
William J. Fielding

Planning Department, The College of The Bahamas, New Providence, The Bahamas

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William J. Fielding
Planning Department, The College of The Bahamas, New Providence, The Bahamas

This article reports the first known study on dog breeding in an Afro-Caribbean community. The study obtained the information on 517 matings through interviews with dog caregivers. Few litters (6.8%) from mongrels (potcakes) resulted from planned matings, whereas 66.5% of matings between purebred dogs were planned. Confinement of the female is often inadequate, and roaming dogs may have been responsible for 24.8% of the litters. The lack of confinement of potcakes has resulted in the perception that potcakes are “responsible” for the companion animal (pet) overpopulation problem; however, potcakes made up the minority (29.4%) of the breeding females. Until regulations concerning dog breeding are introduced, caregivers can be expected to continue exploiting their nonhuman animals to supplement their incomes from the sale of puppies. A consequence of unregulated breeding may also be inbred offspring of “purebred” dogs as few self-styled “professional” breeders appeared to use dogs who were not their own.

The Bahamas has suffered from the consequences of poor dog care since at least the 1840s when the first (of several) Dog License Acts was passed (Fielding, Mather, & Isaacs, 2005). Throughout the 19th century, dogs were allowed to roam freely and, consequently, able to breed at will, resulting in their becoming a nuisance. The irritations caused by dogs, both roaming and confined, have continued to the present day (Fielding, 2008a). Being a perceived nuisance is
not in the best interest of the dogs; they may be harmed as a result (Plumridge, Fielding, & Bizzell, 2007). Elsewhere, for example, Taiwan (Hsu, Severinghaus, & Serpell, 2003) and Dominica (Davis, Alie, Fielding, Morters, & Galindo, 2007), it has been noted that dog-keeping practices can have an important influence on the presence of roaming dogs on the streets.

In New Providence, 43.2% of 551 dogs in residential areas roam at night (Fielding, 2008b), and this triangulates with 42.8% of 236 dog caregivers (owners) admitting that at least one of their dogs was able to roam (Fielding & Plumridge, 2005). Overall, neutering rates in New Providence are low, but local mongrels, called potcakes, are more likely to be neutered than purebred dogs. Typically, dogs who are kept outside the home are less likely to be neutered than dogs kept inside, which would appear to be conducive to these dogs producing unplanned litters (Fielding et al., 2005). In The Bahamas, that dogs are intact and able to roam has resulted in households with multiple dogs being only 3.6 times more likely to have a litter compared with single-dog-owning households, contrasted to 9.5 times in North America, where dogs are generally confined (Fielding & Plumridge, 2005). This result suggests that roaming and breeding are probably linked, and the result may be unplanned litters. A low neutering rate combined with the ability to roam may be responsible for the dog overpopulation problem, as it seems that more puppies are born than are required to maintain the population (Fielding & Plumridge, 2005). These findings have been repeated elsewhere in the Caribbean (Davis et al., 2007). Such observations have resulted in the view that roaming dogs are responsible for the “stray dog problem,” and nonhuman animal control efforts and neutering programs have traditionally focused on the roaming dog population (Fielding et al., 2005; Matter & Daniels, 2000).

On the Bahamian island of Abaco, all the female dogs who had given birth in the previous 12 months had also been free to roam, which would suggest that most if not all the litters could have been unplanned (Fielding, 2000). A study on dog-keeping practices in the Mexican state of Yucatan found that 90% of litters had been unplanned (Ortega-Pacheco et al., 2007), and a 2007 study in Barbados (Heath & Grannum, n.d.) found that 75% of litters were unplanned.

In The Bahamas, the breeding of dogs is not regulated; anyone can set up as a dog breeder. We use the term backyard breeder as defined by Strand (1993), who considers

breeders [to be those] . . . whose mixed-breed or purebred pets produce litters . . . .

The reasons given by pet owners for breeding their pets are not generally endorsed by professionals . . . [and] . . . without club affiliations. (p. 921)

Provided they obey the laws surrounding animal welfare (laws about which many people are uninformed), such breeders can use their dogs to produce
as many puppies as they wish. Typically, however, potcakes are not sold, and mixed breeds are often worth little; only purebred dogs are of commercial value (Fielding, 2007). In The Bahamas, residents distinguish between potcakes and mixed-breed dogs as the latter retain clear manifestations of one or both parents. Consequently, intentional breeding would be expected to focus on purebred dogs. As relatively few dogs are registered by the Bahamas Kennel Club (Fielding et al., 2005), it is likely that few purebred dogs are pedigrees.

The common reason for keeping dogs in New Providence is for protection. This means that many dogs are kept as watchdogs (to bark at intruders) and guard dogs (to attack intruders). Consequently, breeds such as pit bulls, chow chows, Rottweilers, and German shepherds account for 44.1% of the dogs in the owned dog population; the local mongrels, potcakes, account for only 29.7% (Fielding & Plumridge, 2005). Locally, these breeds have a reputation for being good guard dogs, and potcakes are considered good watchdogs. Pit bulls have been implicated in all known fatal dog attacks on New Providence. An alleged intruder was killed by pit bulls, and this seems to have contributed to the popularity of pit bulls as guard dogs (Burrows, Fielding, & Mather, 2004). This is despite the doubt associated with the ability of dogs to successfully deter criminals (Fielding et al., 2005) and the stigma that can be associated with keeping pit bulls (Twining, Arluke, & Patronek, 2000).

In communities where dogs are allowed to roam, the population of street dogs consists of dogs both with and without regular caregivers. This has been noted in a range of settings from the United States (Beck, 1973) to Taiwan (Hsu et al., 2003). Although dog population control programs have often focused on street dogs, it has been shown that such dog populations, which lack recruitment from outside sources, can have difficulty in sustaining themselves (Boitani, Francisci, Ciucci, & Andreoli, 1995; Rinzin, 2007). Consequently, the interaction between the populations of dogs with and without caregivers becomes important as the level of care offered dogs can permit the transfer of dogs from one population to another and so perpetuate the street dog population. Through unplanned matings, caregivers can facilitate the production of puppies who, if not responsibly relinquished to shelters or responsible owners, may become recruits to the street dog population.

The purpose of this study was twofold: (a) to identify factors associated with planned and unplanned dog breeding and (b) to determine how this breeding may affect the roaming dog population.

**METHOD**

A survey form was devised that collected information about the most recent mating from a female dog in the past 12 months. This limitation was imposed to assist in recalling the details about the breeding. Information was collected
Dog Breeding and Roaming Dog Population

Information, though not necessarily complete, was obtained on 517 females who had bred in the previous 12 months. Of 503 interviews where the location was recorded, 22.4% took place at veterinary clinics with the remainder conducted elsewhere. Caregivers kept a mean of 2.90 dogs ($SE = 0.084$), with an average of 1.19 males ($SE = 0.055$) and 1.70 females ($SE = 0.049$); 67.2% (of 516 respondents) kept at least 1 dog of each sex. The average age of 490 females who had bred was 2.93 ($SE = 0.060$) years (median: 3 years). The three most common types of females were potcakes, (29.4% of 517), pit bulls (15.9%), and Rottweilers (8.7%). Overall, breed or breed-type dogs accounted for 70.6% of the litters.

General Care

Potcake and purebred females were kept differently. Potcakes were typically kept outside the home with access to the street, whereas purebred dogs were...
TABLE 1
Types of Dogs Classified by Where They Are Kept and Their Ability to Interact With Trespassing Dogs, Percentages Within Type of Dog

<table>
<thead>
<tr>
<th>Type of Dog</th>
<th>Kept</th>
<th>Can Interact With Trespassing Dogs</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Yes</td>
</tr>
<tr>
<td>Purebred Inside the home/enclosure</td>
<td>5.4</td>
<td>39.8</td>
</tr>
<tr>
<td>Confined outside</td>
<td>5.4</td>
<td>38.7</td>
</tr>
<tr>
<td>Kept outside with street access</td>
<td>4.0</td>
<td>0.3</td>
</tr>
<tr>
<td>Overall</td>
<td>14.9</td>
<td>78.8</td>
</tr>
<tr>
<td>Potcake Inside the home/enclosure</td>
<td>1.3</td>
<td>1.3</td>
</tr>
<tr>
<td>Confined outside</td>
<td>14.8</td>
<td>15.4</td>
</tr>
<tr>
<td>Kept outside with street access</td>
<td>48.3</td>
<td>1.3</td>
</tr>
<tr>
<td>Overall</td>
<td>64.4</td>
<td>16.8</td>
</tr>
</tbody>
</table>

prevented from getting onto the street, and many were kept inside the home or other enclosure (Table 1). However, as mentioned previously, confinement did not necessarily prevent interaction with trespassing dogs. The effectiveness of the security of the dog can be seen in Table 1, where even dogs who were kept inside were reported as being able to interact with trespassing dogs. Of 499 females, as many as 39.9% may have been able to interact with trespassing dogs.

Planning

Overall, 48.8% of 508 matings were planned; however, potcake matings were less likely to be planned than were purebred matings. When the breed was reported, only 6.7% of 149 potcake litters were planned, whereas 66.5% of 358 purebred litters were planned (Fishers exact test: $p < .001$, $df = 507$; the breed of one dog was not known).

In the case of planned mating, 239 respondents gave reasons as to why they wanted the litter. The most common reason for having the litter was for the sale of the puppies (71.1%), and 6 respondents described themselves as “professional” breeders. All 6 of these respondents mated their females with males who were their own. Four of these respondents bred pit bulls, 1 bred German shepherds, and 1 bred Rottweilers. Of the six professional breeders, four kept only one male dog; the others kept two. Three of these breeders had one female, two had two females, and one kept three.

The planning of the previous litter was associated with the wish for the female to breed again in the case of purebred dogs, whereas many keepers of potcakes had not planned the litter, nor did they want their dog to breed again. In the
case of purebred dogs, 48.6% of 346 caregivers had planned this mating and wanted the dog to breed again compared with 2.0% of 147 potcake caregivers. A logistic regression was performed to determine which factors, if any, were associated with the planning of a litter. Only type of dog and ability to interact with trespassing dogs were related with the planning of litters: type of dog, Wald statistic \( W = 31.3, df = 1, p < .001 \); where kept, \( W = 1.4, df = 2, p = .49 \); interact, \( W = 44.7, df = 2, p < .001 \); and pair of dogs, \( W = 1.1, df = 1, p = .29 \).

Mating

Where possible, information was obtained about the dog who mated with the female. Of 517 females, the breed of the father was not known for 24.4%. Overall, male and/or female potcakes were responsible for at least 32.1% of the litters (Table 2). Matings between dogs of the same breed accounted for the majority of litters; 51.7% were bred with males of the same type (purebred or mixes [other than potcakes]) and 10.3% of the matings were between potcakes. Pit bull litters (both parents being pit bulls) accounted for 67 matings or 12.6% of all matings or 25.6% of all matings from parents of the same breed. Overall, pit bulls were involved with 18.3% of the matings. A clear objective of planning matings was to produce purebred puppies. When only planned mating was considered, 79.8% of 248 matings were between like breeds.

The source of the male (known or unknown) varied on the type of female and if that female could interact with trespassing dogs. In the case of purebred females, a caregiver’s male was the most common mate (62.4% of 322 matings) followed by males chosen for mating (28.9%) and a neighbor’s dog (7.1%); known strays accounted for 1.6% of litters. In the case of potcake litters, the caregiver’s male was the most likely mate (74.5% of 55 litters) followed by a

<table>
<thead>
<tr>
<th>Breed of Female</th>
<th>Unknown</th>
<th>Breed1</th>
<th>Breed2</th>
<th>Potcake</th>
<th>Mixed</th>
<th>Overall %</th>
<th>N</th>
</tr>
</thead>
<tbody>
<tr>
<td>Unknown</td>
<td>0.2</td>
<td>1</td>
<td>0.2</td>
<td>0.6</td>
<td>61.1</td>
<td>316</td>
<td></td>
</tr>
<tr>
<td>Breed1</td>
<td>7.7</td>
<td>50.7</td>
<td>2.1</td>
<td>0.6</td>
<td>61.1</td>
<td>316</td>
<td></td>
</tr>
<tr>
<td>Breed2</td>
<td></td>
<td>6.8</td>
<td></td>
<td></td>
<td>6.8</td>
<td>35</td>
<td></td>
</tr>
<tr>
<td>Potcake</td>
<td>16.1</td>
<td>2.9</td>
<td>10.3</td>
<td>0.2</td>
<td>29.4</td>
<td>152</td>
<td></td>
</tr>
<tr>
<td>Mixed</td>
<td>0.4</td>
<td>0.6</td>
<td>0.6</td>
<td>1.0</td>
<td>2.5</td>
<td>13</td>
<td></td>
</tr>
<tr>
<td>Overall %</td>
<td>24.4</td>
<td>54.2</td>
<td>6.8</td>
<td>13.0</td>
<td>1.7</td>
<td>100.0</td>
<td>517</td>
</tr>
</tbody>
</table>

Breed1 = matings with dogs of the same breed; Breed2 = matings with breed dogs of different purebreds; offspring were mixed breed.
neighbor’s dog (16.4%) and known strays (9.1%). When the male was unknown, caregivers generally had little idea how the mating took place, irrespective of the type of female they kept (48.4% of 31 purebred litters and 45.2% of 93 potcake litters).

Spaying

Obviously, not one of the female dogs whose breeding was reported was spayed. In some cases (5.9% of 239 caregivers), the litter had been wanted to give the dog the experience of a litter and in other cases, the litter was wanted in order for the female to be spayed. However, since the breeding, 25.8% of the mothers had been spayed. Again, there were type-dependent differences (Table 3) in the action toward spaying the female (female since spayed vs. still intact): purebred (Fisher’s exact test: $n = 348$, $p = .003$) and potcake ($n = 148$, $p = .31$). The importance of breeding dogs for sale was again seen as more respondents with purebred dogs wanted them to breed again than did those with potcakes (63.0% of respondents with purebreds compared with 12.1% of respondents with potcakes; Fisher’s exact test: $p < .001$, $n = 500$).

When respondents did not want to get the female spayed and did not want her to breed again, they were asked how they would stop the female breeding in the future; 66 responses were recorded. The most common response (53%) referred to confining the female better; 6% said they would chain the female. One person had “no plans,” and 21.2% did not know what they would do. Some respondents planned to give the female away (9.1%), 1 person would kill the female, and another would abandon the female. Other responses included warding off males and stopping the female from mating in unspecified ways.

<table>
<thead>
<tr>
<th>Type of Dog</th>
<th>Breeding Planned</th>
<th>Has the Female Been Spayed?</th>
<th>Overall</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td>Yes</td>
<td>No, but Plan To</td>
</tr>
<tr>
<td>Purebred</td>
<td>Yes</td>
<td>11.8</td>
<td>14.9</td>
</tr>
<tr>
<td></td>
<td>No</td>
<td>10.9</td>
<td>9.2</td>
</tr>
<tr>
<td></td>
<td>% overall</td>
<td>22.7</td>
<td>24.1</td>
</tr>
<tr>
<td>Potcake</td>
<td>Yes</td>
<td>3.4</td>
<td>2.0</td>
</tr>
<tr>
<td></td>
<td>No</td>
<td>31.1</td>
<td>32.4</td>
</tr>
<tr>
<td></td>
<td>% overall</td>
<td>34.5</td>
<td>34.5</td>
</tr>
</tbody>
</table>
DISCUSSION

Bahamians are more likely to plan their companion animals’ (pets’) litters than in other developing countries such as Mexico or Barbados (Heath & Grannum, n.d.; Ortega-Pacheco et al., 2007). In The Bahamas, it is clear that the care and planned breeding of dogs depends on the type of the female dog: potcake females are less likely to be intentionally bred than are purebred females. The underlying motive for this is financial gain. The value of “pure” bred dogs is evident from newspaper advertisements that indicate each puppy can be worth hundreds of dollars (Fielding et al., 2005), whereas potcakes are considered worthless (Fielding & Plumridge, 2005). The popularity of breeding pit bulls probably reflects the demand for these dogs for protection (Fielding & Plumridge, 2005).

It is apparent that the purebred dog population is responsible for the majority of the litters. Not all offspring of purebred females were purebreds; some were mixes. These mixed puppies are at risk of being unwanted because they are of limited commercial value. Many planned matings of purebred dogs used a mate who was also kept by the caregiver. If a female is repeatedly mated with a small genetic pool of males, this can be expected to result in inbreeding and subsequent decline of breed health. The case of the 6 respondents who identified themselves as “professional breeders” may be important. They failed to use animals other than their own for matings. If this is the usual practice, they can be expected to contribute significantly to inbreeding within the breed.

That this study included caregivers who bred dogs to sell their offspring as well as professional breeders indicates the prevalence of commercially orientated dog breeding by backyard breeders. Such caregivers are unlikely to participate in neutering initiatives and so will place limits on the reach of any neutering program. Provided dog breeders conform to the laws with respect to basic animal welfare, a female can be bred ad libitum. The lack of regulations regarding the breeding of dogs may also contribute to the overpopulation of dogs (Fielding & Plumridge, 2005). The importance of breeding for profit would suggest that legislation is required. Elsewhere, various laws have been proposed to control breeding (Sturla, 1993); however, relatively simple laws, along the lines of Bermuda (Government of Bermuda, 2000), where caregivers require a license to breed their dogs, might also be successful in The Bahamas.

This study suggests that unplanned breeding results in a supply of mixed-breed and potcake puppies. There are several consequences associated with this. First, as these mixed-breed or potcakes puppies are essentially of no monetary value, they can become recruits for low-cost spay/neuter programs, which typically neuter mixed breeds (Poss & Bader, 2008). Second, it explains a local concern that pit bulls are able to mate with potcakes (and other breeds) and the perception that such matings will make “our potcakes turn vicious” (“Pitbull Infiltration,” 2001).
Information on the authorized interactions between dogs is not easy to obtain. Although many dogs may be kept in an enclosed yard, barriers may not be in place at all times, allowing dogs to interact unsupervised. Some caregivers may simply not know how effective their barriers are in securing their females. For simplicity, and to encourage accurate reporting, we assumed the interviewee confined the female dog well enough so that any unauthorized interactions are due to trespassing dogs and so the unplanned interaction does not appear to be the interviewee’s fault. Blame was not the point of interest here, merely the occurrence of unsupervised interactions with dogs outside of the household.

Although not all dogs in a household may be kept in the same way (Shore, Riley, & Douglas, 2006), we assume that dogs in a household would be able to interact enough with each other to mate. The lack of confinement certainly explains why potcakes are more common on the streets and so most closely associated with the “stray dog problem” or dog overpopulation problem. As noted by Fielding (2007), potcakes receive less care than purebred dogs, and lack of confinement illustrates this. The lack of confinement means that male potcakes may well be associated with unplanned breeding, even when the female’s caregiver makes some attempt at confining the female. Lack of confinement is clearly important as many unauthorized matings occur. The resultant puppies can become clients of neuter programs or shelters. Litters from potcakes are less likely to be planned and the puppies less likely to be wanted. Thus, if the puppies are abandoned, they add to the perception that potcakes are the cause of the roaming dog population rather than the fact that unwanted litters reflect the level of care offered.

With potcakes being less confined than purebred dogs, they are more likely to be visible and so may become more closely associated with the roaming dog “problem.” However, behind this façade, it is the intentional breeding of dogs that produces most of the litters. When this breeding results in unintended mixes, the puppies become first-generation potcakes, constantly replenishing the potcake population.

The limited number of dogs neutered also contributes to the number of unplanned litters, particularly when confinement is inadequate. It would be expected that caregivers who breed their dogs for gain would have no intention of getting their animals neutered; however, a relatively large number of caregivers whose potcakes had produced unwanted litters also had no intention of having the dogs neutered. This may reflect the objections that some caregivers have toward neutering dogs (Fielding et al., 2005) and the need for education (Fielding, 2007). Respondents who indicated a willingness to neuter their pets (have not neutered the dog “but plan to”) suggest that low-cost neuter programs (Plumridge et al., 2007) have an important role in helping reduce the number of potentially unwanted litters.

In summary, it appears that breeding in the breed-dog population may be the primary source of litters in the island’s dog population. This is despite potcakes
being more visible on the street. Potcake puppies are probably more at risk of being relinquished because they have no commercial value, giving the impression that potcakes are the major source of puppies. Although potcake caregivers historically have been blamed for the roaming dog population—and this is still true to some extent today—changes in preferences for purebred dogs mean that this view may need to be revised and new regulations required to control the production of puppies. Inadequate confinement may mean placing greater reliance on neutering dogs to help control reproduction, although the many caregivers who breed dogs to sell the litters may limit the reach of neutering programs.

LIMITATIONS OF THE STUDY

That relatively few dog caregivers take their dogs to a veterinarian regularly and that relatively few dogs are licensed (Fielding et al., 2005) means that there are no useful lists of dog caregivers; this requires the use of a convenience sample for research on dogs. Such a nonprobabilistic sample can result in bias, making it difficult to extrapolate the results beyond the sample set. However, the results from this study triangulate with previous studies, which suggests that this sample may not be too biased. For example, the percentage of potcake to purebred dogs (and the mix of breed dogs) was similar to that reported by Fielding and Plumridge (2005). Unpublished data show the percentage of potcakes in that study who had bred in the previous 12 months was 32.6% (of 43 litters), which is similar to the percentage found in this study. The mean age of the females in this study was similar to that found in earlier studies as was the number of dogs per household (Fielding et al., 2005). These points of triangulation are important because a look at the pattern of matings in this study may reflect the picture in the wider dog population of New Providence.

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REFERENCES


