

RATIONALE FOR CHAMPIONSHIP STATUS FOR THE MAINE COON POLYDACTYL

INTRODUCTION

Their true origin has been lost in the passage of time, but one certainty in the heritage of the Maine Coon cat is the presence of polydactyly in the barn cats who form the basis of today's breed. While polydactyl Maine Coons appear frequently in show cat pedigrees, almost forty years after the acceptance of the Maine Coon breed into Championship, polydactyls themselves remain barred from the attainment of titles.

Advancement of the polydactyl Maine Coon (from its rather ironic placement in "New Traits") to Championship status has been passionately debated now for nearly ten years.

It has been said that history repeats itself, and indeed, the barriers to acceptance of the polydactyl Maine Coon into Championship are eerily reminiscent of the struggles once faced by the Maine Coon breed itself. Each has been near extinction, and each has been rescued from oblivion by dedicated enthusiasts and a growing popularity.

Like the Maine Coon Breeders and Fanciers Association (MCBFA) formed in the 1960's, PolyStandard started as a small group of Maine Coon breeders and fanciers dedicated to the advancement of the cats they love. Now with 90 working members and more than 200 associate members, the primary goal of PolyStandard is to have the Maine Coon Breed Standard modified to accept the polydactyl digit configurations and thereby permit the polydactyl Maine Coon to be accepted for show status. With that end in mind, application for the advancement of the polydactyl Maine Coon from the New Trait division to Championship has been filed, and this Rationale is submitted in support.

HISTORY AND GENETICS OF THE POLYDACTYL MAINE COON

The term polydactyly (poly meaning many and dactyl referring to digits) refers to the existence of extra digits.

Two basic configurations of polydactyly exist: pre-axial and post-axial. The "thumb" side is before the axis (pre-axial) and the "little finger" side is post-axial. In humans, extra digits are usually post-axial, consisting of an extra little finger, whereas in cats, the additions are usually pre-axial, on the thumb side of the foot or distal extremity.

History

Polydactyly has been noted in the general cat population as early as the late 1800's. Polydactyl cats are found in Great Britain, Southeast Asia and other parts of the world, as well as all over the United States. New England and Florida, especially the Florida Keys, however, seem to have the densest population. No one is entirely sure whether polydactyl cats originated in the United States or came here from elsewhere. Some people believe polydactyls are an American phenomenon and made their way to other parts of the globe on sailing vessels. Others believe the reverse. "*Are they separate mutation events or the result of human commerce?*" asks Dr. Pflueger, MD, director of medical genetics at the Baystate Medical Center in Springfield, Massachusetts and chair of the genetics committee for The International Cat Association (TICA).

(*'A little bit extra'* by Karen Commings, Catwatch Feb'06, interview with Dr. S. Pflueger)
http://polycoons.com/rationale/1-Catwatch_Feb06.pdf

Without question, though, the polydactyl Maine Coon is part of the Maine Coon heritage and has contributed to the gene pool of this breed from the very beginning. Today, we find polydactyls in almost every Maine Coon pedigree. (Heritage and historical polys)
http://www.polytrak.net/database/heritage/heritage_complete.htm

In an interview conducted with Don Shaw in Memphis in early March 1976, Mike Hicks, Beth Hicks, and Rick Bramham talked with Mr. Shaw, TICA Allbreed Judge, geneticist and outspoken genetics editor of "Cats" Magazine. In this interview they also talked about the polydactyl Maine Coon. Beth Hicks stated: *'I don't know if you are familiar with it but there was a study done by someone connected with a university in the 1950's which showed that 40% of the Maines were polydactyls. Now, this was before they came back on the show circuit.'* (The interview was taped and then transcribed verbatim.)

(The Scratch Sheet, Summer 1976 - The origin of the Maine Coon)

<http://www.pawpeds.com/MCO/mchs/articles/DonShaw3.html>

Why were polydactyls excluded in the beginning? Quite simply-- aesthetics. In the initial struggles to get the Maine Coon cat accepted in Fancier Associations, a decision was made to exclude the trait, not for health concerns, but because the image of polydactyly was seen as a close reference to the domestic or barn cat. During its inception, the MCBFA actually included a polydactyl Standard, which remains valid to this day. It states: Our MCBFA Polydactyl Standard has been voted in by our membership, and the wording is as follows: *"The Maine Coon Polydactyl Cat should conform to the Standard of the Maine Coon Cat, with the exception that multiple toes are allowed on either fore or hind paws or both."*

(The Scratch Sheet spring 1970) http://polycoons.com/rationale/2-Scratch_Sheet.pdf

Further evidence exists in a letter dated September 29th, 1973 written by the Vice-President of the MCBFA at that time. Rodney Ljostad writes: "We have a six toed kitten in our house too. You are right that they are not accepted at cat shows yet. We knew that many Maine Coon cats were polydactyl and did not want this trait to get entirely lost from the breed. Then we heard that some of the breeders who had these cats were no longer able to breed them. So my wife and I decided we had better get one and keep this trait going in the breed."

A key word here is "yet". This clearly shows the intention to include polydactyls in the future.

(Letter dated September 29th, 1973 of the then Vice-President of the MCBFA Mr. Ljostad)

http://polycoons.com/rationale/3-Ljostad_Letter.jpg

Sadly, once the Maine Coon breed was established, that aim was not achieved, and over time, polydactyly was bred out to fit show standards. A cat FAQ on the MCBFA website comments on why the Maine Coon polydactyl was culled from the breed (due to it being a disqualification in competition). (The Maine Coon: Cat Breed FAQ)

<http://www.fanciers.com/breed-faqs/maine-coon-faq.html>

Over the years, a small number of Maine Coon breeders kept the trait alive in their breeding programs. Between 2001 to 2004, these breeders started to organize and realized there were others across the globe that shared their desire to maintain polydactyly in the Maine Coon breed. In 2005, a concentrated effort to introduce the trait to the show ring began. Polydactyl Maine Coons were entered into the New Traits division in TICA. The process of education and exposure was started.

Because they had been ineligible to compete, polydactyl Maine Coons had been seen as pets for many years, and consequently, their Breed Standard type had faltered. Since 2005, with the hope of seeing their cats in showhalls, polydactyl breeders started a concentrated effort to tighten up the standard on the poly Maine Coon. This will indeed take time, but from 2005 to present day, the type has greatly improved.

In 2008 the New Zealand Cat Fancy made history when they became the first World Cat Congress (WCC) member organization, and the first registry in the world to change the Maine Coon Breed Standard to allow polydactyl Maine Coons to compete.

Genetics

Numerous assertions have been made over the years that polydactylism is a breeding defect that will produce extreme expressions and severe maladies in the Maine Coon. This subject has triggered many a heated debate when poly breeders counter to defend the fitness of their cats. Scientific studies and empirical experience now provide abundant evidence: the

polydactyl trait in the Maine Coon is an innocent variance that poses no threat to the well-being of the cat.

Note: Over time, more and more is discovered about the specific mechanisms of the genetics of polydactyly. In 2008, Lettice, et al, reported that the polydactyl trait in cats is not due to a gene mutation or a (Pd) gene but rather to a single point mutation of the regulatory element responsible for expression of the gene that determines digit formation (see specifics below). While their terminology may be dated, earlier studies and research remains valuable for the observations they provide.

- I. In 1947 The Danforth Studies of a largely in-bred population from two DLH Dams produced 254 poly kittens which were observed and logged: **"The trait is not related to sex, and no evidence is found that its gene is lethal"**. Danforth found no evidence of split foot or radial hypoplasia (also called radial hemimelia) in his studies. (Polydactyl Cats – Part 1 Copyright 2001-2009) <http://www.messybeast.com/poly-cats.html>
- II. **"The form of polydactyly most often seen in cats is the result of a simple autosomal dominant trait. It does not appear to affect the cat adversely and is not known to be associated with other anomalies."** (Polydactyly and Related Traits - Dr. Solveig Pflueger, Fall 1998) http://polycoons.com/rationale/4-Pflueger_Traits.pdf
- III. The autosomal dominant gene Pd produces a condition that deviates from normal but does not compromise the well-being of the cat. There is another unrelated gene, RH, that produces a severely crippling condition called radial hypoplasia that resembles polydactyly. A cat suffering from radial hypoplasia has an unusually small, twisted or absent radius producing the "twisty cat" phenomenon. Although extra toes may be present in RH cats, the normal (Pd) form of polydactyly is not harmful. **"The gene that eliminates or produces a poorly developed radius has nothing to do with the normal form of polydactyly,"** says Dr. Pflueger. ('A little bit extra' by Karen Commings, Catwatch Feb'06, interview with Dr. S. Pflueger) http://polycoons.com/rationale/1-Catwatch_Feb06.pdf
- IV. Dr. Leslie Lyons (University of California, Davis) has worked with Maine Coon breeders for years, collecting DNA samples to identify the polydactyl gene. Her determination coupled with other studies states the following:
"The Pd gene is absolutely harmless even when homozygous and has nothing in common with the RH gene." (Dr. Lyons in Moscow) http://polycoons.com/rationale/5-Dr_Lyons_Moscow.pdf
"The fact that remains is the gene is variable in expression regardless of breeding combinations. It is not lethal or even different in expression in its homozygous form, as is the case in some other expressions of a dominant gene." (Dr. Lyons Speaks before the WCC in Arnhem, The Netherlands) http://polycoons.com/rationale/6-Dr_Lyons_Arnhem.pdf
- V. 2008, Laura A. Lettice, Alison E. Hill, Paul S. Devenney and Robert E. Hill from the MRC-Human Genetics Unit, Western General Hospital in Edinburgh U.K. This paper investigated polydactylism in the feline world, in an attempt to expand knowledge of the currently known genes that produce polydactyl expression in various species, including humans, mice and cats. The feline study identified three mutations of polydactyly that were similar but that had slightly different expressions. It was found that the polydactyl trait in cats is not due to a gene mutation or a (Pd) gene but to a single point mutation in a sonic hedgehog cis-regulator element known as ZRS. Sonic hedgehog (Shh) is the gene that determines digit formation, and is regulated by a non-coding ZPA regulator sequence (ZRS) which is a distant cis-element in cat's DNA. This information not only revealed a previously unknown mechanism of control, but brought the total number of identified genetic expressions of polydactylism to thirteen, three of which were specifically associated with cats. Although noted in the study that polydactylism can be a problem in other species, no issues were found in the feline world. Subjects included pedigreed Maine Coons, as well as pedigreed Pixie Bobs and British Cats. All three mutations were benign expressions of polydactyly. The study concluded that: **"Analysis of polydactylous cats identified three new**

mutations...we submit that this type of polydactyly has no further detrimental effect on the cat's health". (Human Molecular Genetics, 2008, Vol. 17, No. 7 978–985)

http://polycoons.com/rationale/7-Molecular_Genetics.pdf

- vi. 2011, Alexia Hamelin: La Polydactylie du Maine Coon – École Nationale Vétérinaire d'Alfort. Ms. Hamelin published as her dissertation the first analysis worldwide on pre-axial polydactyly combining genetic and phenotypic data. Approximately 100 polydactyl cats were examined, with the majority (86) being Maine Coons. Sixty cats were analyzed genetically and sixty by X-ray. Sixteen Maine Coons of American lineage demonstrated the mutation type first reported by Lettice et al in 2008. In forty-one Maine Coons of Canadian lineage, however, the specific mutation could not be identified but was not part of the cis-regulatory mechanism described previously. This study supported earlier suppositions that polydactyly in Maine Coons is an autosomal-dominant trait with complete penetration and high variability. Empirical tests of reproduction, body height, peri-natal, mortality and malformation showed no significant statistical differences between polydactyl and non-polydactyl Maine Coons. **This data leads to no concerns for the morphology or health of the cats. The mutation is a purely aesthetic modification passed on in dominant autosomal mode and with variable expression or outcome.** (La Polydactylie de Maine Coon) <http://theses.vet-alfort.fr/telecharger.php?id=1334>
- vii. 2013, Axel Lange, Hans L. Nemeschkal, Gerd B. Müller – Department of Theoretical Biology, University of Vienna. Research on the genetics of the formation of the polydactyl paw continues with this technical publication describing the molecular basis of the formation of the polydactyl limb. The different phenotypic polydactylous patterns of the Maine Coon are described in detail (fore and hind limb) and the paper presents a mathematical/statistical model of how a point mutation can result in new digits, using threshold effects in cell states as an explanation. <http://link.springer.com/article/10.1007/s11692-013-9267-y>

PolyTrak

In 2006 the database service, PolyTrak, was established to examine expressions of polydactylism in the Maine Coon breed. Although not scientific from the standpoint of controlled breeding and observations in a sterile lab, the PolyTrak studies have involved a large number of pedigreed Maine Coon kittens and adults in "real-world" settings in the seven-plus years it has functioned. This observational study continues to compare the scientific studies with data tracking from catteries and pet-homes throughout the world.

With over 1300 Maine Coons, no noted detrimental effects from a genetic standpoint have been observed, lending credence to published studies and observations.

See (PolyTrak Website - Litter & Breeder Tracking) <http://www.polytrak.net>

PolyTrak		
KITTENS AND RELATED INFORMATION FROM OUR POLY LITTER TRACKING PROGRAM!		
TABULATED TOTALS & PERCENTAGES		
Total Kittens Listed = 1355		
Total Males = 669 (51.4%)	Total Females = 633 (48.6%)	Total Not Counted = 53
Total Polys = 766 (57.6%)	Total Non Polys = 563 (42.4%)	Total Not Counted = 26
Number of Pd gene affected paws per kitten (Polydactyl)		
Number of Polys sampled = 766		
1WD = 7 (1%)	2FWD = 261 (35.6%)	2RWD = 9 (1.2%)
3WD = 47 (6.4%)	4WD = 410 (55.9%)	Unknown = 32

See (Individual Kitten Listings - Sorted by User Choice) <http://www.polytrak.net/database/search/selectsort.php>

Poly x Poly breedings

The question has been raised of outcomes with the polydactyl trait, should breeders attempt poly x poly breedings. In examining Danforth's data as well as the PolyTrak database, poly x poly breedings differ only in the higher percentage of polydactyl offspring. With two heterozygous parents, 75% of kittens will express the trait and with even one homozygous parent, of course, 100% of the kittens will be polydactyl. Kittens of two polydactyl parents do not show statistically higher numbers of digits than poly to straight-foot breedings. This has been shown in Danforth's observations and has been confirmed by the collected data of PolyTrak.

Litters	Kittens	Non poly	Stillborn	Max. total digits on all 4 paws
14	72	9	3	26 (7/7/6/6)

See (poly x poly listing on PolyTrak for more details) <http://www.polytrak.net/msc/polyxpolysummary.php>

Per Dr. S. Pfleuger: **"Although the number of extra toes varies from cat to cat, a total of 28 toes seems to be the upper limit."** ('A little bit extra' by Karen Commings, Catwatch Feb'06, interview with Dr. S. Pfleuger) http://polycoons.com/rationale/1-Catwatch_Feb06.pdf

COMMENTS & CONCLUSION

Over 40 years of breeding and working with polydactyl Maine Coons from catteries and responsible breeders around the world supports the hypothesis that if polydactyl breeding in pedigreed Maine Coons were a problem, "We would certainly know by now!"

TICA, as a genetics based registry with member-driven policies, has made provisions for the introduction of a non-harmful and genetically valid trait into a Breed Standard. This is done primarily through the New Traits division, where the trait can be observed and the cat judged as its peers in a show ring setting. In this manner, all may see the expression and how that cat compares to its counterparts. Judging of the polydactyl Maine Coon has continued since September of 2005. No noted problems nor genetic expressions in this trait have appeared that would preclude its full acceptance.

Some have expressed apprehension that accepting polydactyl Maine Coons in the show ring would encourage extreme breeding practices. Due to the nature of the polydactyl trait, this concern is not founded on a realistic base. Not only have documented Maine Coons never exceeded eight digits (source: www.polytrak.net), but Mother Nature has built in a limit as well, simply due to the physical limitations and space on the limb bud. Even were such breeding feasible, there would be no profit in it. TICA, in recognizing polydactyly as a valid trait, has placed a limit of seven digits per paw.

In short-- polydactyly is intrinsic to the Maine Coon cat and is without detrimental effects. The polydactyl trait was essential in past development of our breed, is a growing influence in our present, and given the support of its admirers, will be a vibrant piece of our future. Polydactyly is woven into the very essence of what a Maine Coon is.

These cats deserve to be recognized in our show halls, as they are in our pedigrees.



**Maine Coon Breeders and Fanciers in support of the
Maine Coon polydactyl for Championship Status
PolyStandard**