

Residents' management of, and attitudes towards, the dog population on two Mariana Islands

This study reports the level of care dogs received from their caretakers and the caretaker and non-caretaker attitudes towards dogs on the islands of Guam and Saipan in order to identify hurdles in dog care and management options for the stray population. Surveys were collected from residents of Guam and Saipan “(274 and 275 respectively)” and analyzed using chi-squared tests. Dogs were the most popular companion animal (Guam 66.4%; Saipan 72% ownership) with a strong preference toward pedigree, male puppies (Guam 45.4%; Saipan 62.4%). The more preferred dogs were housed inside and fed dog food, while the less preferred local mixed-breed dogs were free-roaming and fed table scraps. The majority of caretakers in Saipan and the minority in Guam (59% and 22.8% respectively) had never provided veterinary care to their dog. Generally, caretakers on both islands did not sterilize their dogs, which may result in the potential for unplanned litters and a growth in the dog population. Residents of both islands reported witnessing abusive acts toward dogs, despite dogs being reported as having an important role on the island. This paper considers obstacles regarding veterinary cost, free-roaming populations, and low sterilization rates.

Keywords: attitudes, dog, free-roaming, management, Mariana Islands, welfare

Introduction

The Mariana Islands are separated into two entities, Guam (a single island) and the Commonwealth of the Northern Mariana Islands (NMI), which consists of fourteen islands (Central Intelligence Agency, 2015b). The islands' initial fauna was characterized predominately by various species of birds, fruit bats, and land crabs (Wickler, 2004), all of which began to diminish with the increasing rate of human colonization (Fritts & Rodda, 1998). These limited resources required agricultural colonists to import domestic animals; the most common of which were the pig, dog, and chicken (Wickler, 2004). The exact date of the introduction of domestic dogs in the Mariana Islands is unclear, although genetically the dogs across the Pacific are derived from several lineages (Anderson, 2009).

It is believed that ancient Mariana dogs were a variation of the Ponape dog, a dog with the coloration of an old copper coin and a stump for a tail (Titcomb, 1969). Care for dogs was limited as dogs tended to search for their own food and may have been used as a food source when resources were limited, but dogs were also guardians and used for ritual and ceremonial purposes (Simoons & Baldwin, 1982). Elsewhere, dogs may have been treated brutally due to the perception that their behavior was "stealthy and thievish" (Titcomb, 1969). However, records for the dog population existing on Mariana Islands remain anecdotal and limited, therefore little evidence can be provided as to the historic and current treatment of dogs.

The most recent introduction of dogs occurred during World War II when war dog platoons were brought to the Mariana Islands from the United States of America (USA) to act as scout, messenger, or infantry dogs (Anonymous, 2008). The Japanese had imported dogs for similar purposes. Of the war dogs, 25% were German Shepherds and the remainder Doberman Pinschers, a result of the Doberman Pinscher Club of America partnering with the military to provide free dogs (Putney, 2001; University of Tennessee, 2008). Following these introduction events there would have been substantial potential for interbreeding between newly introduced populations and the resident island dogs known as "boonies". The term 'boonie' is used by the residents of the Mariana Islands to refer to a local free-roaming or stray dog phenotype that may or may not have a caretaker (Putney, 2001).

Guam and Saipan were a single nation before World War II and attempted to reintegrate after the war, but Guam residents voted to remain separate (Dela Cruz, 2010).

Guam remained a territory of the USA and the rest of the NMI became part of the USA commonwealth (CNMI). Both countries have similar ethnic groups (Asian and Pacific Islander predominantly), religions (Roman Catholic and Christian predominantly), languages (Philippine languages, Chamorro, and English), life expectancy (approximately 76 years), and similar age ranges (largest proportion of the population is between 25-54 years of age). However, due to their political stance and natural resources, the islands remained quite different (Central Intelligence Agency, 2015a; Central Intelligence Agency, 2015b). Guam, as compared to the CNMI, is known for its military presence, increased rate of urbanization, higher availability of goods from the USA, and significantly larger Gross Domestic Product (Central Intelligence Agency, 2015a; Central Intelligence Agency, 2015b). These functional differences can be easily observed by visitors and residents.

The estimate of the Saipan free-roaming population is approximately 21,000 (Humane Society International [HSI], 2015; Nimer, Meneses, Watson, Shuster, & Benford, 2018). This translates to a 1 : 2.3 ratio of free-roaming dogs to residents in Saipan, although ownership ratios are unclear (Furey, 2006). In Guam, the HSI estimated the total dog population to be 61,000 where 36,500 are family companions provided with care, 19,000 are free-roaming companions, and 5,500 are strays (Raymundo, 2015). This equates to a 1 : 29.4 ratio of stray dogs to residents. Both islands exhibited a large free-roaming dog population with potential to increase in size and negative perceptions.

No previous research on dogs with caretakers (including animal care, quality of care, and overall welfare) has taken place in Micronesia, including the Mariana Islands. Although Saipan has never had a case of rabies and Guam has not had a case since 1970 (Glosser & Yarnell, 1970) there remains a need for information on dog care. Preventative and veterinary care is required as dogs in Guam and Saipan are susceptible to a variety of parasitic worms including hookworms (*Ancylostoma caninum*) and heartworms (*Dirofilaria immitis*), along with Demodectic Mange (*Demodex sp.*), ticks, and fleas (Nimer et al., 2018; Isla Veterinary Clinic, personal communication, June 6, 2018).

Currently, Saipan does not have a formal animal welfare legislation but they are working towards integrating animal protection legislation (The Animal Protection Act (2015))(an earlier iteration of which failed to be passed in 2010 (Perez, 2016b)) in order to combat the 1,880 cases of animal cruelty being reported as of 2007 (Chan, 2016). Animal welfare in Saipan has been undergoing many changes as of 2015 with the introduction of its first spay and neuter clinic (Dayao, 2015) and the opening of an animal

shelter with a capacity of 50 dogs (Perez, 2016a). The previous holding facility had a 100% euthanasia rate (as it was a holding facility, not an adoption facility)(Humane Society International, 2018). Currently, stray and relinquished dogs are brought to the center by The Saipan Mayor's Office Dog Control Program where adoptions can take place, but euthanasia rates remain high (Total intake 2014 - 2016: 2281; Total euthanasia 2014 – 2016: 2209 (Bautista, 2017)).

Conversely Guam, despite its cultural similarities, has four pieces of legislation protecting animals against Animal Neglect (2012), Cruelty to Animals (2012), Animal Abandonment (2012), and Dog Fighting (2012) (along with baiting). Guam has maintained an animal shelter since 1989 and has been operating low cost spay and neuter clinics since 1993 (Miller, 2014). Currently, stray and relinquished dogs are brought to the Guam Animals In Need (GAIN) shelter where adoption and foster programs take place, but euthanasia rates are high (Total intake 2016-June 2018: 7833; Total euthanasia 2016-June 2018: 6491 (Cyrus Luhr - President of GAIN's Board of Directors, personal communication, June 6, 2018)). Given the differences between the islands and potential for differences in attitudes and actions from residents this research seeks to understand how Guam and Saipan care for, manage, protect, and perceive the dogs within their community while recognizing possible barriers hampering the welfare of the islands' dogs and value of boonies.

Methods

A survey was utilized to collect information on caretaker attitudes and actions regarding dogs as well as how residents perceived the general dog population. Students from the islands' community college environmental clubs (two from Guam and four from Saipan) were given a script, trained on how to conduct the survey (directing questions and recording answers) in a standardized manner, and participated in role-play before conducting face-to-face interviews. Island residents who were at least eighteen years of age were opportunistically approached to participate in the survey. Before the interview, the surveyors defined the purpose of the survey and ensured confidentiality of the responses. Respondents were canvassed on the streets and in public locations such as supermarkets, flea markets, and churches across the islands. Enumerators would pick a high-traffic location and approach individuals walking within three meters of their location. Answers were provided verbally and recorded by the enumerators. Most questions required ticking a box, a simple yes/no, a 5-point scale (not important to

extremely important and strongly disagree to completely agree), or the Nestle Purina PetCare Co. Purina's Body Condition Chart 1-5. On average, each survey took ten minutes to complete if the respondent was a caretaker and about five minutes if they were not (see Appendix I for survey questions).

Both caretakers (those providing a degree of care to a dog they considered 'theirs') and non-caretakers (those not providing any care to a dog) were asked questions to document their perceptions toward stray dogs, legislation for dogs, and local animal welfare issues. For the purpose of this study dogs were classified as follows:

Dog Classification (see Figure 1)

1. Boonie – a dog resembling the phenotype of a historically introduced breed that may or may not be free-roaming and may or may not be owned.
2. Non-boonie – a dog not resembling the phenotype of a historically introduced breed. Such dogs are likely to be owned.

Age

1. Puppy - between birth and six months of age
2. Juvenile/Adolescent – between six months to eighteen months of age
3. Adult – between eighteen months to seven years of age
4. Senior - over seven years of age

Housing

Inside – Dog's movements are restricted by a four-walled and roofed structure

Fenced – Dog's movements are restricted by a barrier, outside

Chained – Dog's movements are restricted by a tether attached to an object

Free-roaming – Dog's movements are not restricted



Figure 1. A photo of a female, juvenile, boonie, commonly identified by its short coat, mesocephalic head, erect or rose ears, saber tail, black and tan coloration, and medium size (exceptions can be found in Guam and Saipan).

Statistical Analysis

All data were entered into Minitab Express© for Macintosh. If respondents omitted to answer a question their information was included in the database. However, non-responses were excluded from the pertinent analyses resulting in the number of valid responses varying between questions. Primary analysis of the sample population was evaluated by island. Chi-squared analysis and Cramer V tests were conducted to identify differences between island residents and between dog types; statistical significance is indicated by $p \leq 0.05$. To show a distinct contrast, dog classification was limited to boonies and non-boonies.

Results

A convenience sample was taken in Guam in November 2015. The total sample was 144 men and 129 women (Guam ratio 1.03 male/female) from a population of 161,785 (Central Intelligence Agency, 2015a). Guam respondents reported a total of 417 dogs, 26.9% boonie and 73.1% non-boonie. In Saipan sampling took place in February 2016. The total sample was 131 men and 137 women (Saipan sex ratio is .93 male/female)

surveyed from a population of 49,000 (Central Intelligence Agency, 2015b). Respondents in Saipan reported a total of 470 dogs; 51.5% boonie and 48.5% non-boonie. Most respondents interested in participating in the survey were caretakers (see Table 1).

(Insert Table 1 here)

Across both islands dogs were the most popular companion animal amongst respondents (Guam 66.4%; Saipan 72%, Cramer $V=0.06$) demonstrating a strong and shared motivation to become a caretaker for dogs between the islands. Other pets included cats (Guam 84; Saipan 147), birds (Guam 18, Saipan 264), fish (Guam 47, Saipan 138), rabbits (Guam 12; Saipan 67), goats (Saipan 16), and a lizard (Saipan 1). In Guam 15.9% (29/182) of caretakers and 13% (12/92) of non-caretakers were providing care to an animal besides a dog. In Saipan 34.8% (69/198) of caretakers and 27.3% (21/77) of non-caretakers provided a level of care to an animal that was not a dog. Most caretakers had only one or two dogs (Guam 69.8% (127/182); Saipan 70.7% (140/198)), but there were ten households with more than six dogs (one with ten and one with twelve dogs) in Guam and eighteen households with more than six dogs in Saipan (one with ten and one with fourteen dogs). In Guam, dog caretakers with more than two dogs, 49.1% (27/55) had more than one boonie whilst 12.7% (7/55) had only boonies. In contrast, in Saipan caretakers with more than two dogs 78.4% (29/37) had at least one boonie and 45.9% (17/37) had only boonies. In Guam and Saipan respectively, 48.7% (202/415) and 54.3% (242/446) of companion dogs were boonies.

The majority of caretakers in Guam and Saipan prefer puppies (Guam 58.5% (158/270); Saipan 75% (204/272)) and had chosen to acquire their dogs as puppies rather than juveniles, adults, or senior dogs (choosing a puppy vs. a dog that was not a puppy; Guam $df=1$, $\chi^2=189.42$, $p<.0001$; Saipan $df=1$, $\chi^2=238.02$, $p<.0001$). Although caretakers reported that the majority of household dogs in Guam and Saipan were acquired as puppies, most of the dogs reported on were adults (see Table 2). Dogs were predominantly acquired as gifts (Guam 41.2% (161/391); Saipan 52.5% (233/444)). The second most common route of acquisition was purchasing in Guam (21.5% (84/391)) and finding the dog in Saipan (15.8% (70/444)). Caretakers of both islands demonstrated a preference for non-boonies (Guam 34.4% (93/270); Saipan 54% (147/272)) and purchased dogs who more likely to be a non-boonie as opposed a boonie (Guam: 91.8% (67/73) non-boonie, 8.2% (6/73) boonie; $df=1$, $\chi^2=50.97$, $p<.0001$. Saipan 88.6% (31/35)

non-boonie, 11.4% (4/35) boonie; $df=1$, $\chi^2=20.83$, $p<.0001$). Of the dogs given as gifts in Guam, most were non-boonies (72% (85/118) non-boonie, 28% (33/118) boonie; $df=1$, $\chi^2=22.92$, $p<.0001$). However, this was not the case in Saipan where a gift was more likely to be a boonie (72% (113/157) boonie, 28% (44/157) non-boonie in Saipan ($df=1$, $\chi^2=30.32$, $p<.0001$)). The top three breeds of respondents in Guam were Pit Bull (33.3% (71/213)), Chihuahua (27.2% (58/213)) and Shitzu (6.1% (13/213)), whilst in Saipan they were Pit Bull (24.5% (26/106)), Maltese (22.6% (24/106)) and Labrador Retriever (18.9% (20/106)).

(Insert Table 2 here)

In Guam, non-boonies were predominantly housed inside or in a fenced area, whilst boonies were more likely to be chained or allowed to roam freely. In Saipan, there was no clear difference between the four housing methods (i.e. inside, fenced; chained; free-roaming) for non-boonies (see Table 3). However, boonies were far more likely to be allowed to roam freely. The preference toward male dogs (Guam 43.3% (117/270); Saipan 58.1% (158/272)) increases this exploratory behavior in the population. Even though a large number of caretakers allowed their dogs to roam, in Guam 32.2% (58/180) of residents found roaming behavior to be completely unacceptable, 18.9% (34/180) considered roaming behavior to be somewhat unacceptable, 15.5% (28/180) considered roaming behavior to be completely acceptable, 10.6% (19/180) considered roaming behavior to be somewhat acceptable, and 22.8% (41/180) were neutral. In Saipan, 26% (51/196) caretakers found roaming behavior to be completely acceptable, 24% (47/196) found roaming behavior somewhat acceptable, 15.3% (30/196) found roaming behavior to be completely unacceptable, 9.7% (19/196) found roaming behavior to be somewhat unacceptable, and 25% (49/196) were neutral.

Dogs in Guam may fill one or more roles as companion (63.3% (264/417)), guard (62.4% (260/417)), and/or pet (47.8% (199/417)). In Saipan, the dog was more likely to fulfill the guard role (87% (409/470)) before filling the role as pet (64.5% (303/470)) or companion (52.8% (248/470)). In Guam and Saipan dogs were seen as part of the family (82.4% (342/415); 79.6% (374/470) respectively) as well as property (70% (280/402); 55.1% (259/470) respectively).

(Insert Table 3 here)

In Guam manufactured dog food (48.1% (200/416)) and a combination of manufactured dog food and table scraps (46.6% (194/416)) were the most common foodstuffs for dogs with feeding only table scraps being the least common (5.3% (22/416)). In Saipan, dogs were fed a combination of manufactured dog food and table scraps (61.2% (293/479)) with 19.8% (95/479) receiving solely manufactured dog food, 17.3% (83/479) fed only table scraps, and 1.7% (8/479) finding their own food. The choice to use manufactured dog food as the primary diet (vs. not only dog food) was significantly different between Guam and Saipan ($df=1$, $\chi^2=37.37$, $p<.0001$). In Guam, non-boonies were most likely to be fed manufactured dog food (58.2% (117/201)) and in Saipan non-boonies were most likely to be fed a combination of manufactured dog food and table scraps (63.2% (67/106)). Boonies in Guam (49.6% (55/111)) and Saipan (61.4% (148/241)) are fed a combination of manufactured dog food and table scraps. Table 4 demonstrates the level of care provided to dogs by their caretakers. Both islands ranked daily clean water, daily food, and shelter as extremely important. Items offered by veterinarians such as vaccines, flea treatments, and bathing were also seen to be an important aspect of care. Saipan caretakers claimed basic dog training was extremely important for their dog. Caretakers have reported that 86.6% (354/409) of dogs have been trained in Guam and 53.7% (252/469) in Saipan.

Table 5 demonstrates the opinions on sterilization between islands and between genders. Males found sterilization to not be important whereas females found sterilization to be equally not at all important and extremely important. Men seemed to provide more definitive opinions of sterilization where as women seemed to provide more ambiguous opinions. There was no statistical difference between the residential opinions of males in Guam and Saipan ($df=1$, $\chi^2=0.206$, $p=.6503$) or between females on Guam and Saipan ($df=1$, $\chi^2=0.193$, $p=.6606$). Saipan residents took a neutral stand (male 57% (49/98) and female 50% (54/108)) on the topic of sterilization of dogs.

(Insert Table 4 here)

(Insert Table 5 here)

In Guam, caretakers had access to several veterinary clinics and only 3.2% (12/381) of dogs with caretakers had not visited the veterinarian due to limited veterinary access. Most caretakers indicated that regular veterinary visits were not made because the

dog did not require veterinary attention (69.3%; 261/381). In Saipan, caretakers only had access to one veterinary clinic and caretakers likely to be provided veterinary care due to a lack of veterinary access 18% (78/433), although the largest impediment was reported as cost (56.1% (243/433)). Dogs in Guam, received greater levels of preventative care than those in Saipan: vaccines (Guam 75.6% (307/406); Saipan 37.7% (177/470)), dewormer (Guam 72.7% (295/406); Saipan 32.8% (154/470)), heartworm prevention (Guam 63.3% (257/406); Saipan 22.8% (107/470)), and flea/tick prevention (Guam 66.5% (270/406); Saipan 19.4% (91/470)). Irrespective of the increased accessibility, 22.8% (94/412) of dogs in Guam and 59% (280/473) of dogs in Saipan had never been taken to the veterinarian.

In Guam, there was no significant difference in caretaker gender and the provision of preventive health care for dogs (Female: 30.9% (54/175); Male: 30.3% (53/175)). In Saipan, there was no significant difference in caretaker gender and the provision of preventive health care for dogs (Female: 11.8% (23/195); Male: 11.3% (22/195)). In Guam, there was no significant difference in caretaker education level (above vs. below high school level) and provision of veterinary care ($df=1$, $\chi^2=.03$, $p=.8618$), but did for those in Saipan where a lower education had a significant effect on visitation. ($df=1$, $\chi^2=14.62$, $p=.0001$). Caretakers on both islands reported that their dogs were healthy and with body condition scores of three (Guam 28.7% (118/411); Saipan 47.7% (204/428)) and four (Guam 54.5% (224/411); Saipan 36.2% (155/428)).

In Guam and Saipan, the majority of caretakers reported that their dogs were not sterilized (78.7% (325/413) and 86.9% (398/458) respectively). In Guam the ratio of sterilized non-boonie to non-sterilized non-boonie 1:4 and 1:2 for sterilized boonie to non-sterilized boonie. In Saipan the ratio of sterilized non-boonie to non-sterilized non-boonie is 1:6 and 1:7 for sterilized boonie to non-sterilized boonie. In Guam, 19.7% (64/325) of caretakers were strongly against the sterilization process; 16.6% (54/325) did not believe the dog needed to be sterilized, and 17.2% (56/325) wished to breed the dog. Saipan caretakers did not sterilize their dogs due to cost (14.8% (59/398)), did not believe the dog needed to be sterilized (11.1% (44/398)), wished to breed the dog (10.8% (43/398)) or did not wish to answer this question (46.5% (185/398)).

Of dogs that carried litters to term in Guam, 39.1% (25/64) produced only a single litter in their life, 45.3% (29/64) had 2-4 litters, 6.3% (4/64) had 5-7 litters, and 9.4% (6/64) had eight or more litters. In Saipan dogs 26.9% (18/67) delivered only a single litter, 44.8% (30/67) had 2-4 litters, 22.4% (15/67) had 5-7 litters, and 6% (4/67) had

eight or more litters. The litters were predominantly unintentional (not planned/unaware of the pregnancy)(Guam 45.3% (24/53); Saipan 71.8% (51/71)). In Guam, 73.4% (47/64) of the litters came from non-boonies with almost a 1:2 ratio on non-intentional to intentional. In Saipan, the proportion of unintentional litters were similar between non-boonies and boonies, but intentional litters for non-boonies took place 19.7% (14/71) of the time and there was only a single case of an intentional boonie litter. In Guam caretakers kept (31.5% (45/143)), sold (35.7% (51/143)), or gave away (22.4% (32/143)) puppies of unwanted litters. Caretakers in Saipan kept (38.5% (37/96)) and gave away (28.1% (27/96)) puppies of unwanted litters, they were rarely sold (9.4% (9/96)). Guam's 9.8% (14/143) of litters were futile (stillborn or deceased shortly after birth) and in Saipan 18.8% (18/96) were futile.

A majority of survey participants in both locations believed that there were too many stray dogs (Guam 93.7% (251/268), Saipan 95.2% (257/270)). This was identified as causing several problems. In Guam, overpopulation of stray dogs pose a nuisance (e.g. ruining yards and chasing other animals), environmental concern (e.g. defecating and spreading trash), public health concern (e.g. disease spread), and traffic hazard concerns(e.g. causing accidents or traffic). In Saipan similar environmental concerns, public health concerns, and traffic hazard concerns were present with the concern that stray dogs may negatively affect their tourism industry (e.g. dogs scaring tourists or viewed as an eye sore), see Table 6. Dog bites were reported by 52.8% (142/269) of Guam and 44.1% (120/272) of Saipan residents, of those bit overall no action was taken against the dog (Guam 76.2% (99/130); Saipan 49.5% (51/103)). The exceptions were three dogs killed and nine restrained in Guam and ten killed and two restrained in Saipan as reported by responders.

(Insert Table 6 here)

Though both islands have animal control, residents from Guam (97% (263/271) and Saipan (94.4% (252/267)) believed the stray population needed further control. Residents in Guam suggested that to control the population increasing the number of shelters to increase adoptions (35.2% (81/230)), catching more strays (17.8% (41/230)), killing strays (13.9% (32/230)), sterilizing (10% (23/230)), and laws (2.2% (5/230))(Other ideas 20.9% (48/230)). Residents in Saipan suggested more shelters allowing for more adoptions (26.3% (73/278)), an improved animal control program

(21.9% (61/278)), catching more strays (16.9% (47/278)), killing the strays (14.4% (40/278)), sterilizing (7.9% (22/278)), and laws (7.9% (22/278))(Other ideas .7% (2/278)).

Guam has four articles of dog welfare legislation and dog registration, but only 22.7% (61/269) of Guam residents knew dog legislation existed. Saipan is lacking dog welfare legislation, 23% (62/269) of residents knew of dog registration. Only a small number of dogs had tags (Guam 15.5% (52/336); Saipan 17.6% (73/415)). Despite this lack of legislative awareness, residents from both islands believed there should be legislation protecting dogs (Guam 90.5% (182/201), Saipan 91.7% (198/216)). Residents were asked if they or someone close to them had ever witnessed at least one of the following acts: dog fighting, consuming a dog, beating/killing a dog, or neglecting to provide food or water to a dog. In Guam 40.5% (109/269) of respondents and 39% (106/272) of respondents in Saipan said they had witnessed at least one of the acts. In Guam residents reported 86 acts of consuming dog meat, 41 acts of dog fighting, 109 acts of beating a dog, and 93 acts of not providing food or water to a dog. In Saipan residents reported 106 acts of consuming dog meat, 38 acts of dog fighting, 73 acts of beating a dog, and 72 acts of not providing food or water to a dog.

Residents on both islands agreed that dogs can feel pain (Guam caretaker 92.7% (166/179), non-caretaker 90.9% (80/88); Saipan caretakers 85.7% (168/196), non-caretaker 86.1% (62/72)) as well as being able to feel happiness, sadness, and/or love (Guam caretaker 92.7% (166/179), non-caretaker 90% (81/90); Saipan caretaker 87.7% (171/195), non-caretaker 88.9% (64/72)). Dogs are believed to be extremely important (Guam 44.7% (119/266); Saipan 38% (103/271)) to the island (not at all important, Guam 1.5% (4/266); Saipan 4.1% (11/271)).

Discussion

Household Dogs

In Guam and Saipan, dogs are the most popular companion animals suggesting that dogs are important members of communities in both locations. Households favored male puppies to play the role of pet, companion, family member, and guard dog. This is may be due to the perception of males being more vocal, therefore performing better as a guard dog than a female dog (Anonymous, 2017). This preference toward guard dogs may have skewed the population's sex ratio toward males as they make up 56% of the roaming dog population in Guam (Raymundo, 2015) and skewed the Saipan population (Todiño, 2015; Nimer et al., 2018). A similar effect has also been observed in other

island-based studies: e.g. The Bahamas, (Fielding et al., 2005), Haiti (Fielding, Gall, Green, & Eller, 2012), Dominica (Davis, Alie, Fielding, Morters, & Galindo, 2007), Indonesia (Mustiana et al., 2015), and Samoa (Farnworth, Blaszak, Hiby, & Waran, 2012).

The preference and high ownership of non-boonies in Guam was most likely due to the increasing presence of USA military personnel after World War II, but also the start of the 2000s where military assets increased significantly in Guam and the naval and air force bases merged (Dawson, 2018). Conversely, in Saipan, caretakers prefer non-boonies, but they were less prevalent on the island either due to reduced local accessibility or higher ownership costs. The preference for non-boonies over boonies may reflect social perception of the breed and what they represent (Ghirlanda, Acerbi, Herzog, & Serpell, 2013). Non-boonies may be a symbol of economic status and demonstrate wealth due to rarity of purebred dogs (Harrington, 2009). Boonies are less likely to offer such status to the caretaker. This can be paralleled with the potcake dogs of the Bahamas which are considered “cheap, or indeed worthless, and so the poor can own them,” (Fielding, Mather, & Isaacs, 2005). In Saipan, despite a preference for non-boonies, there is substantially higher boonie ownership. Saipan has a lower Gross Domestic Product meaning boonies may be more commonly owned due to their generally lower cost.

Boonies were less likely to receive veterinary care perhaps due to the perception that boonies require little to no financial investment. Further, boonies were more likely to be given freely as gifts as opposed to non-boonies, which were usually purchased. Although the majority of dog caretakers believed vaccines, flea treatment, bathing, grooming, training, and exercise were extremely important for their dog, the majority of caretakers in Saipan, and a quarter of those in Guam, rarely provided veterinary care due to cost. Similar levels of veterinary care are evident within other island-based studies with only 12% of dogs vaccinated in Samoa (Farnworth et al., 2012) and, around “30% of dog-keeping households [taking] their pets to the veterinarian” in the Bahamas (Fielding, 2007). Further supporting the concept of reduced value of “local dogs”, potcakes received the least health care and dogs identified by breed received the most (Fielding, 2007). The absence of preventative health management may relate to affordable veterinary care accessibility (sterilization is offered by veterinarians at a minimum of four times the cost of a low-cost spay/neuter clinic) and the healthcare investment of caretakers.

Sterilization

In this study the majority of dogs in Guam (78.7%) and Saipan (86.9%) were not sterilized. On both islands, our survey revealed that sterilization was divergently viewed as “extremely important” and “not at all important”. Women reported equally divergent views on sterilization whereas slightly more men reported that sterilization was unimportant. This ambivalence in the female sample was somewhat surprising given their generally greater concern for animal welfare (Serpell, 2011). Mens’ views on sterilization of dogs suggests they are less likely to sterilize their dogs than women. It is suggested that the majority of survey respondents view neutering as decreasing their dog’s maleness or masculinity (Blackshaw & Day, 1994; McKay, Farnworth, & Waran, 2009). Caretakers on both islands believed their dog did not need to be sterilized or wished to breed their dog. In Saipan, but not Guam, cost was a significant barrier. Litters generally occurred unintentionally, which is likely due to low sterilization rates and the free-roaming lifestyle within the dog population overall.

Low sterilization rates are similarly common in other island locales such as Haiti where only 6% of the females are spayed (Fielding et al., 2012) and in Samoa only 19% of owned dogs were sterilized (Farnworth et al., 2012). Guam had several veterinary clinics and a long running low cost spay/neuter clinic (Miller, 2014). Meanwhile, sterilizations in Saipan were provided at a single veterinary clinic which did not have a low cost spay/neuter option. Veterinary clinics are relatively new to Saipan, having been initiated in 2015 (Dayao, 2015). Due to the challenges of accessibility to, and cost of, sterilization on both islands, substantial populations of unsterilized free-roaming dogs exist in Guam and Saipan. However, access to low-cost services alone is not sufficient to promote change in ownership behavior, improved legislation and public education campaigns may also be required. A large dog population with low sterilization rates and high free-roaming capabilities will continue to grow, increasing “nuisance” behavior on the islands. As the dog population grows, it can be postulated that intake of dogs into shelters will also rise. With relatively few adoptions, euthanasia rates may therefore increase in Guam and Saipan. Similar circumstances in Puerto Rico resulted in 90% of shelter intake being euthanized (Humane Society International, 2018)).

Stray Population

A large number of caretakers on both islands allow their dogs to roam freely. Guam had 19,000 free-roaming companions and only 5,500 strays (Raymundo, 2015) and Saipan had 11,000 owned street dogs and 1,300 strays (Todiño, 2015). These free-

roaming companion dogs were more likely to be boonies than non-boonies, demonstrating a further difference in management of the two groups of dogs. The majority of caretakers in Guam found free-roaming behavior to be unacceptable whereas Saipan caretakers found it to be acceptable. Residents of both islands however deemed the free-roaming dog population (boonie and stray) as a nuisance and having a negative impact on the environment, public health, and tourism. This perception is supported by previous work conducted in Saipan (Nimer et al., 2018). The concept that dogs on islands are perceived as a nuisance is supported by several other studies (Farnworth, Blaszkak, Hiby, & Waran, 2012; Fielding, 2008; Alie, Davis, Fielding, & Maldonado, 2007).

Public health and tourism may be affected by the high levels of aggression within a dog population and a substantial incidence of dog bites (Beckman, Hill, Farnworth, Bolwell, Bridges & Acke, 2014). A recent report identified that 52.5% and 44.1% of residents had been bitten in Guam and Saipan, respectively (Todiño, 2015). Similar effects may occur as a result of a disparity between tourists' prior experiences of dogs compared to those in Guam or Saipan. A Humane Society International dog count observed that street dogs in Saipan were "unhealthy, either undernourished, wounded, ill, or suffered a combination of these conditions" and 15% of observed dogs had mange or similar skin maladies (Todiño, 2015). The negative effects of semi-free or completely free-roaming dog populations on tourism and public health are shared in Indonesia (Mustiana et al., 2015), Samoa (Farnworth et al., 2012), Dominica (Davis et al., 2007), Haiti (Fielding et al., 2012), and the Bahamas (Fielding, 2007). The impact of traffic congestion/accidents caused by dogs was labeled important by those surveyed, but no reports have ever been filed in Guam (Officer Joseph Mansapit, personal communication, May 19, 2016) or Saipan (Officer Norris Kwon, personal communication, May 16, 2016).

Residents on both islands suggested that the best ways to handle the stray dog population was to increase and improve animal shelters and dog control programs that catch strays. This differed from the results of a similar study carried out in Saipan in 2013 wherein most residents suggested implementing leash laws and registration policies to manage dogs with caretakers, followed by collection and sheltering initiatives to manage strays (Nimer et al., 2018). These are viable options, but may not benefit the dogs if sheltering of strays and relinquished dogs leads to high levels of euthanasia (International Companion Animal Management Coalition, 2007). In 2016 the shelter in Guam euthanized 1944 dogs (Cyrus Luhr - President of GAIN's Board of Directors, personal communication, June 6, 2018) and the shelter in Saipan euthanized 623 dogs (Bautista,

2017). In this study, residents did not suggest sterilization or controlling the roaming behavior of dogs with caretakers as a control method. Decreasing the size of the stray population decreases its negative perceptions, resulting in fewer request for dogs to be collected by dog control and improves welfare of dogs by decreasing disease prevalence, resource competition, and euthanasia in shelters (Trotman, n.d.).

Decreasing the boonie population may not only improve perceptions and value of boonies, but may also decrease instances of dog abuse. Guam (40.5%) and Saipan (39%) residents reported incidents of dog fighting, consuming dog, beating/killing a dog, and neglect. Improving the perception of the dog population, possibly by using animal welfare legislation and enforcement, may help to decrease euthanasia rates and improve animal welfare.

Although this work represents the first exploration of the dog population in Guam, and one of only a few in Saipan, it is not without its limitations. Despite a systematic approach, our sample may be biased based on the target groups' willingness to respond. Therefore these results may not represent the views of the wider population of either island. Surveys were conducted at similar demographic sites on both islands with areas of high tourist volumes avoided so as to attempt to ensure a sample from residents of the islands. However, this may have excluded representation of certain local groups. The sample included a higher percentage of caretakers, which may reflect the general populations or an increased willingness for caretakers to respond. There are currently no caretaker statistics with which to compare these results. Observational studies of owned dog behavior and lifestyle alongside the survey would assist in identifying any disparities between owner report and actual care, management and comparative health within the dog populations.

Conclusion

The findings from this study were similar to findings across other island communities. The remoteness, limited access to services, and large free-roaming dog population are all likely to be hurdles toward improved animal care and welfare in Guam and Saipan. Improvements in responsible ownership, especially rates of sterilization and free-roaming behavior of dogs, are likely contingent on substantial changes in attitudes towards the dog population and its management. Though Guam has animal welfare legislation and a higher quantity of services for dogs, the public perception of the dog populations in Guam and Saipan were relatively similar. Therefore, more effective

strategies to create long-term changes in attitudes and behavior must be considered by those in animal control and sheltering, and animal welfarists, to educate and promote programs that will manage the free-roaming dog population and increase responsible pet ownership.

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TABLE 1

Number of Caretakers, Their Dogs, and Non-Caretakers Data Were Collected On

Responders	Location	
	Guam	Saipan
Caretakers	182	198
Dogs owned	417	470
Non-caretakers	92	77

TABLE 2

Development of the Owned Dog Now and When Acquired as Reported per Dog.

Numbers in Parentheses are Percentage of Total Responses.

Location	Developmental Classification	Developmental Class			
		Puppy	Juvenile	Adult	Senior
Guam	Age Now	67 (16.4)	98 (24)	185 (45.3)	58 (14.2)
Saipan		85 (19.1)	119 (26.7)	203 (45.5)	39 (8.7)
Guam	Age at acquisition	343 (84.1)	33 (8.1)	30 (7.4)	2 (0.5)
Saipan		390 (87.4)	37 (8.2)	23 (5.2)	2 (0.4)

Note. For these questions $n^{\text{Guam}} = 408$ $n^{\text{Saipan}} = 446$.

TABLE 3

Types of Housing Provided to Companion Dogs by Their Caretakers. Numbers in Parentheses are Percentage of Total Responses.

Location	Dog type	Housing type				Sample Size
		Inside	Fenced	Chained	Free to Roam	
Guam	Non-boonie*	104 (40.2)	62 (23.9)	39 (15.1)	54 (20.8)	259
Saipan	Non-boonie*	44 (30)	26 (17.7)	37 (25.2)	40 (27.2)	147
Guam	Boonie**	24 (20)	24 (20)	36 (30)	36 (30)	120
Saipan	Boonie**	26 (9.2)	28 (10)	60 (21.3)	168 (59.6)	282

Note. *For this question $n^{\text{Guam}} = 259$, $n^{\text{Saipan}} = 147$; **For this question $n^{\text{Guam}} = 120$, $n^{\text{Saipan}} = 282$

TABLE 4

Level of Importance on Aspects of Dog Care as Determined by Caretakers for their Dog. Numbers in Parentheses are Percentage of Total Responses.

Aspects of care	Location	Level of importance
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		Not at all Important	Somewhat Unimportant	Neutral	Somewhat Important	Extremely Important
Daily Clean	Guam	3 (0.7)	0 (0)	8 (2)	26 (6.4)	371 (90.9)
Water	Saipan	9 (1.9)	4 (0.9)	12 (2.6)	29 (6.2)	413 (88.4)
Daily Food	Guam	1 (0.2)	0 (0)	2 (0.5)	28 (6.9)	367 (90)
	Saipan	15 (3.2)	0 (0)	5 (1.1)	10 (2.1)	436 (93.4)
Shelter	Guam	3 (0.7)	0 (0)	7 (1.7)	13 (3.2)	385 (94.4)
	Saipan	9 (1.9)	3 (0.6)	23 (4.9)	62 (13.3)	370 (79.2)
Vaccines	Guam	23 (5.6)	18 (4.4)	42 (10.3)	55 (13.5)	270 (66.2)
	Saipan	74 (15.8)	35 (7.5)	125 (26.8)	42 (9)	169 (36.2)
Flea Treatment	Guam	22 (5.4)	7 (1.7)	28 (6.9)	62 (15.2)	285 (69.9)
	Saipan	27 (5.8)	38 (8.1)	95 (20.3)	88 (18.8)	213 (45.6)
Sterilization	Guam	180 (44.1)	22 (5.4)	43 (10.5)	16 (3.9)	147 (36)
	Saipan	162 (34.7)	40 (8.6)	114 (24.4)	37 (7.9)	106 (22.7)
Bathing/ Grooming	Guam	6 (1.5)	8 (2)	90 (22.1)	93 (22.8)	208 (51)
	Saipan	31 (6.6)	21 (4.5)	86 (18.4)	130 (27.8)	177 (37.9)
Training/Exercise	Guam	20 (4.9)	12 (2.9)	115 (28.2)	77 (18.9)	179 (43.9)
	Saipan	53 (11.3)	32 (6.9)	107 (22.9)	126 (27)	143 (30.6)
Exercise	Guam	7 (1.7)	6 (1.5)	54 (13.2)	80 (19.6)	259 (63.5)
	Saipan	32 (6.9)	25 (5.4)	66 (14.1)	113 (24.2)	219 (46.9)

Note. For these questions n^{Guam} = 408 n^{Saipan} = 467.

TABLE 5
Opinions on Sterilization as Determined by Caretakers, Categorized by Gender

Numbers in Parentheses are Percentage of Total Responses.

Sex	Location	Extrememly Important	Neutral	Not at all Important
Male	Guam	29 (33.7)	15 (17.4)	42 (48.8)
	Saipan	18 (20.9)	49 (57)	31 (36)
Female	Guam	37 (40.7)	20 (22)	34 (37.4)
	Saipan	26 (24.1)	54 (50)	28 (25.9)

Note. For these questions $n^{\text{GuamMale}} = 86$ $n^{\text{SaipanMale}} = 98$ $n^{\text{GuamFemale}} = 91$
 $n^{\text{SaipanFemale}} = 108$

TABLE 6

Issues Surrounding Stray Dogs and the Degree With Which They Impact as Reported by Residents. Numbers in Parentheses are Percentage of Total Responses.

Location	Issue	Degree of impact				
		No impact	Small impact	Moderate impact	Large impact	Do not know
Guam	Nuisance	29 (10.8)	36 (13.4)	79 (29.5)	107 (39.9)	17 (6.3)
Saipan		29 (10.7)	74 (27.4)	68 (25.2)	83 (30.7)	15 (5.6)
Guam	Noise	42 (15.7)	67 (25)	64 (23.9)	90 (33.6)	5 (1.9)
Saipan		36 (13.3)	91 (33.7)	70 (25.9)	68 (25.2)	5 (1.9)
Guam	Negative Tourist Experience	48 (17.9)	43 (16)	44 (16.4)	83 (31)	50 (18.7)
Saipan		37 (13.7)	44 (16.3)	56 (20.7)	92 (34.1)	41 (15.2)
Guam	Positive Tourist Experience	62 (23.1)	61 (22.8)	42 (15.7)	35 (13.1)	67 (25)
Saipan		82 (30.4)	73 (27)	46 (17)	22 (8.1)	47 (17.4)
Guam	Environmental	20 (7.5)	37 (13.8)	73 (27.2)	121 (45.1)	17 (6.3)
Saipan		16 (5.9)	55 (20.4)	75 (27.8)	108 (40)	16 (5.9)
Guam	Public Health	19 (7.1)	35 (13.1)	70 (26.1)	125 (46.6)	19 (7.1)
Saipan		26 (9.6)	53 (19.6)	67 (24.8)	93 (34.4)	31 (11.5)
Guam	Road Accidents	13 (4.9)	32 (11.9)	58 (21.6)	153 (57.1)	11 (4.1)
Saipan		11 (4.1)	30 (11.1)	66 (24.4)	158 (58.5)	5 (1.9)

Note. For these questions $n^{\text{Guam}} = 268$ $n^{\text{Saipan}} = 270$.

Appendix I
Survey performed on Guam and Saipan

Enumerator Name: _____

Time (start): _____

Date: _____

Location: _____

Hafa Adai, my name is _____. I would like to talk dogs with you. I am assisting the Royal School of Veterinary Studies. We are conducting a survey to learn more about Guam/Saipan residents' attitudes towards the dogs of Guam/Saipan. Your participation in this survey is completely anonymous to the researcher; I will not write down your name, contact details, or identifying comments. If at any point you are not comfortable answering any of the questions feel free to skip them. It will take about 10 minutes of your time. Would you be willing to participate?

Is the respondent willing to take the survey?

Yes. Proceed to screening questions

No. Reason for refusal to participate (if given): _____

Screening Questions:

Have you taken this survey before?

_____ Yes (*Stop*)

_____ No

Do you live on Guam/Saipan?

_____ Yes

_____ No (*Stop*)

Are you at least 18 years old?

_____ Yes
_____ No (*Stop*)

Note: *if the participant's response is marked "Stop", DO NOT CONTINUE.*

Do a survey for each dog owned.

Marianas Dog Attitude Survey

1). How many pets do you have? (*if own dogs skip to Question 3, if do not continue*)

_____ Dogs _____ Cats _____ Birds _____ Rabbits _____ Fish _____ Other

2). On a scale of 1 – 5, how important were the following in choosing **NOT** to have a dog? [*1=not at all important, 5= extremely important*] (*skip to Question 26*).

A. Noisy _____ C. Scary/Dangerous _____ E. Cost _____
B. Messy _____ D. Allergic _____ F. Other _____

3). How did you acquire your dog?

A. Purchased C. Gifted E. Other _____
B. Adopted D. Found

4). How old is your dog? (#) _____

5). How old was your dog when you acquired it? (#) _____

6). What kind of dog do you have? [*purebred, boonie, pit, lab, etc.*] _____

7). Using the table provided [*on a separate page*], what condition is your dog in? (*What does it look like? #*) _____

8). What role does your dog play in the household? [*circle all that apply*]

A. Pet C. Guard/Alarm E. Other _____
B. Companion D. Hunter

9). On a scale of 1 – 5, do you consider your dog your property? [*1=strongly disagree, 5= completely*] _____

10). On a scale of 1 – 5, do you consider your dog to be a member of the family? [*1=not at all, 5= completely*] _____

11). Do you take photographs of your dog **Yes** **No**

12). Where does your dog live?

- A. Free to roam C. Within a fenced area E. Other _____
B. Chained D. Inside the house

13). On a scale of 1 – 5, how acceptable is it to allow dogs to roam?
[1=not at all/unacceptable, 5= completely acceptable] ____

14). Is your dog neutered/spayed (sterilized)? **Yes** **No**

If yes, how was it sterilized? (e.g. vet, program) _____

If no, why? (e.g. too costly, bad for dog's health) _____

15). How many litters has your dog had? _____

If yes, were the litters intentional? **Yes** **No** **Sometimes**

16). What happens to the puppies?

- A. Keep C. Abandon E. Euthanize (by vet)
B. Sell D. Kill F. Other _____

17). What do you do with unwanted dogs?

- A. Give away C. Leave in a safe place E. Kill
B. Release D. Give to animal control F. Euthanize (by vet)
G. Other _____

18). On a scale of 1 – 5, how important are the following items in caring for your dog? [1=not at all important, 5= extremely important]

- A. Daily Clean Water D. Vaccines ____ G. Bathing/Grooming

B. Daily Food ____ E. Flea Treatments ____ H. Training ____
C. Shelter ____ F. Sterilization ____ I. Exercise ____
J. Other _____

19). Is your dog trained? **Yes** **No**

20). What type of food do you feed your dog?

- A. Dog food C. Combination E. Other _____
B. Table scraps D. It finds its own food

21). How often do you take your dog to the veterinarian?

- A. Never
- B. Only if sick
- C. Annually
- D. More often than annually (*skip to Question 23*)

22). What hinders you from visiting the vet more often?

- A. Do not need to
- B. Cost
- C. Limited vet options
- D. Other_____

23). Has your dog received any of the following from a veterinarian?
(*circle all that apply*)

- A. Vaccines
- B. Deworming
- C. Heartworm preventative
- D. Flea/tick preventative
- E. Bathing/Grooming
- F. Other_____

24). How do you dispose of a dead dog? (*circle all that apply*)

- A. Bury
- B. Burn
- C. Put in trash
- D. Put in jungle
- E. Other_____

25). Does your dog have a license from animal control? **Yes** **No**

26). Using the table provided, how important are the following factors when acquiring a dog? [*tick only one box per question*]

	Not at all	Somewhat	Preferred/ Moderate	Very	No Opinion
Male					
Female					
Puppy					
Adult Dog					
Sterile					
Color/Markings					
Pure Bred					
Mutt/Boonie					
Cost					

27). On a scale of 1 – 5, do dogs feel pain? [*1=not at all, 5= completely*] ____

28). On a scale of 1 – 5, do dogs feel happiness, sadness, and/or love?
[*1=not at all, 5= completely*] ____

29). Have you ever been bitten by a dog? **Yes** **No**

If yes, what happened to the dog? _____

30). Do you think there are too many stray dogs? **Yes** **No**

31). Using the table provided, how significant are stray dogs in contributing to the following issues? *[tick only one box per question]*

(e.g. Nuisance is ruining the yard/going after other animals; Environmental is defecating/spreading trash; Noise is excessive barking; Public Health is disease spread; Tourism is unsightly/scare tourists; Traffic is cause accidents or road congestion)

	No impact	Small impact	Moderate impact	Large impact	Do not know
Nuisance					
Noise					
A Negative Tourist Experience					
A Positive Tourist Experience					
Environmental					
Public health					
Road Accidents or Congestion					

32). Do you think stray dog numbers should be controlled? **Yes** **No**

If yes, how? _____

33). Do you know of any legislation related to dogs? **Yes** **No**

If yes, what legislation? _____

If no, do you think there should be legislation? **Yes** **No**

34). On a scale of 1 -5, do you think dogs are important to the island?

[1=not at all important, 5= extremely important] ____

(Inform the participant that the last question concerns some questionable practices. Remind them once again that the information is anonymous to the researcher and if they are uncomfortable answering they can skip.)

35). Have you or someone close to you participated in any of the following? *(circle all that apply)*

- A. Consumed dog
- B. Dog fighting
- C. Beaten, harmed, or killed a dog
- D. Not fed or provided water to a dog they own

1. What is your Gender? Male Female (*do not ask*)

2. What is your highest level of education? (*If respondent says 'high school' or 'college', please clarify by asking, "Did you finish high school/college?"*)

- | | | |
|------------------------|-------------------------------|--------------------|
| No formal education | Completed high school | Some graduate work |
| Some grade school | Technical training | An advanced degree |
| Completed grade school | Some college/two-year program | Other |
| Some high school | Completed four-year college | Did not answer |

3. Where do you source your local news? (*circle all that apply*)

- Newspaper Radio Television Internet Social Media Other

Thank you for taking the time to answer our survey. That is all the questions I have. Do you have any questions for me or any other comments you would like me to write down? (*Please write comments below*)