Proposal to North American Breeders of Fell Ponies June 2026
Coefficient of Inbreeding: Strategies to Improve the Future Effective Population
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What is a COI?

COI stands for coefficient of inbreeding, a number determined by a scientific calculation based on the number of common ancestors found between the sire and the dam. Essentially this is an assignment of value to help us see the level of inbreeding that exists between two ponies.

Table A: Coefficient of Inbreeding (COI) for the NA effective and future effective populations.

	Breeding Stallions 2017-2025	**Breeding Mares 2017-2025**	**Breeding Mares/ Stallions Combined**	**Future Effective Population born 2017-2025**
COI Under 5.0	22	68	90	132
% of Total	22/65 , **34%**	68/156 , **44%**	90/221 , **41%**	132/211 , **62%**
COI 5.0 - 10.0	39	80	119	67
% of Total	39/65 , **60%**	80/156 , **51%**	119/221 , **54%**	67/211 , **32%**
COI Over 10.0	4	8	12	12
% of Total	4/65 , **6%**	8/156 , **5%**	12/221 , **5%**	12/211 , **6%**

Snapshot of the 'small gene pool'?

A. The Effective Population (See Table A.)

By analyzing the North American annual Fell pony foal crops in the last 9 years (2017-2025), I was able to identify the NA breeding pool (effective population). This pool consists of 158 mares and 65 stallions. The combined total of 223 is considered the 'effective population'. In this 9 yr. window, the NA effective population has averaged 39 foals per year. There is a familiar guideline in conservation to estimate the minimal viable population (MVP) which refers to the smallest number of animals considered necessary for a gene pool to survive. This is known as the 50/500 guide where you need at least 50 breeding individuals to avoid extinction and at least 500 breeding individuals to ensure the population creates enough new genetic variety through natural mutations to be able to adapt to future environmental changes. In order for the minimum 50 to prevent inbreeding depression, inbreeding coefficients should not exceed 1.0% with every generation. In order for the '500' rule to be effective, you need to consistently produce progeny with inbreeding coefficients (COI's) as low as possible, ideally below 5.0%.

B. The Pool of Prospects: Candidates for the Future Effective Population. (See Table B.)

I tallied a total future effective population of 211, roughly 60% of the total 352 foals born since 2017. Once a prospect produces a foal, they are removed from the future effective population and counted as part of the effective population. By identifying the maiden portion of 352, then eliminating castrations and deaths, I tallied 70 colts and 141 fillies (211 future effective population). The number for colts is most likely smaller as many castrations are not recorded.

Table B: COI breakdown of NA future effective population born 2017-2025.

Future Effective Population (FEP)	#/211 % of Total	# Below 5.0 % of Total	# 5.0 or Greater % of Total
'FEP' COI is Less Than Both Parents	86 **41%**	74 **35%**	12 **6%**
'FEP' COI is Less Than One Parent	80 **38%**	43 **20%**	37 **17%**
'FEP' COI is Greater Than Both Parents	41 **19%**	14 **7%**	27 **13%**
'FEP' Had No Real Change	4 **2%**	1 **.6%**	3 **1.4%**

** green to red correlates to green being what we want to increase and red we want to decrease.*

Table C: COI Comparison of the NA effective population to the NA future effective population.

Pool Category	COI's Below 5.0%	% of Prospects where COI is reduced from both parents in breeding pool and are less than 5.0%.	% of Prospects where COI is reduced from one parent in the breeding pool and are less than 5.0%
2017-'25 NA Breeding Pool Effective Population	41%	_____	_____
2017-'25 Prospect Pool Future Effective Population	62%	35%	20%

This table shows that NA has been able to somewhat lower COI's. Collectively, the goals would be to increase that 35% we see in the middle column of Table C. But this is not the extent of it. Let's say we create a future effective population that has a high percentage of COI's below 5.0%. If all those ponies carry the same few bloodlines, the healthy future is short lived. This is where my reverse pedigree data will show very helpful.

Preservationists understand the risks to the vitality of a rare breed when working with a limited gene pool. Breeding 'pure' within a closed gene pool is the best assurance for achieving consistent traits. But if that gene pool is small with a high number of line bred individuals, there are risks associated with inbreeding depression, something that eventually leads to decline in vitality, fertility and overall health. Outcrossing strategies are essential for creating a viable future breeding pool of Fell ponies in North America.
Note: When looking at Fell pony pedigrees in depth (6th-10th generation), the majority not only

shows in/line-breeding, but overuse of the same common ancestors. This practice continues today in the UK. Knowing this helps us resolve that a big part of what we should be doing as breeders is make effort to dilute the genetic concentrations we have acquired. There are theories that inaccuracies in stud book records made decades ago eases this concern. While this may have warded off inbreeding depression for a time, the practices continue and are not sustainable for the long term.

Outcrossing is a strategy of matching a line/in-bred pony to a pony that does not share those same ancestors. In many cases for the Fell pony, both sire and dam will show considerable line breeding. The mainstream suggestion for minimizing risks to a small gene pool is to keep COI's below 5.0%. As you can see in Table A, 59% of the total effective population has a 10G COI over 5.0%. The challenge for proper outcrossing is amplified as many line bred ponies share the same lines. In such a case as the Fell pony in North America, there is a need to strategize beyond outcrossing, where we need to look at the diversity of the lines we are collectively producing. This is something I hope to talk about more in the future. But for here, I wanted to give insight into how tracking COI's can be used to help outcrossing strategies. Identifying the true pool of prospects (the future effective population) and analyzing their common ancestors provides helpful insight. Since the bones of the active NA effective population were extracted from a limited and heavily line bred 'mother' pool, we are doubly challenged with making beneficial strategic choices.
I have determined 4 main strategies that, if implemented by a majority, will help the future genetic health of the NA future effective population. The data above in the 3 tables relates to the 2nd strategy, but I will briefly list all 4 here:

1. Produce foals that increase bloodline diversity and minimize bloodline bottlenecks (an overuse of certain lines) in the future effective population.
2. Produce foal prospects that have coefficient of inbreeding scores (COI's) lower than 5.0% and possess a lower COI of at least one parent, but ideally lower than both parents.
3. Increase the size of the effective population by increasing the average annual foal crop. Avoid 'popular sire effect' by limiting his use correlated to the number of viable prospects he produces and how closely he is related to others. Ideally, suggestions are given to have a minimum ratio of 1 stallion to every 4 mares. We currently have a ratio of 1 stallion to 2.4 mares. Note: Several of the stallions in the effective population are closely related, thus compounding the concern.
4. Utilize ponies that are free of genetic problems and will positively impact desired type and temperament of the breed.

As I stated, the data in the tables are related to the 2nd strategy. Recently, I have created a database for both the effective and future population in NA. It will be updated with each annual foal crop going forward. The database contains pedigrees up to 10 generations where possible. It automatically calculates a 10G COI for each pony. It also can calculate resulting COI's from hypothetical matings.

Why keep track of inbreeding?
Most people have a sense that inbreeding is a concern, but don't fully understand how it might play out in a negative way. Each parent possesses 2 alleles (variants of a gene) for every trait. We know that each parent passes one of the two alleles to pair with one allele from the other parent. Some alleles are dominant where they express the trait if present. Other alleles are recessive, meaning both parents must contribute the same recessive allele for a trait to express (recessive dominance). The most well known example of recessive dominance would be FIS. Where there is no concern for a foal if it inherits one FIS allele (is heterozygous) from a parent, inheriting the allele from both parents (homozygous), the foal will not survive. Homozygosity is what pure breeding is relying on to ensure high incidence of desired traits. Homozygosity is

more reliably achieved by breeding ponies that have shared ancestors because they will have higher incidence of having the same alleles. Mutations (good and bad) are inevitable with every breed. Unwanted recessive alleles most likely already exist within the Fell pony breed. They may already be manifesting as we see higher incidence of retained placentas, uterine cysts, allergies, insulin resistance, etc. This is where homozygosity becomes problematic. From a preservationist standpoint, you can't preserve type if you abuse homozygosity and lose heterozygosity.

What goals should NA breeders work towards improving COI #'s for the future breeding pool?

What would be ideal is to produce foals that have a lower COI than both parents and their COI's are less than 5.0%. Keeping line breeding to a minimum and avoiding line breeding lines that are over represented is a great step in the right direction. As an aid for all of us, the database I have created has automatically calculated COI's for every pony in both the NA effective population, future effective population as well as their ancestors. Being able to examine the COI data for both populations helps us to see if we can improve these numbers going forward. Utilizing the database to determine the best stallion/mare matches can help us make plans for forming and maintaining the members in our breeding herds. For some, getting to consistent low COI's may take a few generations to achieve. This is because we may have a quality pony with a high COI that will not be significantly reduced with the options we have for matches to that pony. Sometimes we are utilizing a pony with a high COI because it brings a number of new ancestral DNA to the gene pool and has very good type. When this happens, we then need to strategize matching this beneficial pony so that the progeny will have lower COI's.

Working together to make a positive impact on the future effective population.

I am happy to provide COI data to breeders and discuss strategies for matchings in North America. I can create a list of COI's for their ponies and hypothetical matchings. I can also help people who are wanting to acquire new ponies by comparing COI's as well as providing insight into determining if certain bloodlines will help or hinder needed dilution.

I hope, as this data becomes more commonly considered, that we all hold a forward attitude of positivity and trust with each other rather than judging decisions that have been made in the past. In a situation where we collectively produce an annual average of 39 foals where roughly 23 potentially find their way into the effective population…….encouraging each other in this effort is of the utmost importance.