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Community attitudes and perceptions towards free-roaming dogs in Goa, India

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ABSTRACT

Free-roaming dogs (FRD) represent a large proportion of the canine population in India and are often implicated as a source of conflict with humans. However, objective data on the attitudes and perceptions of local communities toward FRD are lacking. This study collected baseline data from 1141 households in Goa, India, on FRD feeding practices and assessed people's attitudes toward FRD in urban and rural communities. Additionally, respondents identified problems caused by FRD and proposed potential solutions.

The study reported that 37% of respondents fed FRD with dog owners and Hindus being the most likely to feed. The majority of respondents agreed FRD were a menace (57%), a nuisance (58%) and scary (60%). Most respondents also agreed FRD were a vulnerable population (59%), that belong in communities (66%) and have a right to live on the streets (53%). Barking was the most commonly reported problem associated with FRD and the preferred solution was to impound FRD in shelters. This study reveals the complex and often misunderstood relationship between local communities and FRD and highlights potential strategies to reduce human-dog conflict.

KEYWORDS

Dog; free-roaming; conflict; animal welfare

Introduction

The total domestic dog (*canis familiaris*) population in India is estimated at 118,902,760 (Wallace, Undurraga, Blanton, & Franka, 2017) and most of the dogs in both urban and rural areas are free-roaming. The World Organization for Animal Health (OIE) (2020) defines a free-roaming dog (FRD) “to be any dog not supervised or confined at a particular time, free-roaming with no owner or feral; a domestic dog that has reverted to a wild state and is no longer directly dependent on humans” (p.7). In India, many FRD are actually owned or semi-owned and fed by the community.

Although dogs have coexisted alongside people in India as working animals for thousands of years and more recently as companion animals (Baskaran, 2017), human-dog conflict is widespread. Irresponsible dog ownership, uncontrolled breeding of unowned dogs and the indiscriminate dumping of food waste has likely contributed to FRD populations in India. FRD welfare is often poor and many FRD do not reach adulthood (Pal, 2001; Paul, Majumder, Sau, Nandi, & Bhadra, 2016). FRD are neglected, abused and are susceptible to injuries from fighting with other dogs, adverse weather, collisions with vehicles, infections, chronic disease and malnutrition (Totton, Wandeler, Ribble, Rosatte, & McEwen, 2011).

Understanding community perceptions and attitudes toward FRD may help in resolving human–dog conflict in India and improving FRD welfare. However, this is an area of extremely limited research and people’s perceptions and attitudes are likely to be strongly influenced by a variety of factors including culture, religion (Doniger, 2014), companion animal ownership (Paul, 2000; Taylor & Signal, 2005), gender (Herzog, 2007) and socio-economic status (Peek, Bell, & Dunham, 1996). There is increasing concern regarding the FRD population in India and the risks FRD pose to public health and safety which subsequently leads to direct conflict and complaints to authorities.

FRD transmit a wide range of viral and bacterial infections to humans (Sharma et al., 2017) and in India, people live with the threat of rabies. It is estimated that 17.4 million people in India are bitten by dogs every year (Gongal & Wright, 2011) with 20,000 people dying from canine-mediated rabies in India annually (Sudarshan et al., 2007). Further risks to public health associated with FRD include environmental contamination from feces (Cinquelpalmi et al., 2013) and road traffic accidents (Slater et al., 2008). Although FRD in India have been found to chase moving vehicles and roam on busy highways, data is limited regarding how many people are injured in dog-related traffic accidents.

In addition to the implications on public health and safety, the natural behavior of dogs including barking, howling and other vocalizations have been deemed a source of noise disturbance in some communities (Flint, Minot, Perry, & Stafford, 2014; Strickland, 2015). In a study undertaken in the Bahamas, Fielding (2008) found that barking was one of the most common nuisances associated with dogs, particularly at night. Barking and howling from dogs, also ranked well above other noises (skill saws and lawn mowers) as sources of disturbance in New Zealand (Flint et al., 2014). Although barking has been suggested as a nuisance behavior, limited studies have been conducted in India investigating people’s attitudes toward FRD and associated noise pollution.

As FRD often live in close proximity to humans, other natural canine behaviors such as chasing and hunting are likely to be viewed negatively when they impact upon other animal populations. A study conducted by Home et al. (2017) in Himachal Pradesh, India, revealed that the number of dog attacks on livestock closely relate to that of leopard attacks resulting in substantial economic losses for farmers. It has also been reported that FRD in India were responsible for attacking 80 species of wildlife, 31 of which were IUCN Red List Threatened Species (Home, Bhatnagar, & Vanak, 2017).

In an attempt to try to resolve problems associated with FRD, a number of methods are utilized for dog population management (DPM) including animal birth control (ABC), culling, relocation and placing dogs in shelters. Although illegal in India, culling and relocation of FRD is still executed in some states as a ‘quick fix’ to reduce the dog population. Culling or mass killing of FRD is now widely considered unethical and ineffective (Hiby & Tasker, 2018) and ABC (surgical sterilization) is implemented as a humane alternative. Following sterilization, FRD are returned to their original locations to help maintain stable and healthy populations (Taylor et al., 2017).

Despite attempts to manage FRD populations, human–dog conflict persists. In Goa, India there are many animal shelters and animal welfare organizations trying to resolve this conflict yet knowledge regarding how the community perceives the FRD population is currently limited. Most of the research conducted in India has assessed attitudes toward FRD in relation to rabies prevention and Tiwari, O’Dea, Robertson, and Vanak (2019) found that perceptions toward FRD in India were influenced by incomplete or incorrect information regarding rabies. Other dog-related problems which can adversely impact society or the welfare of FRD have rarely been investigated. The purpose of our survey was to describe the public perception of FRD across a wide range of communities in Goa, India, in efforts to support the development of initiatives and reduce conflict between human and dog populations.

Methods

Survey location

Goa is a state of India located on the southwest coast of the subcontinent with a human population of roughly 1.458 million people (Government of India, 2011a). Of the total population, 62% live in urban regions vs 38% in rural regions, with an overall gender ratio of 973 females per 1000 males (Government of India, 2011a). Goa state covers an area of 3702 sq. km and is divided into North and South districts. Within each district, areas are classified as municipalities, towns, and villages (Government of India, 2011b).

Survey site

The 412 administrative boundaries of Goa used in the 2011 National Census (Government of India, 2011a) were subdivided into 1,083 working zones as part of the Goa Rabies Control program. Working zones were stratified by district and by municipality, town or village according to designation in the 2011 National Census (Figure 1A). Clustered random sampling by district and land-type strata was performed by assigning a unique consecutive number to all zones. A random number generator in Microsoft Excel version 2016 (Redmond, WA) was then used to randomly select 6 zones from each land type-district cluster, giving a total sample of 36 zones. Selected zones were visually reviewed on Google Satellite imagery and zone selection was repeated for areas consisting entirely of forest or agricultural land due to lack of human habitation.

Survey Methodology

To examine how the public view the FRD population, a community-based cross-sectional survey was conducted in the selected sites (Figure 1B) from April 2019 to June 2019. The number of households surveyed in each area ranged from 30 to 40. In villages a rolling door-to-door (every house) method was followed (Tiwari et al., 2019), whereas in towns and municipalities, systematic sampling (1 in every 4 houses) was used to obtain a representative sample across a larger geographic area with higher housing density. If a household member declined to participate in the survey or if

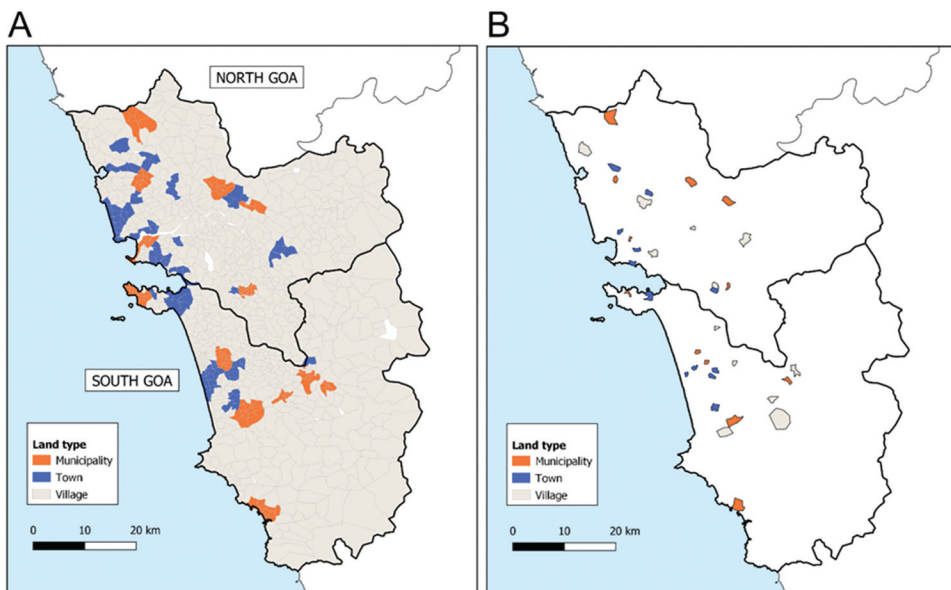


Figure 1. Maps of Goa state showing the designation of land type according to the 2011 National India Census (A) and surveyed regions ($n = 36$) polygons coloured by land type (B).

a household was unoccupied, the adjacent house was selected. In municipalities and towns, the fourth house thereafter, was selected for inclusion in the survey.

To gather qualitative data regarding the perception of FRD in Goa, India one adult from each household was invited to anonymously respond to the questionnaire in their preferred language (Hindi, English, or Konkani). Those who were guests of the selected household, under the age of 18 years, or were unable or unwilling to provide informed consent were not interviewed. Consent was obtained verbally prior to commencing the survey and an information leaflet was given to each respondent. Each leaflet displayed a barcode which was scanned in to the app and contact information of the researcher so that participants could opt out of the survey at a later date if they wished.

A total of twenty eight students fluent in Hindi, English and Konkani were recruited from Vidya Prabodhini College, Damodar College and Margao Government Industrial Training Institute to conduct the door-to-door survey. Training for the survey was carried out over two days which involved practicing interview technique and role play to ensure students were able to ask questions in a standardized manner and record responses accurately. To confirm students had sufficient understanding of the terminology and translations, assessments were conducted prior to commencing the survey.

The questionnaire (in English) was uploaded as a form in the WVS smartphone app (WVS Data Collection App, Worldwide Veterinary Service, Version 5.8.) (Gibson et al., 2018) which was installed on the student's mobile phones. All the respondents' answers were entered into the app during the course of the survey. At the end of each survey session all data was encrypted within the app and securely transferred to a password-restricted cloud-based server. All mobile phones used during the survey were password protected and the app was deleted from the phones upon completion of the survey.

Questionnaire design

The questionnaire was divided in to eight sections commencing with an introduction and statement of consent. Questions focused on dog ownership, attitudes toward FRD, care and feeding of FRD, problems associated with FRD, solutions and management of FRD. The questionnaire concluded with a demographic section which gathered information regarding the respondents age, gender, religion, education level, household size, and income. Respondents were required to complete all sections of the survey although certain questions were only relevant for dog owners and feeders of FRD.

The questionnaire consisted of attitude rating Likert-type scale questions and multiple-answer questions with pre-listed responses which were ticked accordingly and not read aloud by the students. Multiple-answer questions also included an "other" option for free-text. The questionnaire was pre-tested by visiting 62 households outside the selected survey areas and revised as necessary. Ethical approval to conduct the survey was granted by the University of Edinburgh Royal (Dick) School of Veterinary Studies Human Ethical Review Committee in March 2019.

Data analysis and statistics

Data collected through the questionnaire was summarized using Microsoft Excel version 2016 (Redmond, WA) and R statistical software (R Core Team, 2019). Maps were created using QGIS 3.16.9 (QGIS Development Team, Open Source Geospatial Foundation Project). Multivariable logistic regression was used to understand the effect of different respondents' characteristics on their attitudes toward FRD (seven response variables) and on the feeding of FRD (one response variable). Predictor variables considered for inclusion in each of the eight final multivariable models as fixed effects included, respondents age, gender, religion, educational level, household income, number of occupants in the household, dog ownership, FRD feeding and which type of area they lived in.

Using R package MuMIn (Bartori, 2019) models including all explanatory variable combinations were fitted. The final model for each response variable was chosen based on the lowest corrected Akaike Information Criterion (AIC). Variance inflation factor was computed for each final model, in order to ensure there were no issues of collinearity or multicollinearity. All questions describing attitudes toward FRD included in the regression analysis were in the form of Likert-type questions. These were converted into “yes” (strongly agree/agree) and “no” (agree nor disagree/disagree/strongly disagree) responses for ease of interpretation.

Results

To gather data on attitudes and perceptions toward FRD in Goa, India, 1450 households were approached for the survey and 1141 people completed the questionnaire (79% response rate). Of these respondents, 33% (n = 378) lived in municipalities, 34% (n = 393) in towns and 32% (n = 370) in villages. Slightly more females 55% (n = 624), than males 45% (n = 517) were surveyed. The majority of respondents 47% (n = 539) were aged 31–50 years and the predominant religion of respondents was Hinduism 61% (n = 698). Information relating to monthly household income was also obtained although the majority of respondents 46% (N = 526) declined to answer. Full demographic data of the respondents is summarized in supplementary Table 1.

Dog ownership

The majority of respondents did not own a dog (n = 752). Of the 389 dog-owning households, 29% (n = 110) were in municipalities, 40% (n = 158) in towns and 33% (n = 121) in villages. A total of 493 dogs were owned, of which 72% (n = 356) were male and 28% (n = 136) were female (for 1 dog sex was unknown). Entire dogs 53% (n = 263), made up the largest category across all 3 land types. Regarding confinement of owned dogs 20% (n = 101) were always free-roaming, 59% (n = 290) sometimes free-roaming and 20% (n = 101) never free-roaming (for 1 dog confinement was unknown). Of the 290 sometimes free-roaming dogs, 61% (n = 178) were entire (Figure 2).

Respondents that owned dogs (n = 389) were asked to rate their level of agreement with a series of statements. Regarding “my dogs are part of the family”, 57% (n = 223) of respondents strongly agreed, 41% (n = 161) agreed, 1% (n = 2) disagreed and 1% (n = 3) neither agreed nor disagreed. Regarding “I feel affection for my dogs”, 53% (n = 205) of respondents strongly agreed, 44% (n = 172) agreed, 2% (n = 8) disagreed and 1% (n = 4) neither agreed nor disagreed. Regarding “if my dog were to die, it would be easy to replace him/her”, 7% (n = 27) of respondents strongly agreed, 32% (n = 126) agreed, 18% (n = 72) neither agreed nor disagreed, 30% (n = 115) disagreed and 13% (n = 49) strongly disagreed.

FRD feeding

The findings revealed that 37% (n = 424) of respondents feed FRD and this result did not vary significantly across municipalities 37% (n = 141), towns 40% (n = 156) and villages 34% (n = 127). In relation to gender, 39% (n = 242) of female respondents feed FRD and 61% (n = 382) do not feed FRD; whereas 35% (n = 182) of male respondents feed FRD and 65% (n = 335) do not feed FRD. With regards to religion, 41% (n = 284) of Hindus, 32% (n = 122) of Christians and 30% (n = 17) of Muslims feed FRD.

Additionally, 41% (n = 163) of dog owners feed FRD and 58% (n = 226) do not feed FRD; whereas 35% (n = 261) of non-dog owners feed FRD and 65% (n = 491) do not feed FRD. The mean number of dog's respondents reported to feed was 3 and of the 424 feeders, 40% (n = 170) feed every day, 25% (n = 106) every other day, 27% (n = 116) once or twice per week and 8% (n = 32) not every week. The majority 45% (n = 190) of FRD feeders did not know if the dogs they feed were sterilized, 31% (n = 131) feed unsterilized FRD and 24% (n = 103) feed sterilized FRD.

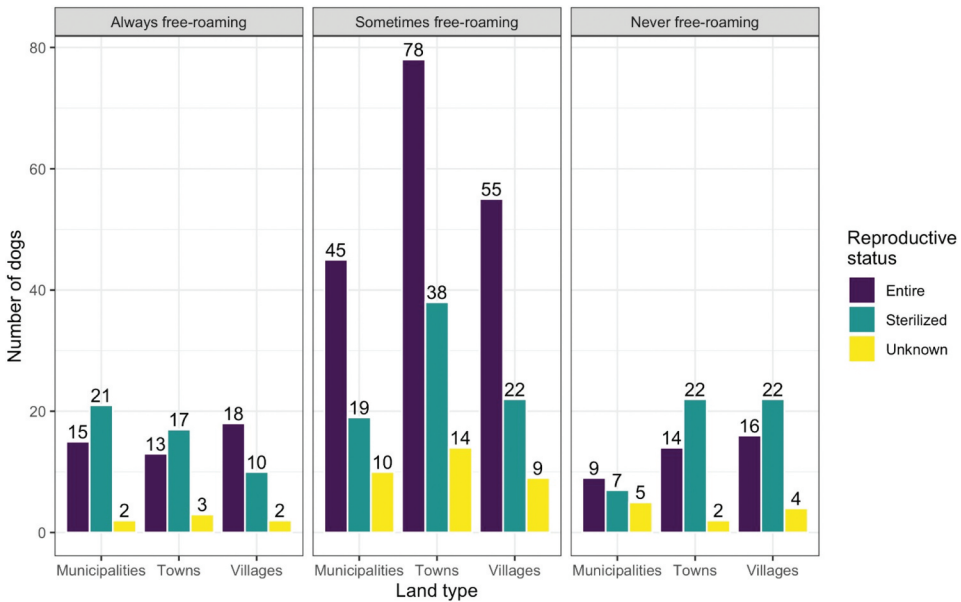


Figure 2. Reproductive and confinement status of owned dogs (n=492) by land type (municipalities, towns and villages) in Goa, India. For this analysis, 1 dog (neutered/town) was removed due to unknown confinement status

Multivariable logistic regression was used to identify factors associated with FRD feeding (Figure 3 and supplementary Table 2). Dog owners were more likely to feed FRD compared to non-dog owners and Hindus were more likely to feed FRD compared to Christians. Lastly, the odds of feeding FRD decreased with age.

Attitudes associated with FRD feeding

Respondents that feed FRD (n = 424) were asked to rate their level of agreement regarding their sentiment toward FRD. Regarding if “FRD need to be cared for as they do not have a home”, 24% (n = 101) strongly agreed, 57% (n = 243) agreed, 12% (n = 49) neither agreed nor disagreed and 7% (n = 31) disagreed. Regarding if respondents “felt affection for FRD”, 18% (n = 77) strongly agreed, 55% (n = 233) agreed, 10% (n = 43) neither agreed nor disagreed, 14% (n = 60) disagreed and 3% (n = 11) strongly disagreed. Regarding if “feeding FRD made respondents feel good”, 28% (n = 120) strongly agreed, 54% (n = 229) agreed, 10% (n = 42) neither agreed nor disagreed, 6% (n = 25) disagreed and 2% (n = 8) strongly disagreed. Regarding if “FRD would starve to death if people did not feed them”, 12% (n = 49) strongly agreed, 39% (n = 165) agreed, 23% (n = 98) neither agreed nor disagreed and 26% (n = 112) disagreed.

Attitudes toward FRD

The five-point scale was also used to assess attitudes toward FRD by asking respondents to rate their level of agreement with seven statements (Figure 4). The majority of respondents 66% (n = 756) agreed FRD belong in their community, 59% (n = 667) agreed they are vulnerable and 53% (n = 599) agreed FRD have a right to live on the streets. The majority of respondents 57% (n = 651) also agreed that FRD were a menace, 58% (n = 658) agreed FRD were a nuisance, 60% (n = 682) agreed FRD were scary and 53% (n = 609) agreed FRD have no place in modern society. These results reflect

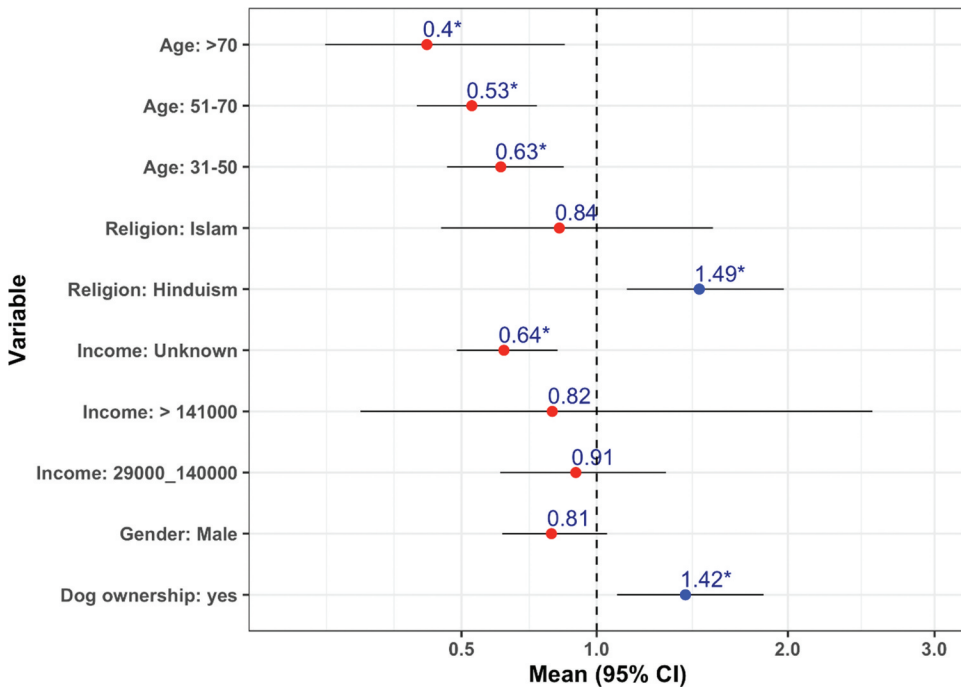


Figure 3. Final logistic regression model: FRD feeding as the outcome variable in Goa, India (n=412). Dots represent odds ratios (red = negative association, blue = positive association) and bars represent 95% confidence interval for each category compared to the baseline. The baseline category for age was 18 – 30 years, religion was Christianity, income was >28,000 INR, gender was female and for dog ownership, no. Respondents with missing information regarding their age (n=5), level of education (n=6) and religion (n=1) were removed from this part of the analysis.

some conflicting responses. To capture these, cross tabulations of each pair of these seven attitude questions are presented in [Figure 1](#) in the supplementary material.

Factors associated with the seven attitude assessment statements were further investigated using multivariable logistic regression models. Three statements reflected positive attitudes toward FRD; “FRD belong in our community” (supplementary [Figure 2](#), Table 3), “FRD have a right to live on the street” (supplementary [Figure 3](#), Table 4) and “FRD are vulnerable” (supplementary [Figure 4](#), Table 5). Dog owners were more likely to agree with all three statements, compared to those who did not own dogs. FRD feeders and Hindus (compared to Christians) were also more likely to agree with the first two statements, but less likely to agree that FRD are vulnerable. Additionally, the odds of respondents agreeing that FRD have a right to live on the streets, decreased with age.

Four statements were used to capture negative attitudes toward FRD; “FRD are a menace” (supplementary [Figure 5](#), Table 6), “FRD are a nuisance” (supplementary [Figure 6](#), Table 7), “FRD are scary” (supplementary [Figure 7](#), Table 8) and “FRD have no place in modern society” (supplementary [Figure 8](#), Table 9). FRD feeders were less likely to agree that FRD are scary and that they are a nuisance or a menace, compared to those who do not feed dogs. Both dog owners and FRD dog feeders were more likely to agree that FRD have no place in modern society compared to those who did not own dogs or feed FRD respectively. Hindus and Muslims were less likely to agree with this statement. Additionally, compared to those who live in municipalities, those who live in towns were more likely to agree FRD are a menace and a nuisance. Lastly, the odds of agreeing that FRD are a menace and scary increased with age, except for the oldest age group (>70 years), where the odds did not differ from the baseline group (18–30 years).

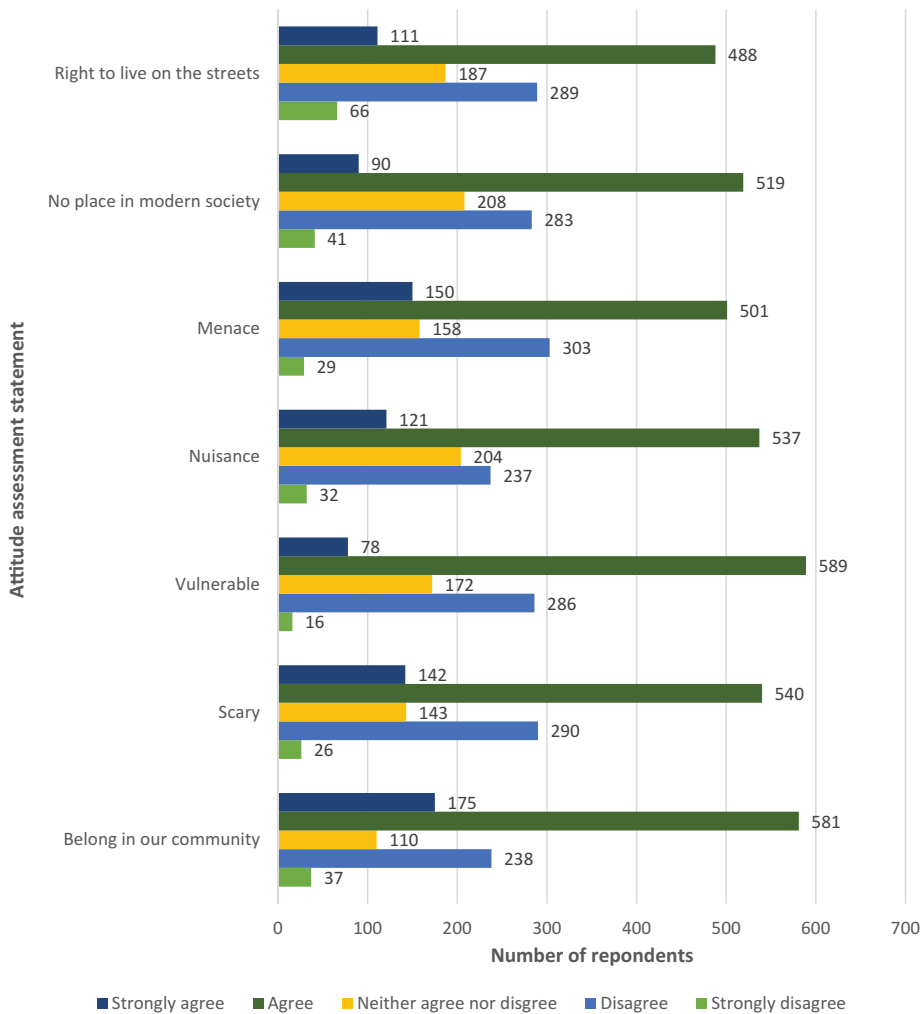


Figure 4. Community members (n=1141) attitudes towards FRD in Goa, India

Problems associated with

Respondents were asked to identify the problems (Figure 5) and benefits (Figure 6) associated with FRD and were able to give multiple answers. Responses from all three land types were combined for this analysis. Of the respondents, 21% (n = 237) stated that there were no problems and 56% (n = 643) stated there were no benefits. Barking was the most common problem reported by 56% (n = 635) of respondents, followed by chasing 37% (n = 425) and dog bites 36% (n = 412). Guarding and security was identified as the main benefit associated with FRD by 42% (n = 484) of respondents.

As some dog-related problems are influenced by human behavior, data was collected on respondents' reactions toward FRD that bark and chase them on the street. If approached by a barking dog respondents would; stand still 43% (n = 486), walk slowly 15% (n = 172), wave a stick 13% (n = 149), run away 13% (n = 146), hit the dog with a stick 11% (n = 129), ignore the dog 8% (n = 89), shout 6% (n = 69), scream 6% (n = 65) and try to make friends 1% (n = 16). Such an incident had not happened to 7% (n = 77) of respondents so they did not know what their reaction would be. If chased by a dog whilst riding a two-wheeler vehicle, respondents would; slow

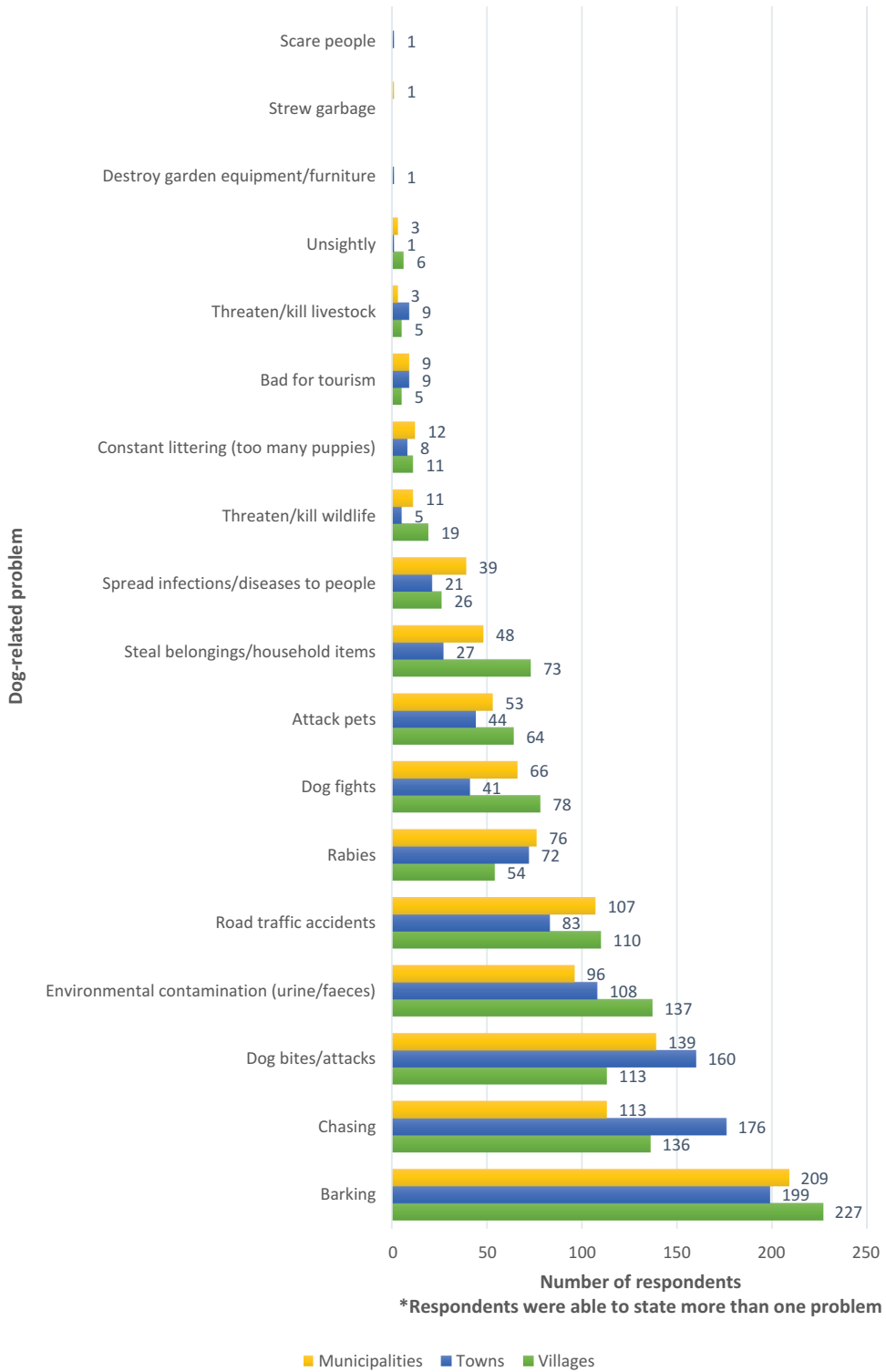


Figure 5. Problems associated with FRD from the community perspective in Goa, India

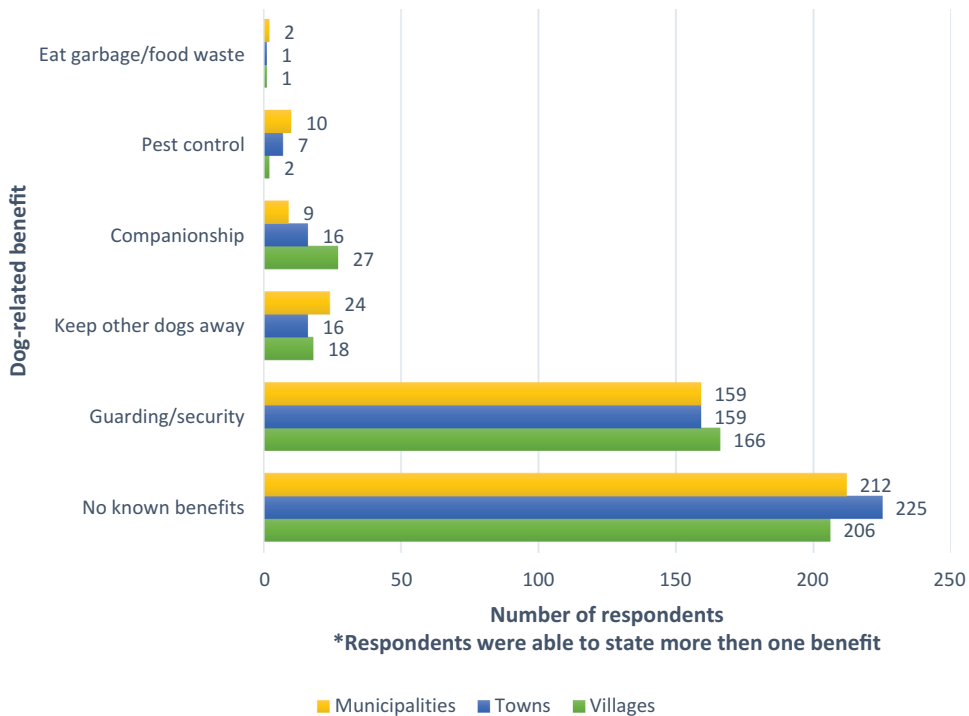


Figure 6. Benefits associated with FRD from the community perspective in Goa, India

down 39% (n = 449), speed up 26% (n = 299), stop 25% (n = 282), ignore the dog 8% (n = 87), throw something 4% (n = 50), scream 2% (n = 25), shout 2% (n = 23), raise legs 2% (n = 21) and kick out at the dog 2% (n = 19). Of the respondents, 12% (n = 138) did not know what their reaction would be.

All respondents were asked if they had ever been bitten by a dog; 74% (n = 839) said no, 25% (n = 283) said yes, 1% (n = 19) could not remember. To determine if there was any correlation between dog bites and gender, further analysis revealed that of the 624 female respondents, 22% (n = 139) had been bitten by a dog and of the 515 male respondents, 28% (n = 144) had been bitten. Furthermore, 22% (n = 82) of respondents in municipalities, 27% (n = 106) of respondents in towns, and 26% (n = 95) of respondents in villages had been victims of dog bites.

FRD solutions

Community members identified potential solutions to manage FRD (Figure 7). Placing FRD in shelters was the most common solution put forward by respondents in municipalities 34% (n = 128) and towns 24% (n = 93). Respondents from villages 41% (n = 151), suggested ABC followed by placing FRD in shelters 34% (n = 127). Although a number of different solutions were proposed, respondents from all three land types agreed that the FRD population in Goa needs to be reduced, 92% (n = 349) in municipalities, 88% (n = 347) in towns and 91% (n = 337) in villages.

Discussion

This survey is the first large-scale study to investigate factors associated with people's attitudes and current practices toward FRD in India. This work reveals the complexity of the relationship between human and FRD populations, defines the problems caused by FRD in urban and rural communities

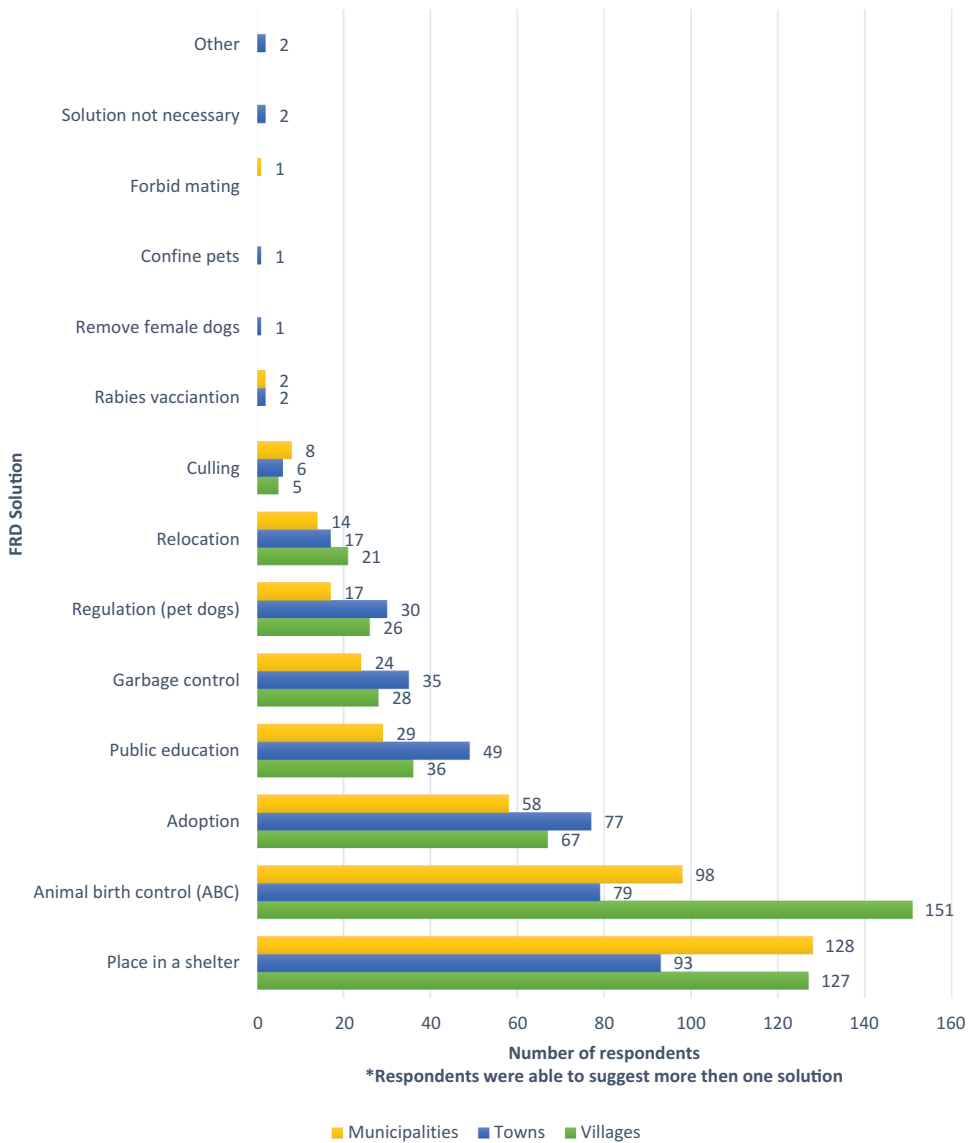


Figure 7. Possible solutions to manage FRD from the community perspective in Goa, India

and identifies potential solutions to manage FRD from the community perspective. Our results provide a crucial evidence base for future initiatives which aim to reduce the human–dog conflict.

Dog ownership and FRD feeding

Of the 493 owned dogs in this survey, male dogs were more popular than females. Biases toward male dogs have been observed in other countries including Taiwan (Hsu, Severinghaus, & Serpell, 2003), Haiti (Fielding, Gall, Green, & Waller, 2012), Samoa (Farnworth, Blaszk, Hiby, & Waran, 2012) and Thailand (Kongkaew, Coleman, Pfeiffer, Antarasena, & Thiptara, 2004). Male dogs are often considered more effective guard dogs and less of a nuisance than females as they do not produce unwanted litters (Massei et al., 2017). The abandonment of entire female dogs and female

puppies are a significant source of FRD therefore understanding why gender biases exist and identifying any misconceptions may be beneficial in communities where there is a need to encourage responsible dog ownership and promote the adoption of female dogs.

Another factor which contributes to FRD populations and dog-related problems is the confinement status of owned dogs. The majority of owned dogs in this survey were free-roaming intermittently and a large percentage of these dogs were entire and thus, highly likely to be contributing to the FRD population in Goa. To engage more dog owners in DPM campaigns, misconceptions and cultural beliefs surrounding sterilization should be identified. It may then be possible to address such beliefs through education and by using examples of sterilized dogs in the community (International Companion Animal Management Coalition, 2007).

The majority of dog owners surveyed, felt affection for their pet dogs, considered them to be part of the family and stated that if their dog was to die it would not be easy to replace him or her due to the bond they had developed with their dog. These results are similar to a study conducted in Haiti, by Fielding et al. (2012) wherein 88% of caregivers considered their dog's members of the family. Although positive attitudes were identified, responsible dog ownership must be promoted in communities across Goa to reduce some of the problems associated with FRD.

FRD feeding

Dog owners and Hindus were identified as the predominant feeders of FRD. Companion animal ownership has been suggested to positively influence people's actions and care toward animals (Paul, 2000) and Hindus religious beliefs center around the concept of karma. Dog owners and Hindus could be key stakeholders in making change and helping to resolve the human-dog conflict in Goa. As religion and culture play an important role in peoples' attitudes and beliefs, religious representatives and community leaders should be engaged in DPM to explore how religious or cultural interpretation could hinder or support potential interventions (ICAM Coalition, 2007).

The majority of feeders, reported to feed FRD on a daily basis which correlates with a study in Israel where feeders of free-roaming cats were extremely dedicated to the cats and invested considerable resources in their care (Finkler & Terkel, 2011). Whilst the majority of feeders in this survey cared for and felt affection for FRD, they were more divided in their opinions on whether or not FRD would starve to death if people did not feed them. Thus, these results suggest that some feeders may feed purely out of affection for FRD rather than due to the belief that dogs depend on humans for food. Furthermore, the act of feeding FRD may function as an emotional or self-rewarding behavior as the majority of feeders reported that feeding FRD made them feel good.

Although the motivations for feeding FRD may differ, changing attitudes and behaviors associated with this activity can be extremely difficult as FRD feeders often form relationships with the animals they feed (Taylor et al., 2017). The human-animal bond could be a major advantage for DPM interventions in Goa, particularly in areas where feeders exist as they can be utilized in handling and catching FRD for sterilization, vaccination and veterinary care. However, the majority of feeders in our survey, did not know if the FRD they feed were sterilized. Fielding et al. (2012) state that "feeding roaming dogs will improve their chances of reproducing" (p.248) therefore, it is important to educate and support feeders across Goa to maintain sterilized populations of FRD.

Community attitudes toward FRD dogs

FRD were perceived as a menace and a nuisance by the majority of respondents which correlates with a study undertaken in Samoa, where 64% of those canvassed agreed that FRD were a nuisance (Farnworth et al., 2012). Despite negative associations with FRD in Goa, attitudes and perceptions are certainly not clear-cut. Whilst the majority of respondents believe FRD have no place in modern society, they also claim that FRD belong and have a right to live in their communities and even though people are scared of FRD they also view them as vulnerable.

Although attitudes and perceptions associated with FRD in Goa are complex, influencing factors were identified; companion animal ownership and religion. Dog owners and Hindus were more likely to feed FRD, so it was expected to find they showed more positive attitudes toward FRD. Paul (2000), revealed that empathy for animals was directly linked to pet ownership and Taylor and Signal (2005), found that those living with a companion animal were more likely to score higher in animal-welfare attitude assessments than those living without. In India, dogs are not associated with any religious ceremony, yet Hindus are taught that the human soul can be reborn into an animal which leads to the belief that all life should be respected (Szucs, Geers, Jezierski, Sossidou, & Broom, 2012).

Additional factors influencing respondent's attitudes and perceptions toward FRD in Goa were identified including, area, household income, and age. In villages, dog-related problems may be reduced due to lower populations of humans and FRD. This may explain why respondents from villages were less likely to view FRD as a menace, than those in towns and municipalities. Compared to respondents in municipalities, those from towns displayed particularly negative attitudes toward FRD which also increased with age.

Respondents in the age group 51–70, were not only more likely to view FRD as a menace, they were more likely to agree that they were scary indicating that their negative views were possibly influenced by fear. Furthermore, respondents with lower household incomes exhibited more negative attitudes toward FRD than those with medium-high household incomes. Respondents from poorer communities may have greater exposure to FRD and associated problems, leading to the perception that FRD are a nuisance.

Although respondents were able to select their preferred language to complete the survey, the survey was not formally translated. Some of the statements used to assess attitudes were also quite similar, for example, FRD are a menace and FRD are a nuisance. However, the differences; menace (threat/danger) and nuisance (inconvenience/annoying) were clearly explained to the surveyors during their training which enabled them to confidently translate to the respondents.

Despite the limitations, our survey has provided an initial insight into community perceptions and attitudes toward FRD in Goa which is essential when considering interventions to reduce human–dog conflict. Although ABC is often recommended as a solution, it may not be enough. The emphasis needs to be on campaigns that drive changes in human behavior and interventions must be tailored to target different communities based on how they view FRD and the dog-related problems that exist.

Problems caused by FRD from the community perspective

The most commonly reported problem caused by FRD across all land types was barking. Barking has also been identified as a social problem in New Zealand (Flint et al., 2014), the Bahamas (Fielding, 2008) and Bhutan (Strickland, 2015). Despite being a major source of noise pollution information is lacking as to why barking is such an annoyance and on the adverse effects. It has, however, been reported that barks connected to negative inner states in dogs are more annoying than others and that men find high-pitched barks more annoying than women (Pongrácz et al., 2016). Furthermore, it has been suggested that “annoying” barks evolved during the process of domestication to evoke the attention of humans (Jégh-Czinege et al., 2019).

Additional information was obtained from the survey relating to people's responses to the barking and chasing behavior of FRD. Although the majority of respondents would stand still when approached by a barking dog, other responses such as wave a stick, throw something at the dog, run away and hit the dog with a stick were reported. This finding highlights the need for public education in behaviors that minimize human–dog conflict. Standing still “like a tree” and remaining calm is recommended to prevent dog bites and people are advised not to run, panic or make loud noises (Centres for Disease Control and Prevention, 2019).

Chasing was the second most common problem of the land types combined and whilst most respondents stated they would slow down, a considerable number reported that they would speed

up. Chasing is normal dog behavior, however, it is also part of the inherited predatory hunting sequence which makes it an extremely complex problem (Ryan, 2009). Although there are no recommendations on what to do if being chased by a dog whilst on a two-wheeler vehicle, the behavior is unlikely to stop if people speed up.

With over 20,000 people receiving treatment for dog bites in Goa every year (Government of Goa, 2019) it was unexpected to find that barking ranked well above dog bites and rabies as a problem associated with FRD. Dog bites/attacks and rabies have been reported as the primary problem associated with FRD from OIE-member countries (Dalla Villa et al., 2010) and there is no doubt that dog bites fuel the human–dog conflict. In this study, 1 in 4 respondents had been bitten by a dog and it was found that more males than females were victims of dog bites. In an extensive review of dog bites by Overall (2001) males were bitten significantly more than females across all age groups and a survey in India revealed that adult males constituted the majority (71%) of human rabies deaths from dog bites (Sudarshan et al., 2007).

Further data was collected on the benefits of FRD. Whilst most respondents stated there were no benefits associated with FRD, 42% recognized their protection role. FRD often alert communities to intruders and future research should perhaps look in to the positive aspects of FRD and how they can be incorporated in to DPM campaigns to benefit more communities.

Solutions for managing FRD from the community perspective

This study has not only highlighted the problems associated with FRD in Goa but has laid the foundation for how to resolve them. The main challenge is to ensure that the solutions implemented to manage FRD are not only practical, achievable and supported by the community but promote animal welfare. Almost all of the respondents in this survey agreed that the FRD population in Goa needs to be reduced. Impounding FRD in shelters was the most popular solution proposed by respondents in municipalities and towns which corresponds to a study in Italy where the majority of participants suggested that new kennels should be built to control FRD (Slater et al., 2008).

Although shelters are utilized as a component of DPM they represent an expense that most countries cannot afford (Dalla Villa et al., 2010). India is a vast country with widespread poverty and an extremely high FRD population. Rounding up all the FRD and placing them in shelters is therefore, unlikely to be a practical or feasible solution even if this is what communities want. Shelters alone, also cannot solve the problem as they do not address the source of FRD. Dogs removed from the streets are likely to be quickly replaced by new puppies if enough breeding female FRD remain and the situation may worsen as shelters provide an easy route for people to dispose of unwanted pets and unplanned litters (Taylor et al., 2017). People may see shelters as a safe-haven for FRD where they will be fed and cared for. In reality, many of the shelters in India and other parts of the world lack resources and are over-crowded due to high intake of sick and injured animals, low adoption rates, and “no-kill” policies.

ABC was the most popular solution suggested by respondents in villages, followed by impounding dogs in shelters. In villages across Goa, ABC is rarely implemented whereas in municipalities and towns there are many animal welfare organizations performing sterilization for FRD. The success of existing ABC programs may influence people’s attitudes and perceptions toward DPM and indeed there are mixed reports on the effectiveness of ABC (Barnard et al., 2015; Belo et al., 2017; Reece, Chawala, & Hiby, 2013; Totton et al., 2010). ABC requires considerable resources and efforts must be sustained if programs are to be successful in substantially reducing FRD populations. In the Indian city of Jodhpur, where intensive ABC has been implemented, it was estimated that it would take between 13 and 18 years to stabilize the dog population (Totton et al., 2010).

It is believed that ABC reduces some forms of aggression in both male and female dogs (Ashton, 2021; Ward, 2021) leading to less disturbance in communities and fewer injuries incurred through dog fights. Although research on the behavioral outcome of sterilization is limited, Garde, Perez,

Vanderstichel, Dalla Villa, and Serpell (2016) reported that no change was observed in the levels of dog–dog aggression following sterilization of male FRD. This highlights that much more research is needed in this area before claims can be made regarding the behavioral benefits of ABC particularly where programs are implemented in a bid to reduce problems associated with male FRD.

Although 10% of respondents felt there was no solution for FRD other solutions put forward were adoption and public education. If adoption programs are to be successful, the status of the Indian dog, particularly females, needs to be raised and associated benefits highlighted through public education. If people's perceptions toward FRD can be improved, it is likely adoptions of FRD will increase. There is a growing trend across India, for obtaining expensive pedigree breeds rather than adopting native Indian dogs yet previous studies have found that FRD are adaptable, trainable and adjustable to domestic environments (Demirbas, Emre, & Kockaya, 2014; Demirbas et al., 2017).

Conclusion

The problems associated with FRD and the somewhat conflicting attitudes identified in this study, not only highlight the complexity of the human–dog relationship but also emphasize the difficulties that are likely to be faced by those attempting to resolve the human–dog conflict. Although it can be concluded from the community perspective, that the FRD population in Goa needs to be reduced; both the preferred solutions of impounding FRD in shelters and ABC have their limitations and implications for animal welfare. Our study highlights the need to further explore the relationship between FRD and humans in all communities where conflict exists. Developing a more comprehensive and detailed understanding of community perceptions and attitudes toward FRD in Goa, India will support the development of more practical and sustainable interventions to minimize human–dog conflict.

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