

# Using DNA to Locate the Ancestry of Today's Island Dogs of the Caribbean: The Case of the Bahamian Potcake

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## ABSTRACT

Dogs in The Bahamas have been documented since the time of Columbus, so dogs have been residents of the country for at least as long as our written records. While the term “potcake” has been associated with mongrel dogs in The Bahamas for some time, written references have been traced back only as far as 1970. Since then, the written word potcake has become relatively common. Potcakes, while reviled by some, are considered as quintessentially Bahamian by others. This paper attempts to determine if the potcake is unique to The Bahamas. Our analysis of potcake DNA from New Providence and Grand Bahama suggests that the importation of dogs has diluted the pool of any ancient potcake DNA to an extent that the Bahamian potcake, if it ever existed, is now either extinct or highly admixed. Some implications for demystifying this Bahamian icon based upon the current welfare offered potcakes are proposed.

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*The Dogology of Nassau is a science worthy of profound study and investigation by all those dogmatically inclined* (Wilson, 1864, pp. 28-29).

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## INTRODUCTION

Local dogs are a common feature of the urban landscape throughout the Caribbean (Fielding & Ostberg, 2008). In many territories they have names which reflect their association with humans, pot hounds, rice dogs, and in

The Bahamas, potcakes (Fielding, 2007a). The potcake is commonly regarded as a Bahamian icon and a “true Bahamian” (Fielding, Mather, & Isaacs, 2005). This accolade is also accompanied by ambivalent attitudes that residents have towards potcakes.

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On one hand, people love them and admire their loyalty and resilience, while on the other hand others abuse and revile them, and consider them a nuisance (Fielding, 2008).

The history of dogs in The Bahamas can be traced back to the time of Columbus who found mute dogs in The Bahamas (Fielding et al., 2005). Subsequently, the Spanish brought fighting dogs to the region and it is possible that some would have ended up in The Bahamas. The dogs introduced by the Spanish included greyhounds, beagles, retrievers, setters, pointers, spaniels, whippets, Irish wolf hounds, blood hounds, lurchers, and mastiffs (Varner & Johnson Varner, 1983).

One dog who may have come to The Bahamas in about 1729 was Woodes Rogers' Spaniel painted by William Hogarth. The English naturalist Catesby made it clear that a wide variety of dogs could be seen in Nassau by the early 1700s. This suggests that dogs of various breeds must already have been imported to have resulted in the diversity reported by Catesby (Feduccia, 1985). His observation on the dogs is noteworthy, as he was interested in birds, so this suggests that the dog population had made an impression on him.

Accounts by Drysdale (1885) and Powles (1888) of dogs in Nassau are well known and Powles felt that the origins of the dogs must forever remain a "puzzle" (p. 76). In the 1860s there was an advertisement in a newspaper concerning a retriever being lost and the fact that from the early 1800s there was a tax levied on imported dogs demonstrates that sufficient dogs of value (presumably pure-breed dogs) were being imported to be taxed (Fielding et al., 2005).

Wilson (1864), writing some 20 years before Powles, gives a detailed account of the dogs in Nassau. He writes:

But it is at night that the Dogs of Nassau

are heard in all their glory ... the trombone sound of the Bull, the prolonged voice of the Hound, the howl of the Newfoundland, the sharp, quick bark of the Terrier, the would-be fierce utterance of the Spaniel (pp. 28-29).

This description is of value as it even suggests the breeds which may have been found in the mongrels as well as the results of interbreeding.

Despite general agreement as to what a potcake looks like, even resulting in a breed standard from the Bahamas Kennel Club, we need to appreciate that as potcakes breed without constraint as typically owned potcakes are allowed to roam freely, so their offspring are the result of a dynamic mixing of genes. While the numbers of dogs imported each year may not be large (Fielding et al., 2005), backyard breeders are a constant source of mixed breed dogs as their attempts to breed "pure" breed dogs are not always successful (Fielding, 2010a, 2010b). Therefore, we can expect that genes from breed dogs constantly enter the potcake population.

Other local dogs, such as the Australian dingo and New Guinea singing dog, have been subject of considerable study (Koler-Matznick, Yates, Bulmer & Brisbin, 2007) as concerns have arisen that local gene pools have been subjected to dilution through hybridisation through imported dogs. An example of an emerging breed resulting from hybridisation from street dogs is the Kintamani dog of Bali (Puja, Irion, Schaffer & Pedersen, 2005). Closer, to the Caribbean, Carolina dogs have been conjectured to have ancestors from Asia (Handwerk, 2003), but the future of these "primitive" dogs may be a cause for concern due to interaction with other dogs.

So it is against a background of imports and interbreeding and social change that the

potcake of the 20th and 21st centuries has emerged. While the potcake is still offered less care than other types of dogs, (Fielding, 2009) its social standing has positive connotations such that elected officials appreciate that being associated with potcakes is positive to their public image (Miller, 2012).

A puzzle which Powels' book still raises is that while he was interested in both the language spoken by the local people and in dogs, he did not say that the local populace called their local dogs potcakes. In fact it is only since Independence that the word potcake appears to become common in the written media (Fielding et al., 2005), which suggests that potcakes, in an obscure way, may have become identified with, or caught up with, freedom at Independence and recognition of things Bahamian as the country started to define itself.

Therefore, the purpose of these studies was to examine the DNA in potcake population to determine (a) if any ancient potcake DNA could be found and (b) determine the types of breeds, if any, in the current potcake population. Knowing the genetic characteristics of current potcakes would allow a determination as to just how unique they may be to The Bahamas and be useful to potcake caregivers so that they would know how to best interact with their pets so as to enhance the animal welfare of their pets.

These studies were approved by the Office of Research, Graduate Programmes and International Relations of The College of The Bahamas. The dogs were not subjected to any harmful procedures. DNA samples were obtained by collecting two samples from the inside of the dog's mouth using sterile nylon cytology brushes.

#### **STUDY 1. METHODOLOGY**

In 2012, DNA samples taken from 20 male

dogs from Grand Bahama and 20 male dogs from New Providence were analysed at the Veterinary Genetics Laboratory, Department Population Health and Reproduction, at the University of California Davis, School of Veterinary Medicine. All the dogs were selected by staff from the Bahamas Humane Society and Humane Society of Grand Bahama based upon their visual appearance as looking like a potcake. The dogs used in this study are pictured in Figure 1.

#### *Mitochondrial Deoxyribonucleic Acid (DNA)*

Mitochondrial DNA (mtDNA) is passed down along matriline. Domestic dogs studies utilizing the control region of the mitochondrial DNA have revealed haplotypes that are common throughout the world, known as universal types (UT) and others that have a restricted geographic distribution (Savolainen, Zhang, Luo, Lundeberg, & Leitner, 2002; Pang et al., 2009).

Ancient dog DNA samples from the Americas prior to European colonization include some of these UTs but also include several haplotypes that are unique to the Americas and therefore diagnostic of Native American dog ancestry (Leonard et al., 2002; Rutledge, Bos, Pierce, & White, 2010; Brown, Darwent, & Sacks, 2013; Thalmann et al., 2013). In order to determine if the potcakes still retain an ancient genetic signature, we analyzed a 582 base pair region of the mtDNA control region (Savolainen et al., 2002), and compared the potcake haplotypes to these and other studies. If the potcakes were indigenous, we would have expected them to possess at least some of the haplotypes seen in Native American dogs.

All laboratory methods were described in detail elsewhere (Brown, et al., 2011; Sacks, Brown, Stephens, Pedersen, Wu, & Berry, 2013).



Figure 1: Potcakes used in the DNA study.

## RESULTS

Our results from 21 individuals analyzed show an abundance of UTs (13/21 individuals, Table 1). Haplotypes A11 and A20 (both UTs), found in 8 individuals are also found in Native American dogs, and therefore uninformative. A few more restrictive haplotypes were identified (A1, A27, A9, A160, C2 and C8) in eight individuals which had previously been found in dogs from Europe, South West Asia and South East Asia. Importantly, we observed no

indication of haplotypes that were widespread in ancient American dogs, such as the A3, found in the oldest known American dog (~8500 Before Present) in Illinois, as well as in Florida and Alaska (Brown et al., 2013; Thalmann et al., 2013), or a closely related haplotype unique to the Americas (Bolivia, Peru, Canada), referred to as “D28” (Leonard et al., 2002; Rutledge et al., 2010). Based on these findings, we conclude that the potcake matriline was primarily of European descent.

Table 1.  
*Mitochondrial control region haplotypes found in 21 Potcakes, and the breeds/regions they have previously been found based on BLAST search of GenBank®*

Haplotype	n	%	Comments
A1	1	0.05	Chow, Jindo, Samoyed, Border Collie, Buhund
A11 <sup>a</sup>	6	0.3	Universal, Ancient Native American dog
A20 <sup>b</sup>	2	0.1	Universal, Ancient Native American dog
A27	1	0.05	Africa, East Asia, Europe, India, SW Asia
A17 <sup>c</sup>	2	0.1	Universal
A9	1	0.05	Basenji, Saluki, East Asian village dogs
A160 <sup>d</sup>	1	0.05	Pungsan
B1 <sup>e</sup>	1	0.05	Universal
C1	1	0.05	Universal
C2	1	0.05	Bouvier, West Highland Terrier
C3 <sup>f</sup>	1	0.05	Universal
C8	3	0.15	Europe (Netherlands)

<sup>a</sup> This sequence was also consistent with rare haplotypes: A142, A89, A166; <sup>b</sup> This sequence was also consistent with the UT A18; <sup>c</sup> This sequence was also consistent with the rare haplotype A61 found in China; <sup>d</sup> Also consistent with rare haplotypes A156 and A153; <sup>e</sup> Also consistent with rare haplotype B21 found in East Asia; <sup>f</sup> This sequence was also consistent with the rare haplotype C11 found in Cambodia

## Y Chromosome

The Y chromosome is specific to males and therefore reflects paternal ancestry, which complements mtDNA studies of maternal ancestry. Recent Y-chromosome studies (Ding et al., 2012; Brown et al., 2013; Sacks et al., 2013) have shown microsatellites (STRs) and Single Nucleotide Polymorphisms (SNPs) to be informative in regards to ancestry and geographic origin of domestic dogs. Unfortunately, no studies of ancient American dog Y chromosomes have been

conducted to provide positive references for indigenous patriline. However, the distribution of Y chromosome haplogroups in surveys of modern dogs have shown one haplogroup in particular (Haplogroup 1: H1) to be indicative of European origins (Sacks et al., 2013, p. 1106, 1112). Although a survey found H1 to be present in relatively low frequency in some, but not other, Asian populations (Ding et al., 2012), a follow-up study that added more rapidly mutating microsatellites on the Y chromosome

demonstrated that H1 haplogroups in Southeast Asia were introduced through recent-historical translocations (Sacks et al., 2013). Moreover, the high mutation rate of Y chromosome STRs ensures that indigenous American haplotypes separated from Eurasian ones by at least several thousand years should be highly distinctive. Conversely, haplogroups restricted to Europe or haplotypes which match those from modern Eurasian dogs can be presumed to share post-colonial ancestry with these dogs. All the Y chromosome SNPs and STRs along with methods of analysis are listed in Sacks et al. (2013). Most of the potcakes showed the H1 haplogroup, indicative of European ancestry, and others

were in the H3 haplogroup, which is found both in European and East Asian dogs (Table 2). In total, there were 15 STR haplotypes found in the 31 individuals. Three of these haplotypes were common among breed dogs, four were found in SE Asia, two were found in Alaskan Huskies, and six were novel (Table 2). However, most of the novel haplotypes corresponded to haplogroup H1 and were therefore presumed to be European, while two novel haplotypes (in H3) could have been indigenous. Therefore, as with the matrilineal marker, the patrilineal marker indicated that most if not all of the observed ancestry reflects post-colonial introductions.

Table 2.

*Y chromosome STR and SNP haplotypes from 31 male potcakes*

STR Haplotype	SNP Haplogroup	n	Comments
0d	H1	3	Found in Bali
6t	H1	2	Found in breed dogs
6zi	H1	1	Identified previously in breed dogs: Brunei, Taiwan, Philippines
8d	H1	1	Found in Brunei and Australian Dingo
n32	H1	10	Found in Alaskan Huskies
n4	H1	3	Found in breed dogs
n45	H1	1	Novel (134/128/126/172/212) <sup>1</sup>
n47	H1	2	Novel (136/122/126/172/216) <sup>1</sup>
n51	H1	1	Novel (130/136/126/172/219) <sup>1</sup>
n54	H1	1	Novel (134/120/126/172/221) <sup>1</sup>
0c	H3	1	Found in Bali
6u	H3	1	Identified previously in Bali
n36	H3	1	Found in Alaskan Huskies
n42	H3	2	Novel (130/124/128/172/214) <sup>1</sup>
n52	H3	1	Novel (130/124/128/172/217) <sup>1</sup>
Total		N = 31	

<sup>1</sup>The Y chromosome alleles in novel haplotypes correspond respectively to the following loci: 79.2b, 79.3b, 990.35.4, ms34CA, ms41b, as described by Brown et al., (2013).

**STUDY 2. METHODOLOGY**

In 2011/12 we used Mar Veterinary Wisdom Panel® Insights™ kits to match the DNA from potcakes with 185 breeds and types. The Mars test attempts to find the best statistical match with the eight great grandparents. We used nine dogs from Grand Bahama and 30

from New Providence. The potcakes chosen for testing were selected on the basis that they looked like a potcake. Almost all of the dogs were selected by staff from the Bahamas Humane Society and Humane Society of Grand Bahama. The potcakes used in this study are pictured in Figure 2.

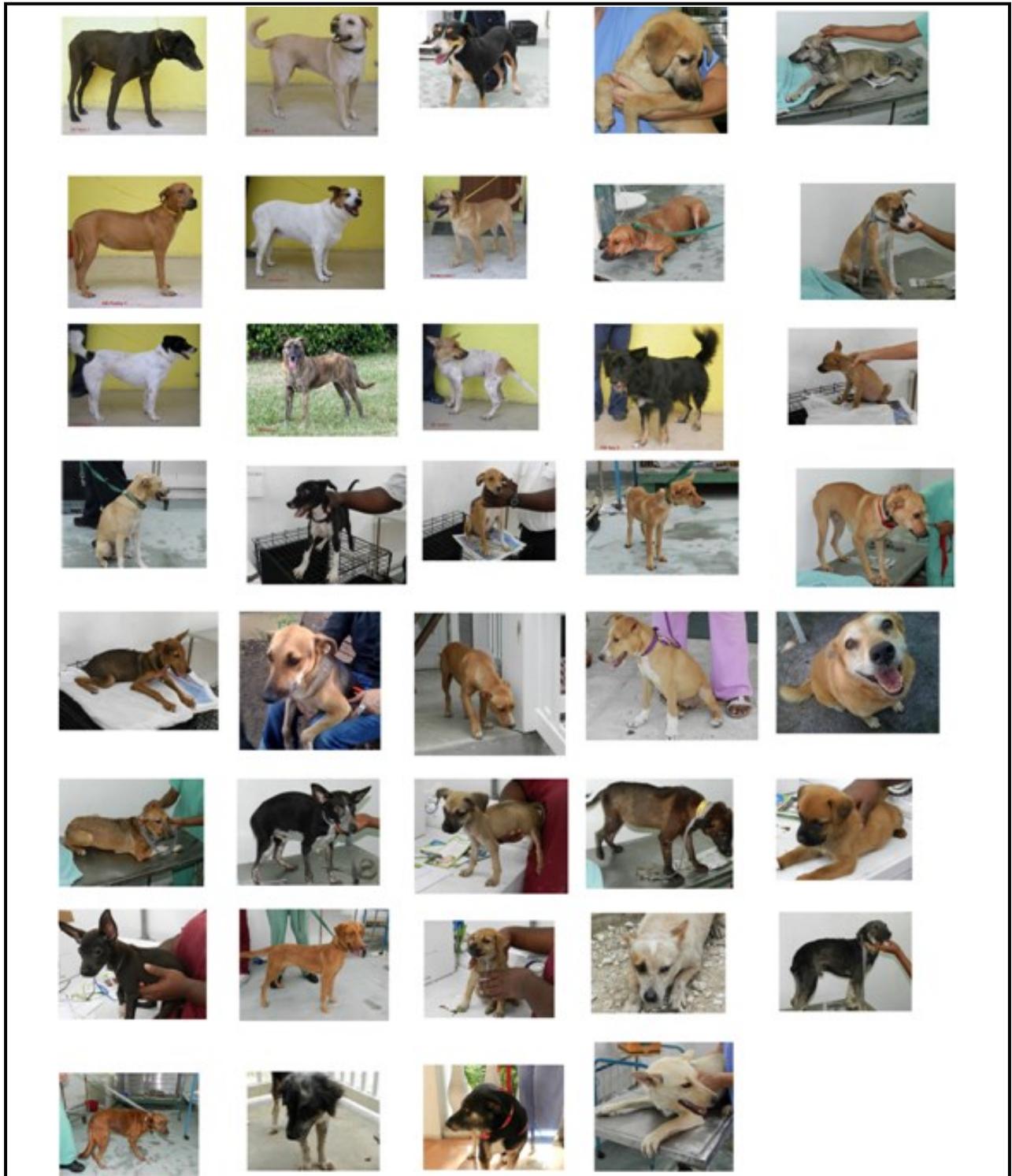


Figure 2: Potcakes used in the Wisdom Panel® Insights™ study.

## RESULTS

Our 39 dogs had a total of 312 great grandparents. Of these 312 great grandparents, 145 or 46.5% could not be identified. All the potcakes had at least two of the eight great grandparents who could be identified. In the case of three dogs, all eight great grandparents were identified. The median number of identified great grandparents was four. A total of 54 breeds/types were found in the 167 known great grandparents. The lack of identification of a breed in an ancestor could be due to that dog having no clear single breed dominating his/her genetic make-up (i.e., really mixed-up) or represent a potcake genome, if we believe that the potcake is its own breed. A list of the breeds/types detected is given in Table 3.

Table 3.

*List of breed/types identified by the Wisdom Panel® Insights™ test*

Akita	German shepherd dog
Alaskan Malamute	German short haired pointer
American Staffordshire terrier	Great Pyrenees
Australian shepherd	Italian Greyhound
Basenji	Keeshond
Basset Hound	Labrador retriever
Beagle	Leonberger
Border Collie	Mini Schnauzer
Boston terrier	Norwegian Elkhound
Bouvier des Flandres	Nova Scotia Duck Trolling retriever
Boxer	Papillion
Brittany	Parson Russell terrier
Bull dog	Pomeranian
Bullmastiff	Puli
Canaan dog	Rhodesian ridgeback
Catahoula Leopard dog	Rottweiler
Chihuahua	Samoyed
Chinese Shar-Pei	Shetland sheep dog
Chow chow	Shiba Inu
Cocker spaniel	Standard poodle
Collie	Tibetan terrier
Dachshund	Vizsla
Dalmatian	Weimaraner
Doberman Pincher	Whippet
Flat coated retriever	Yorkshire terrier

The five most common breeds/types identified in the great grandparents were the Chow Chow (12 times), German Shepherd dog (12), Australian Shepherd dog (12), Cocker Spaniel (10) and Catahoula Leopard dog (8). These breeds/types accounted for 17.3% of the great grandparents.

## DISCUSSION

We should note that just because few markers of ancient North American DNA were found in the dog samples does not mean that no ancestors of the original dogs of The Bahamas exist today. It only means that no unambiguous evidence could be detected from the 40 dogs sampled. It is possible that dogs from elsewhere in The Bahamas may still have these markers. However, given the history of imports over the centuries, and given the probably small size of the original dog population, it is understandable that most of the matriline and patriline observed in this study reflected Eurasian ancestry. As such, our evidence does not support the idea that there is anything particularly unique about the genetic make-up of today's potcake.

The fact that both Chow Chows and German Shepherd dogs were two of the more common breeds should not be surprising given that people typically keep dogs for protection and that both breeds appear high on the list of imported dogs reported by Fielding et al (2005). Two of the great grandparents were identified as American Staffordshire Terriers (also called pit bulls), and so this tends to confirm that pit bull genes have made their way into the potcake gene pool. However, whether or not such a migration of genes can be associated with potcakes turning vicious, as some have claimed, will continue to be debated (Burrows & Fielding, 2005). Of interest was the identification of genes of the Catahoula Leopard dog. This is because the Catahoula Leopard dog is a mix of the indigenous dogs of native North Americans and the fighting dogs of the Spanish

colonizers. Therefore, its genetic presence in the potcake population could be a result of residual Spanish/Indian dog DNA or as a result of the (re-)introduction of Leopard dogs into The Bahamas. We note that this type did not appear in the dog imports reported by Fielding et al (2005), so it may have been imported more recently.

The potcake has assumed an even more respectable place in the cultural fabric of the country, to the point that politicians, who once were insulted if they were called a cur (Fielding et al., 2005), now feel comfortable to be called “the people’s potcake”. This is despite the fact that potcakes continue to be abused and offered a level of care which is a cause for concern. Efforts to heighten the perceptions of potcakes have included re-branding them as Royal Bahamian Potcakes (Fielding et al., 2005) but these have appeared to have had little real impact on the way potcakes are viewed. So what impact will the demystifying of the potcake have on their care? For those owners, who always wanted a breed dog but could never afford one, the

realisation that they have a dog which is a mixture of breed dogs may enhance its value in their eyes. Those who rate the traditional potcake as being “unique” may wish to dismiss these study results and rely on the appearance of their dog as evidence of the continued existence of potcakes. If these people consider that the potcake is at least rare, it may accrue a value associated with any boutique item. For those owners who wish to increase the welfare of their potcakes, appreciation of the genetic mix of their dogs will allow them to interact with their pets so as to increase the benefits to both the dog and owner of dog ownership. Often, caregivers do not spend much time interacting with their potcakes (Fielding, 2009), so this is an aspect of pet care which could be changed to the benefit of dog and caregiver. Given the limited care offered potcakes (Fielding, 2007b), and the purpose for which they are commonly kept (protection), we suggest that the origin of the dogs may be of little concern to some owners as it may not be seen to affect their ability to offer protection.

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## REFERENCES

- American Kennel Club. (2015). Catahoula Leopard dog history. Retrieved from <http://www.akc.org/dog-breeds/catahoula-leopard-dog/detail/>
- Brown, S. K., Darwent, C. M., & Sacks, B. N. (2013). Ancient DNA evidence for genetic continuity in Arctic dogs. *Journal of Archaeological Science*, 40(2), 1279-1288. <http://dx.doi.org/10.1016/j.jas.2012.09.010>
- Burrows, T., & Fielding, W. J. (2005). Views of college students on pit bull “ownership”, New Providence, The Bahamas. *Society & Animals*, 13(2), 49-62. <http://dx.doi.org/10.1163/1568530054300163>
- Ding, Z. L., Oskarsson, M., Ardalan, A., Angleby, H., Dahlgren, L. G., Tepeli, C. ... & Zhang, Y. P. (2012). Origins of domestic dog in Southern East Asia is supported by analysis of Y chromosome DNA. *Heredity*, 108, 507-514. <http://dx.doi.org/10.1038/hdy.2011.114>
- Drysdale, W. (1885). *In sunny lands: Outdoor life in Nassau and Cuba*. New York: Harper & Brothers. Retrieved from <http://babel.hathitrust.org/cgi/pt?id=yale.39002030689013#view=1up;seq=11>
- Feduccia, A. (Ed.). (1985). *Catesby’s birds of Colonial America*. Chapel Hill: University of North Carolina Press.
- Fielding, W. J. (2007a). Potcake mongrels in the Bahamas. In M. Bekoff (Ed.), *Encyclopedia of human-animal relationships* (pp. 572-576). Westport, CT: Greenwood Press.

- Fielding, W. J. (2007b). Knowledge of the welfare of non-human animals and prevalence of dog care practices in New Providence, The Bahamas. *Journal of Applied Animal Welfare Science*, 10(2), 153-168.
- Fielding, W. J. (2008). Dogs, a continuing and common neighborhood nuisance of New Providence, The Bahamas. *Society & Animals*, 16(1), 61-73. <http://dx.doi.org/10.1163/156853008X269890>
- Fielding, W. J. (2009). Determinants of the level of care provided for various types and sizes of dogs in New Providence, The Bahamas. *The International Journal of Bahamian Studies*, 16, 63-77. Retrieved from <http://journals.sfu.ca/cob/index.php/files/article/view/119/128>
- Fielding, W. J. (2010a). Dog breeding in New Providence, The Bahamas, and its potential impact on the roaming dog population I: Planned and accidental. *Journal of Applied Animal Welfare Science*, 13, 250-260. <http://dx.doi.org/10.1080/10888705.2010.483881>
- Fielding, W. J. (2010b). Dog breeding in New Providence, The Bahamas, and its potential impact on the roaming dog population II: The fate of puppies. *Journal of Applied Animal Welfare*, 13, 300-312. <http://dx.doi.org/10.1080/10888705.2010.507122>
- Fielding, W. J., Mather, J., & Isaacs, M. (2005). *Potcakes: Dog ownership in New Providence, The Bahamas*. West Lafayette, IN: Purdue University Press.
- Fielding, W. J., & Ostberg, A. (2008). Animal welfare in the wider Caribbean in 2008, with emphasis on dogs. Retrieved from [http://www.caribbeananimalwelfare.org/images/Report-Animal\\_Welfare\\_Organizations\\_Survey\\_CAWC08.pdf](http://www.caribbeananimalwelfare.org/images/Report-Animal_Welfare_Organizations_Survey_CAWC08.pdf)
- Handwerk, B. (2003, March 11). Did Carolina dogs arrive with ancient Americans? *National Geographic News*. Retrieved from [http://news.nationalgeographic.com/news/2003/03/0311\\_030311\\_firstdog.html](http://news.nationalgeographic.com/news/2003/03/0311_030311_firstdog.html)
- Hogarth, W. (undated). Woodes Rogers and his family [oil painting]. Retrieved from Royal Maritime Museum <http://collections.rmg.co.uk/mediaLib/384/media-384826/large.jpg>
- Koler-Matznick, J., Yates, B. C., Bulmer, S., & Brisbin, I. L. (2007). The New Guinea singing dog: Its status and scientific importance. *Australian Mammalogy*, 29, 47-56. <http://dx.doi.org/10.1071/AM07005>
- Leonard, J., Wayne, R. K., Wheeler, J., Valadez, R., Guillén, S., & Vilà, C. (2002). Ancient DNA evidence for old world origin of new world dogs. *Science*, 298, 1613-1616. <http://dx.doi.org/10.1126/science.1076980>
- Miller: 'Stupid Bahamians' quote out of context. (2012, June 4). *The Tribune*. Retrieved from <http://www.tribune242.com/news/2012/jun/04/miller-stupid-bahamians-quote-was-out-of-context>
- Pang, J.-F., Kluetsch, C., Zou, X.-J., Zhang, A.-B., Luo, L.-Y., Angelby, H., ... & Savolainen, P. (2009). mtDNA data indicate a single origin for dogs south of Yangtze River, less than 16,300 years ago, from numerous wolves. *Molecular Biology and Evolution*, 26(12), 2849-2864. <http://dx.doi.org/10.1093/molbev/msp195>
- Powles, L. D. (1888/1996). *Land of the pink pearl, or, recollections of life in the Bahamas*. Nassau, Bahamas: Media.

- Puja, I. K., Irion, D. N., Scheffer, A. L., & Pedersen, N. C. (2005). The Kintamani dog: Genetic profile of an emerging breed from Bali, Indonesia. *Journal of Heredity*, *96*, 854-859. <http://dx.doi.org/10.1093/jhered/esi067>
- Rutledge, L. Y., Bos, K. I., Pierce, R. J., & White, B. N. (2010). Genetic and morphometric analysis of sixteenth century Canis skull fragments: implications for historic eastern and gray wolf distribution in North America. *Conservation Genetics*, *11*, 1273–1281. <http://dx.doi.org/10.1007/s10592-009-9957-2>
- Sacks, B. N., Brown, S. K., Stephens, D., Pedersen, N. C., Wu, J.-T., & Berry, O. (2013). Y chromosome analysis of dingoes and Southeast Asian village dogs suggests a Neolithic continental expansion from Southeast Asia followed by multiple Austronesian dispersals. *Molecular Biology and Evolution*, *30*(5), 1103-1118. <http://dx.doi.org/10.1093/molbev/mst027>
- Savolainen, P., Zhang, Y.-P., Luo, J., Lundeberg, J., & Leitner, T. (2002). Genetic evidence for an East Asian origin of domestic dogs. *Science*, *298*(5598), 1610-1613. <http://dx.doi.org/10.1126/science.1073906>
- Thalmann, O, Shapiro, B., Cui, P., Schuenemann, V. J., Sawyer, S. K., Greenfield, D. L. ... Wayne, R. K. (2013). Complete mitochondrial genomes of ancient canids suggest a European origin of domestic dogs. *Science*, *342*, 871-874. <http://dx.doi.org/10.1126/science.1243650>
- Varner, J. G. & Johnson Varner, J. (1983). *Dogs of the conquest*. Norman: University of Oklahoma Press.
- Wilson, F. I. (1864). *Sketches of Nassau to which is added the Devil's Ball-Alley, an Indian tradition*. Raleigh, NC: Standard Office. Retrieved from <http://cdm.bostonathenaeum.org/cdm/compoundobject/collection/p16057coll14/id/48100/rec/19>