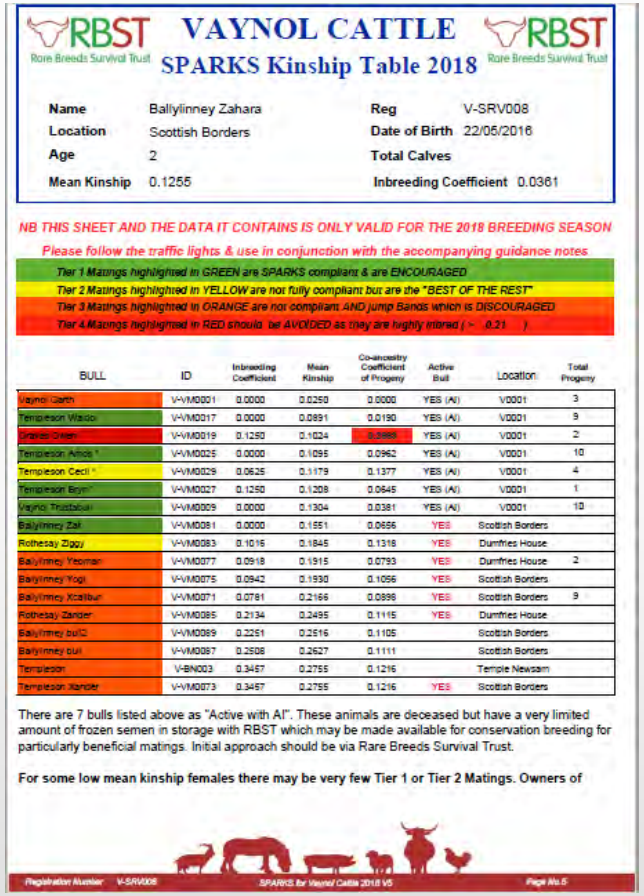
Breeding for The Future Of All Rare Breeds



RBST Rare Breeds Survival Trust

VAYNOL CATTLE

SPARKS Kinship Table 2018

RBST Rare Breeds Survival Trust

Name	Ballylinney Zahara	**Reg**	V-SRV008
Location	Scottish Borders	**Date of Birth**	22/05/2016
Age	2	**Total Calves**	
Mean Kinship	0.1255	**Inbreeding Coefficient**	0.0361

NB THIS SHEET AND THE DATA IT CONTAINS IS ONLY VALID FOR THE 2018 BREEDING SEASON

Please follow the traffic lights & use in conjunction with the accompanying guidance notes

Tier 1 Matings highlighted in GREEN are SPARKS compliant & are ENCOURAGED

Tier 2 Matings highlighted in YELLOW are not fully compliant but are the "BEST OF THE REST"

Tier 3 Matings highlighted in ORANGE are not compliant AND jump Bands which is DISCOURAGED

Tier 4 Matings highlighted in RED should be AVOIDED as they are highly inbred (> .0.21)

BULL	ID	Inbreeding Coefficient	Mean Kinship	Co-ancestry Coefficient of Progeny	Active Bull	Location	Total Progeny
Vaynol Garth	V-VM0001	0.0000	0.0250	0.0000	YES (AI)	V0001	3
Templeson Wizzo	V-VM0017	0.0000	0.0891	0.0190	YES (AI)	V0001	9
Grayce Green	V-VM0019	0.1250	0.1024	0.3665	YES (AI)	V0001	2
Templeson Amos *	V-VM0025	0.0000	0.1095	0.0962	YES (AI)	V0001	10
Templeson Cecil *	V-VM0029	0.0625	0.1179	0.1377	YES (AI)	V0001	4
Templeson Boyd *	V-VM0027	0.1250	0.1208	0.0645	YES (AI)	V0001	1
Vaynol Trustabout	V-VM0009	0.0000	0.1304	0.0381	YES (AI)	V0001	10
Ballylinney Zak	V-VM0081	0.0000	0.1551	0.0666	YES	Scottish Borders	
Rothesay Ziggy	V-VM0083	0.1016	0.1845	0.1318	YES	Dumfries House	
Ballylinney Yeoman	V-VM0077	0.0918	0.1915	0.0793	YES	Dumfries House	2
Ballylinney Yogi	V-VM0075	0.0942	0.1930	0.1056	YES	Scottish Borders	
Ballylinney Xcalibur	V-VM0071	0.0781	0.2166	0.0899	YES	Scottish Borders	9
Rothesay Zander	V-VM0085	0.2134	0.2495	0.1115	YES	Dumfries House	
Ballylinney bull2	V-VM0089	0.2251	0.2516	0.1105		Scottish Borders	
Ballylinney bull	V-VM0087	0.2508	0.2627	0.1111		Scottish Borders	
Templeson	V-BN003	0.3457	0.2755	0.1216		Temple Newsam	
Templeson Xander	V-VM0073	0.3457	0.2755	0.1216	YES	Scottish Borders	

There are 7 bulls listed above as "Active with AI". These animals are deceased but have a very limited amount of frozen semen in storage with RBST which may be made available for conservation breeding for particularly beneficial matings. Initial approach should be via Rare Breeds Survival Trust.

For some low mean kinship females there may be very few Tier 1 or Tier 2 Matings. Owners of

Registration Number V-SRV008 SPARKS for Vaynol Cattle 2018 V5 Page No.5

- The RBST Vaynol Cattle herds are now being managed through Mean Kinship and SPARKS data sheets

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Breeding for The Future Of All Rare Breeds

- Collections for the Genebank and use of Conservation Semen should be guided by this type of advice

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Breeding for Diversity

A SCIENCE BASED GUIDE

HOME 4 STEPS CONTACT

Conservation in Four Steps

Conservation of captive populations Four steps to diversity Conservation is a constant battle with limited resources. Depletion of genetic diversity is the thin end of the wedge of extinction. This website provides guidance for anyone...

READ MORE

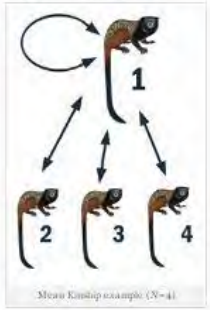
Endangered Species

Rare Domestic Breeds

Preserve them in 4 steps:

Much that once was is lost, for none now live to remember it..

Mean Kinship



Mean kinship is widely accepted as a conservation method within zoos. For example, mean kinship was used to manage genetic diversity of the captive black-footed ferret population before successful reintroduction in the wild.

read more

Breeds

The last two centuries genetic diversity decreased within most if not all domestic breeds. This resulted in a high incidence of breeds specific genetic diseases. What to do if you want your breed to be healthy?

read more

Zoos

Zoos are the last resort for some species. Though their capacity is limited, zoos are an opportunity to aid in preservation of some of the endangered species. Zoos can assist by giving priority for endangered species over abundant species and by applying breeding programs for endangered species. Again the key is genetic diversity. It is necessary to adapt back to environment in the wild.

read more

www.breedingfordiversity.com

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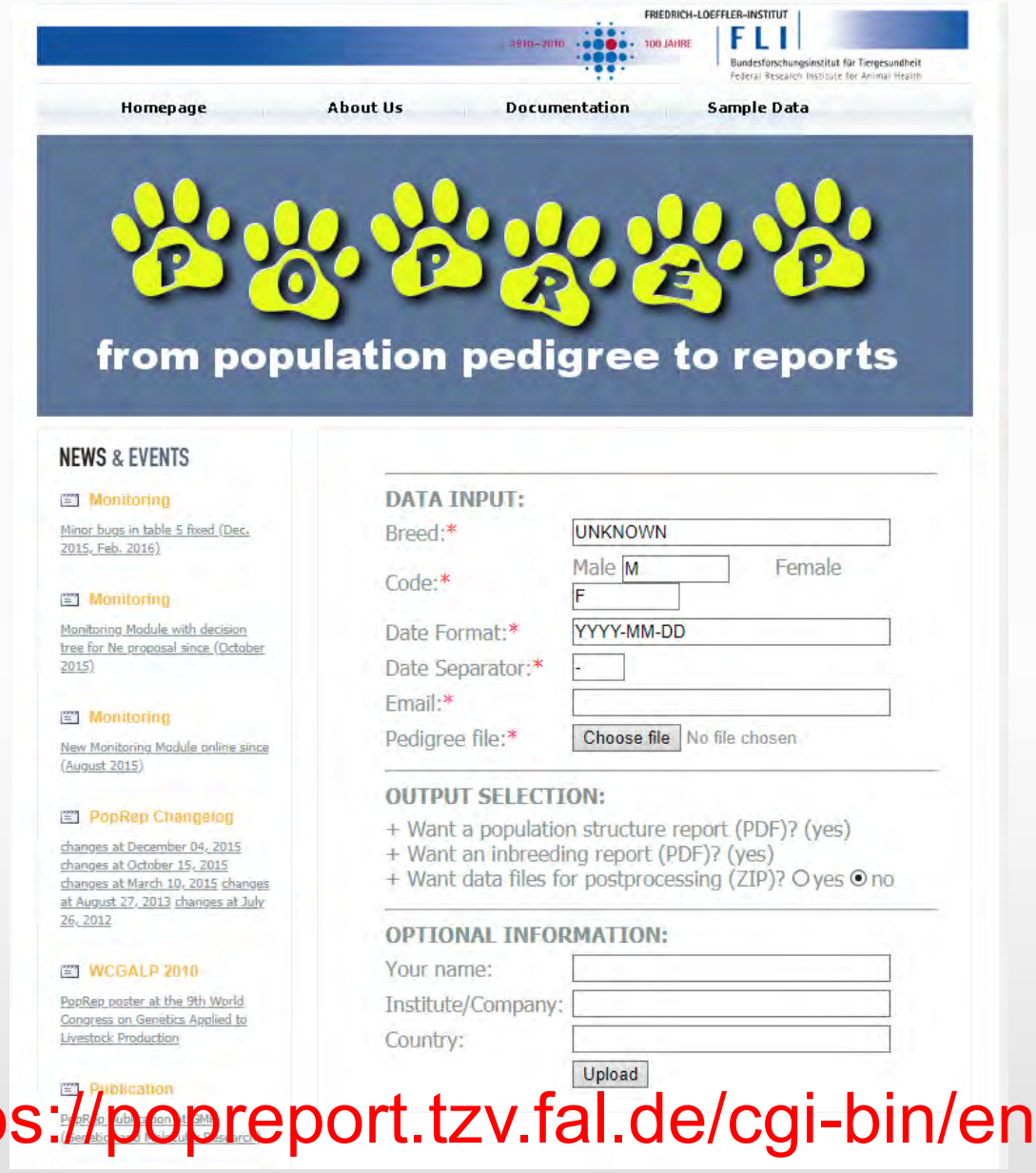

https://popreport.tzv.fal.de/cgi-bin/entry.pl

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Questions

RBST
Rare Breeds Survival Trust