1 **TITLE:** India's canine conundrum, a case of cognitive dissonance?

2 **RUNNING HEAD:** Perception on dog issues

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14 **ABSTRACT**

15 Free-ranging dogs are among the top global invasive species with major impacts on biodiversity
16 and humans. Academicians in conservation or allied fields are at the forefront of investigating
17 this conflict. But are their opinions impaired by their emotional attachment with dogs? We
18 investigated this question through an online survey that reached 360 academicians across 139
19 institutions in India. We assessed the respondent's affinity towards dogs and their perception on
20 their impacts, causes of this problem, suggestions on its mitigation and success of the mitigation
21 measures. We found that although affinity towards dogs had no effect on respondent's
22 perceptions of their impacts, their perceptions on the causes and suggested mitigation measures
23 differed. Respondents who liked dogs suggested ineffective measures like reproductive control
24 and mass adoption to mitigate their impacts, while also acknowledging that the suggested
25 mitigation measures would never work due to multiple reasons. Through our results we show
26 that academicians who are presumed to provide evidence-driven solutions opted for value-driven
27 suggestions. This could be due to high consideration given to emotions in animal rights policies
28 in the country. We interpret this contradiction using cognitive dissonance theory and suggest a
29 need of encouraging a scientific temper of evidence-based mitigation measures.

30

31 **KEYWORDS:** Free-ranging dogs; Perceptions; India; Public health; wildlife; questionnaire
32 survey

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34 1. INTRODUCTION

35 Dogs (*Canis familiaris*) are among the most widely distributed terrestrial carnivores, with an
36 estimated population close to a billion (Gompper 2013). Their free ranging populations have
37 increased globally and are known to thrive on human subsidies and animals in their range. The
38 consequential impacts of these free-ranging dogs on both humans and wildlife has only recently
39 been explored. Most commonly documented impacts include predation of wild animals,
40 spreading of diseases, hybridisation of wild canids, competition with wildlife etc (Kruuk and
41 Snell 1981, Butler and du Toit 2002, Vanak and Gompper 2009, Prager et al. 2012, Belsare et al.
42 2014). Domestic dogs are established as a risk to 188 threatened species and have contributed to
43 extinction of 11 species globally (Doherty et al. 2017). The situation is particularly serious in a
44 tropical country like India where people, domestic animals and wildlife co-occur at high
45 densities, thereby resulting in frequent interactions between them. A high number of free-ranging
46 dogs is reported in many protected areas (e.g. dogs occurred at relatively higher densities in 40
47 of 50 Tiger Reserves in India (Jhala et al. 2020)) and ecologically fragile landscapes outside
48 legal protection (e.g. High abundance of dogs in trans-Himalaya (Home et al. 2017). Their
49 impacts on public health and safety have also been documented. In the past few years, there have
50 been numerous cases of dogs attacking and killing humans- particularly children- in urban and
51 rural areas. Not surprising, ~20,000 deaths every year were estimated to happen due to rabies in
52 India, with free-ranging dogs accounting for 96% of these deaths in the country (Sudarshan et al.
53 2006).

54 In spite of the growing body of evidence surrounding the impacts of dogs on wildlife and
55 humans, there are limited efforts to control their population through scientifically robust
56 strategies but see (Jhala 1993). This has been largely attributed to the emotional and social

attachment between humans and dogs. Having co-evolved as a faithful companion, dogs are one of the most preferred pets, and have borne a long legacy of relationship with humans (Coppinger and Coppinger 2001). A growing body of literature (Vanak and Home 2018, Young et al. 2018) have earlier emphasized on how emotional attachments come in the way of our perception to dogs' impact on wildlife and people. Such emotional longings, added to the evolutionary and cultural context, can draw support from society and influence policies that makes mitigation measures harder to implement. Not surprisingly, we see free ranging dogs getting constitutional rights in (e.g. Prevention of Cruelty to Animals Act, 1960) in India, with few sections (Section 9) advocating building a public opinion for enhancing similar sentiments. Such emotional overtones can be a hurdle for society's scientific progress, particularly for global conservation scenario. It is hence crucial to understand the psychological underpinning in perceiving/neglecting this 'dogged problem'. Why is information on the impacts of dogs on public health and wildlife neglected in policies pertaining to this problem? Are public opinion as well as policies driven by their opinion effective in mitigating these problems?

It is classically believed that information influences individuals' behaviour by strengthening the internal cost-benefit analyses (Andreoni 1990, Akerlof and Kranton 2000, Dellavigna 2009). However, many case studies question the role of information in changing an individual's behaviour. For example, individuals do not quit smoking in spite of the warning information on the cigarette box (Eriksen et al. 1996). But most of such cases, where information resulted in inactions, were when the resulted benefits were restricted to individuals. When actions are reflected on the external settings like environment or society, individuals often use information to demonstrate altruistic behaviour. Norm-activation theory (Schwartz 1973) and the value-belief-norm theory (Stern et al. 1999) suggests that individuals might change behaviour in light

of information, if their actions result in social welfare. However, when the behavioural changes lead to actions that contradicts an individual's pre-held values or morals, it might result in cognitive dissonance (Festinger 1962). Cognitive dissonance is morally costly and can hence induce inaction, in addition to distress caused by contradictory morals (Konow 2000). The case of feral dogs in developing countries like India, where the information on their impacts is clearly limited in the policies can be a case of cognitive dissonance. However, the evidences for this are absent. To possess this collective tendency, it is important to avail the information to a section of society who can understand the problem.

People involved in academia are known to draw their opinions from facts and rationale of different discourses. Hence, how well and how differently they perceive the subject apart from its emotional overtone reflect the scientific progress and its outreach. Additionally, how much of this perception is shaped by the dissonance caused by emotional attachment warrants investigation. This would provide us their opinion on the effect of free ranging dogs, its management and priority of doing so. Including their opinion in the policies can fill in the knowing-doing gap that is increasingly acknowledged in the subject. This has, to our knowledge, not been studied on the aspect of free ranging dogs so far. In the current study we looked into how academicians in the wildlife sciences, conservation and allied disciplines perceive free-ranging dogs and their impact on wildlife. The study was aimed to understand perceptions on mitigation measures as well as highlight knowledge gaps that may arise due to emotional attachment to dogs. Through our results we provide a critique on these opinions in the lights of psychology, as well as provide a way forward on how best this information can be used.

104 2. METHODS

105 To study perceptions and opinions of academicians, we conducted an online questionnaire
106 survey. Our target list for academicians consisted of undergraduate students, graduation students,
107 researchers, scientists, professionals from government institutions, professionals from civil
108 bodies and wildlife managers. We targeted academicians from the subject of ecology, wildlife
109 sciences and conservation, public health, humanities and allied subjects. The online survey was
110 conducted from 20th October 2017 to 10th November 2017. We distributed the questionnaire
111 through email and social media sites among academicians from various Indian institutions and
112 we encouraged add-on responses through a snowball sampling approach. We followed up with
113 known respondents through personal requests to increase the response rate so as to increase the
114 survey adequacy (Nulty 2008).

115 The questionnaire consisted of 31 questions divided into four sections. The first section consisted
116 of questions about the respondent's background and knowledge on the subject. The respondents
117 were asked their age (grouped into categories), occupation, institution, educational qualification,
118 proportion of life sciences, humanities, environmental sciences and conservation in their
119 education, experience in the subject, etc. The second section had questions on their perception
120 about dogs. Based on whether the respondent felt that dogs have an impact on wildlife or not,
121 they were redirected to the next two specific sections of the questionnaire that dealt with the
122 impact of dogs and mitigation measures. For assessing their emotional attachment with dogs,
123 they were asked if they liked "stray dogs". Respondents could also suggest multiple choices for a
124 subset of the questions.

125 The responses were imported into Microsoft excel. For the question on whether dogs have an
126 impact on wildlife, we clubbed "yes" with "Have heard of it, but can't be certain" and "no" with

“I don’t know” and “theory is being propagated to remove dogs from society”. For comparing the difference in total responses with respect to different categories, we used Fisher’s exact test. This was used for assessing 1) the influence of education, demographic region, etc. on liking dogs, 2) influences of liking/not liking dogs on the perception of their impacts, and 3) influences of liking/not liking dogs on the suggested mitigation measures. In case of the perceived impacts of dogs on wildlife, we scaled the responses to index the perceived severity of impact. The most severe impact would be when wildlife is lost singly due to dogs, while the least severe impact would be no loss to life, health, or food resources. For this, the least severe impact ‘aggression and fending off wildlife’ was scored as 1 (life, health or resources are not lost), ‘spreading diseases’ scored 2 (diseases might spread without dog-wildlife physical contact, but can have health consequences), ‘competing with natural predators for food and other resources’ scored 3 (here a direct contact is essentially perceived), selecting all above options was scored 4, and ‘Hunting wildlife’ and ‘Injure and kill wildlife for the heck of it’ was scored 5. To compare the severity of perceived impacts with affinity towards dogs, we plotted the percent responses of these two groups with the scored severity and fitted a trend line.

3. Results

3.1 Details of respondents

A total of 360 people from 139 institutions/organizations responded to the online survey. Of the total, 71% respondents are either pursuing or have completed their post-graduation, while 19% and 10% fall under undergraduate and Ph.D. levels, respectively. A majority of respondents (50.2%) belonged to the age category of 15 to 25, while ~43% belonged to the age group of 25-35. Our study was able to significantly capture the perceptions of the age group of 15-35. A significant proportion of the respondents said they got the information on free-ranging dogs and

their impacts from gray literature (newspapers and magazine articles), followed by social media and scientific journals. Being a multiple-choice question, respondents were free to select more than one response. A comprehensive detail of respondents is given in table 1.

Table 1: Characteristics of survey respondents and their information base about free-ranging dogs.

Characteristics of respondents	Statistics
Age class	
15-25	50%
25-35	43%
35-45	5%
45 and above	2%
Demographic representation	
Urban	69%
Semi-urban	23%
Rural	8%
Educational Qualification	
Undergraduate Complete/Pursuing	19%
Post-graduate Complete/Pursuing	71%
Ph.D Complete/Pursuing	10%
Subjects	
Life sciences	19%
Conservation	3%
Humanities	5%
Life sciences + Conservation	38%
Life sciences + Humanities	5%
Conservation + Humanities	5.5%
Life sciences + Conservation + Humanities	12.5%
Others	12%
Awareness about dogs	
How many respondents knew the difference in stray and feral dogs?	87%

How many respondents knew the category of free-ranging dogs?	67%
How many respondents knew that India had the highest number of free-ranging dogs?	56%
Source of information on dogs (multiple choice)	
Newspaper and Gray Literature	54%
Social Media	49%
Scientific Journals	41%
Word of Mouth	39%
Public Awareness Drives and Popular Talks	24%
Television	15%

155

156 3.2 Emotional association with free-ranging dogs

157 Out of the 360 responses, 69% of the respondents said they like stray dogs, while 31% responded
158 saying they do not. There was no association between liking a dog and age-class ($P = 0.41$),
159 educational qualification ($P = 0.24$), demographic region ($P=0.28$). However, respondents who
160 had no direct negative experiences (been bitten or chased) significantly liked them as opposed to
161 the respondents who have had negative experiences (Fisher's exact test, $P = 0.02$). In turn, the
162 respondents who liked stray dogs significantly opted to adopt free-ranging dogs than the
163 respondents who didn't like stray dogs (Fisher's exact test, $P < 0.01$).

Figure 1: The number of respondents who like dogs vs who do not like dogs (Gray indicates number of people who think dogs impact wildlife, while black indicates people who think dogs do not impact wildlife)

3.3 Perceived dog-wildlife relations

A majority (51%) of respondents perceived that free-ranging dogs procure their food from either scavenging, or hunting, or are fed by humans. However, 29% respondents perceived that it was only through scavenging or fed by humans. Less than 2% respondents perceived it to be only through hunting or only fed by humans. Scavenging was the highest perceived mode of food procurement by dogs (98%). When asked whether respondents feel dogs are a threat to wildlife, 205 out of 250 (82%) respondents who liked dogs said they feel dogs have an impact. Similarly, 95 of the 110 (86%) people who said they do not like dogs said they think dogs have an impact on wildlife. There was no relation in liking a dog and the perception of it impacting wildlife (Fisher's exact test, $P = 0.99$). Nearly 79% of the respondents were also aware that dogs impact livestock, while the remaining either were not aware (19%) or felt that dogs do not impact livestock (2%). On being asked how dogs impact wildlife, a majority of the respondents (79%)

perceived them to compete with natural predators, followed by spreading of diseases (69% and hunting of wildlife (66%). The total responses per impact are shown in figure 2. Being multiple choice options, the individual categories do not add up to 100. On comparing the trend in perceiving severity of impacts between respondents who liked dogs with those who did not liked, the response increased exponentially with severity for both categories (Like dogs: $R^2 = 0.98$, Do not like dogs: $R^2 = 0.95$) (figure 3). However, the increase in severity of response was significantly higher ($P < 0.01$) for respondents who did not like dogs.

Figure 2: (Left) Total number of responses for perceived impacts of dogs on wildlife. As the respondents could choose more than one impact, the total numbers are summation of these choices. (Right) Comparison between the severity of impacts of dogs on wildlife (X axis) perceived by respondents who liked dogs (black) with those who did not like dogs (gray). The exponential increase in percent responses (Y axis) by respondents who did not like dogs was significantly higher ($P < 0.01$) than the increase in percent response by respondents who liked dogs.

196 3.4 Suggested mitigation measures

197 When asked about how the problem of free-ranging dogs can be mitigated, most respondents
 198 (71%) felt contraceptive methods were useful, followed by mass adoption (44%) and enhanced
 199 vigilance of protected areas (40%). Very few (15%) felt that culling was the most effective
 200 mitigation measure. The respondents who liked a dog significantly opted for mass adoption
 201 (Fisher's exact test, $P < 0.01$) or contraception (Fisher's exact test, $P < 0.05$) as compared to
 202 culling. There was no significant relation in respondent liking a dog and opting for control
 203 measures like guarding wildlife areas ($p=0.33$), capture – relocate ($p=0.61$) and neutering
 204 ($p=0.86$). On asking about the reasons for the origin of the dog problem in India, 50%
 205 respondents perceived that it was either due to their predatory instincts, high growth rate,
 206 available habitat or scarcity of food, while 48% perceived it to be due to irresponsible ownership.
 207 Amongst those who opted for a reason of food scarcity ($n = 55$), a significantly higher number
 208 (80%) was of respondents who liked dogs (Fisher's exact test, $P < 0.05$). Of total, 72% of the
 209 respondents felt that effective garbage management can help mitigate the number of free-ranging
 210 dogs in the surroundings, while 9% of the respondents did not feel so.

211 3.5 Perception on success of mitigation measures

212 Of total 340 respondents who perceived that free-ranging dogs pose threats to the wildlife, only
 213 5% respondents perceived that India had all facilities for implementing the desired mitigation
 214 measures, while 35% believed that despite the facilities, the mitigation measures would not get
 215 implemented. When asked for the reasons of implementation failure, a majority (42%) of
 216 respondents felt that it was due to inadequate research, 28% respondent felt it was due to lack of
 217 skills, 21% respondents felt it was due to lack of money as well as skills, while 7% respondent
 218 felt it was due only to inadequate funds. On asking if biological control of the dog population

was ethical, though a majority of respondents (62%) opted for ‘despite feeling bad about it, I feel it is practical for the greater good’, 23% respondents felt that it was very cruel to do so. Interestingly, 18% of the respondents also felt that the country can never achieve the goal of an effective garbage management, which is an important source of food for the free-ranging dogs.

Figure 3: Perception on the different mitigation strategies to control free-ranging dogs and their impact on wildlife and people

4. DISCUSSION

Our study elucidated two important findings: 1) the academicians were well aware about free-ranging dogs, their impacts on wildlife, the necessity of mitigating these impacts and the chances of such mitigations succeeding at national scale; and 2) though affinity towards dogs did not relate with the perception of their impacts, it determined respondent’s choice on mitigation measures and understanding the role of human ownership. Value-judgments play a pivotal role in many conservation scenarios by strengthening the associated policies, but can also conversely weaken them (Perry and Perry 2008). Academicians understanding the totality of this ecological

problem and yet confused to acknowledge the reasons and solution for it, due to value-driven ideas, is a critical paradox that directly influences conservation policies. We interpret our study results in light of the established facts on free-ranging dogs in India, the role of science in addressing the issues brought by them, and the potential cognitive dissonance within academicians involved in the allied research and policies.

The respondents were well-informed about the impact of free ranging dogs on wildlife and livestock. In fact, even with an emotional attachment to dogs, respondents still acknowledged their role in causing negative impacts. This could be a result of increasing studies and reports published on the impact of dogs on wildlife and humans. Indeed, our study shows that many academicians were informed about the impacts of dogs through popular media, social media and scientific journals. Twitter has been, in particular, adjudged as an effective tool for communicating scientific information related to conservation (Bombaci et al. 2016). These forums could thus be used to further disseminate regular information on the evidence of free-ranging dogs in the natural world.

Although the emotional attachment did not change one's perception on the impact of dogs, respondents who liked dogs perceived them to have less severe impacts like aggression to wildlife, spreading diseases and competing for food; as opposed to impacts like injuring or hunting wildlife that requires dogs to be in direct contact with wildlife. As evident from the response, when asked about the source of food for these dogs, 98% respondents perceived scavenging, while less than 2% thought it was by hunting other animals. These perceptions are opposed to the evidence that suggests that dogs attack wildlife, irrespective of their appetite. Though the respondents were aware of the facts that free-ranging dogs impact wildlife, their perceived severity of impacts was less than as shown through multiple evidence. As a result, dog problems were perceived to be a natural product of their hunger due to which they have to

259 compete with wildlife for resources or eat wildlife. Feeding dogs is often considered a noble
260 cause in many societies, including India, where it is culturally practised and promoted socially,
261 politically and legally. These subsidies not only sustain a healthy population of dogs (Jagriti
262 Bhalla et al. 2020) but also help them grow in numbers (Vanak and Gompper 2009). This
263 increased population is not always taken care of by the owners and are strayed. Hence, the dog
264 problem in India could singly be attributed to lacklustre rules on irresponsible ownership, unlike
265 the developed countries (Home et al. 2017). But contrary to these facts, respondents emotionally
266 attached to dogs thought that food scarcity was causing these problems.

267 Similar conflicting ideas were found when academicians were asked for their opinions on
268 mitigating the impacts of free ranging dogs. The overall voting for reproductive control of dogs
269 was higher, which imply techniques of oral contraception and Trap-Neuter-Release (TNR).
270 Reproductive control technique has been recently advocated in many parts, most likely because
271 it is perceived to be a more humane way to mitigate the dog population. Oral contraceptive,
272 because of being non-invasive and more humane- unlike neutering- garnered more response than
273 the latter. As evidently, 62% of our survey respondents felt it was ethical enough for the 'greater
274 good' to control dog population through human interventions. It is likely that many academicians
275 see reproductive control as redemption to control the impacts on wildlife, without opting for
276 methods like culling. The success of such control measures has not been well documented but
277 see (Barnett 1986). On the contrary, it has been challenged to succeed in practice (Loyd and
278 DeVore 2010, Totton et al. 2010, Belo et al. 2017). In India, using TNR on one dog costs 10-15
279 USD. With the current population of free-ranging dogs in India, the investment and resources for
280 mass scale implementation of TNR is huge and time consuming. Even if achieved, it would not
281 stop the present dog population from impacting the wildlife (Vanak and Gompper 2009). These
282 hurdles are also likely acknowledged by the survey respondents, as 95% of them agreed that the

283 country has either no formal facilities and/or funds for using these mitigation measures at large-
284 scale. Moreover, it is known that developing, testing and implementing oral contraceptives is
285 still not well researched. This too is reflected in the respondents opinion, where a majority of
286 respondents who thought that mitigation measures would not work in India, also thought that it
287 was because of the inadequate research on mitigation measures.

288 We examine the survey responses through social psychology that highlight how individuals hold
289 mutually opposing facts and values to achieve a socially moral stance. The present case well
290 suits a case of cognitive dissonance. Like in many case studies (Home et al. 2018), our own
291 study demonstrates how majority of respondents liked free-ranging dogs, perceived their impact
292 on wildlife to be the result of their hunger, and suggested humane-yet ineffective- ways of
293 mitigating their measures. Compassion is central to these ideas. This demonstrates that
294 respondents selected these options only because they were consistent with their original ideas of
295 compassion and morality, and not in lieu of the known facts. Dealing with such cognitive
296 dissonance necessitates that the individuals are rewarded for changing their behaviour. As the
297 reward was a social recognition of performing a noble cause of feeding animals and displaying
298 compassion, the new reward should more strongly enforce the same or better feeling. Studies
299 from social sciences suggest these rewards to be successful in altering the dissonance behaviour
300 and strengthening evidence-based action (Dickerson et al. 1992, Mullainathan and Washington
301 2009, Rennekamp et al. 2015). Thus, Just like how compassion is perceived as a “fatal flaw” in
302 wildlife conservation (Anna Oommen et al. 2019), it can similarly be flawed for addressing the
303 impact of dogs on natural systems. These mutually conflicting ideas shown by academicians for
304 the problems of free-ranging dogs is important to elucidate as it determines the future policies
305 pertaining to the subject.

Opinions of academicians have been known to form direction for legal policies on biodiversity conservation and sustainable development worldwide (e.g. IPCC, IPBES). However, through our results we show that even academicians tend to deflect from scientific rationale on emotional issues pertaining to conservation. Hence, the first step to resolve this cognitive dissonance, is to establish a legal premise for rationally dealing with issues like the free-ranging dog problem. Declaring dogs as invasive in wildlife areas can be the first step to scientifically approach this problem. It will highlight the necessity of removing these species from the natural areas. Thereafter, as indicated by few respondents, steps to eradicate dogs by culling from these areas should be a priority (Home et al. 2018). This has been advocated to be the most practical mitigation strategy in the both short and long run, especially in and around protected areas. Particularly in India, where many protected areas prohibit the use of domestic animals (e.g. cattle, buffalo, etc.) or any kind of human interference (e.g. habitat modification, livestock grazing, etc.), free-ranging dogs should be prohibited as they pose comparatively direct impacts on the occurrence and health of the native wildlife. Secondly, it is important to showcase how native wildlife responds after removing dogs from the system- through experimental setups- so as to encourage the importance of evidence-informed policies. Facilitating such research should be a priority. While this was the first known dedicated survey to account for academicians's perception on free-ranging dogs and interpret it through cognitive dissonance, we missed to incorporate the perception of grassroots-level stakeholders, including forest officials, livestock owners and farmers. They have the first hand information on the impact of free-ranging dogs and effective methods to deter it. We encourage future studies to conduct in-person interviews to account for their knowledge.

330 5. CONCLUSION

331 In conclusion, we find evidence that academicians and conservation practitioners acknowledge
332 that dogs have an impact on wildlife and people in spite of having an emotional attachment to
333 them. However, we also find that this emotional attachment comes in the way of how they
334 perceive mitigation measures and the severity of dogs impact, with respondents who love dogs
335 perceiving ineffective mitigation measures like neutering or adoption. This is consistent with
336 cognitive dissonance, and we suggest that evidence-driven scientific policies be taken up to
337 mitigate the problems of free-ranging dogs. The topmost priority should be to declare dogs as
338 invasive species in areas of high biodiversity, especially in protected areas. We also suggest
339 more dissemination of information about the impact of dogs through newspapers, social media
340 and scientific journals.

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347

348 **References:**

- 349 Akerlof, G. A., and R. E. Kranton. 2000. Economics and identity. *Quarterly Journal of*
350 *Economics* 115(3): 715–753.
- 351 Andreoni, J. 1990. Impure Altruism and Donations to Public Goods: A Theory of Warm-Glow
352 Giving. *The Economic Journal* 100(401): 464.
- 353 Anna Oommen, M., R. Cooney, M. Ramesh, M. Archer, D. Brockington, B. Buscher, R.
354 Fletcher, D. J. Natusch, A. T. Vanak, G. Webb, and K. Shanker. 2019. The fatal flaws of
355 compassionate conservation. *Conservation Biology* 33(4): 784–787.
- 356 Barnett, B. D. 1986. Eradication and control of feral and free-ranging dogs in the Galapagos
357 Islands. *Proceedings of the Twelfth Vertebrate Pest Conference* 358–368.
- 358 Belo, V. S., C. J. Struchiner, G. L. Werneck, R. G. Teixeira Neto, G. B. Tonelli, C. G. De
359 Carvalho, R. A. N. Ribeiro, and E. S. Da Silva. 2017. Abundance, survival, recruitment and
360 effectiveness of sterilization of free-roaming dogs: A capture and recapture study in Brazil.
361 *PLoS ONE* 12(11).
- 362 Belsare, A. V., A. T. Vanak, and M. E. Gompper. 2014. Epidemiology of Viral Pathogens of
363 Free-Ranging Dogs and Indian Foxes in a Human-Dominated Landscape in Central India.
364 *Transboundary and Emerging Diseases* 61: 78–86.
- 365 Bombaci, S. P., C. M. Farr, H. T. Gallo, A. M. Mangan, L. T. Stinson, M. Kaushik, and L.
366 Pejchar. 2016. Using Twitter to communicate conservation science from a professional
367 conference. *Conservation Biology* 30(1): 216–225.
- 368 Butler, J. R. A., and J. T. du Toit. 2002. Diet of free-ranging domestic dogs (*Canis familiaris*) in
369 rural Zimbabwe: Implications for wild scavengers on the periphery of wildlife reserves.
370 *Animal Conservation* 5(1): 29–37.
- 371 Coppinger, R., and L. Coppinger. 2001. *Dogs : a startling new understanding of canine origin,*
372 *behavior, and evolution.* Scribner.
- 373 Dellavigna, S. 2009. Psychology and economics: Evidence from the field. *Journal of Economic*
374 *Literature* 47(2): 315–372.
- 375 Dickerson, C. A., R. Thibodeau, E. Aronson, and D. Miller. 1992. Using Cognitive Dissonance
376 to Encourage Water Conservation. *Journal of Applied Social Psychology* 22(11): 841–854.
- 377 Doherty, T. S., C. R. Dickman, A. S. Glen, T. M. Newsome, D. G. Nimmo, E. G. Ritchie, A. T.
378 Vanak, and A. J. Wirsing. 2017. The global impacts of domestic dogs on threatened
379 vertebrates. *Biological Conservation* 210: 56–59.
- 380 Eriksen, W., K. Serrum, and D. Bruusgaard. 1996. Effects of information on smoking behaviour
381 in families with preschool children. *Acta Paediatrica* 85(2): 209–212.

- 382 Festinger, L. 1962. Cognitive Dissonance. 207(4): 93–106.
- 383 Gompfer, M. 2013. *Free-ranging dogs and wildlife conservation*.
- 384 Home, C., Y. V. Bhatnagar, and A. T. Vanak. 2018. Canine Conundrum: domestic dogs as an
385 invasive species and their impacts on wildlife in India. *Animal Conservation* 21(4): 275–
386 282.
- 387 Home, C., R. Pal, R. K. Sharma, K. R. Suryawanshi, Y. V. Bhatnagar, and A. T. Vanak. 2017.
388 Commensal in conflict: Livestock depredation patterns by free-ranging domestic dogs in the
389 Upper Spiti Landscape, Himachal Pradesh, India. *Ambio* 46(6): 655–666.
- 390 Bhalla, J., R. Kemmers, A. Vasques, A. Tamim Vanak, and S. Bhalla. 2020. “Stray Appetites”:
391 A Socio-Ecological Analysis of Free-Ranging Dogs Living Alongside Human Communities
392 in Bangalore, India. *bioRxiv* 2020.07.19.210617.
- 393 Jhala, Y.V., Q. Qureshi, A. Nayak. 2020. Status of the Tigers, Co-predators and Prey in India.
394 National Tiger Conservation Authority, Government of India and Wildlife Institute of India,
395 New Delhi and Dehradun.
- 396 Jhala, Y. V. 1993. Predation on Blackbuck by Wolves in Velavadar National Park, Gujarat,
397 India. *Conservation Biology*. 7(4): 874-881.
- 398 Konow, J. 2000. Fair shares: Accountability and cognitive dissonance in allocation decisions.
399 *American Economic Review* 90(4): 1072–1091.
- 400 Kruuk, H., and H. Snell. 1981. Prey Selection by Feral Dogs from a Population of Marine
401 Iguanas (*Amblyrhynchus Cristatus*). *The Journal of Applied Ecology* 18(1): 197.
- 402 Loyd, K. A. T., and J. L. DeVore. 2010. An evaluation of feral cat management options using a
403 decision analysis network. *Ecology and Society* 15(4).
- 404 Mullainathan, S., and E. Washington. 2009. Sticking with Your Vote: Cognitive Dissonance and
405 Political Attitudes. *American Economic Journal: Applied Economics* 1(1): 86–111.
- 406 Nulty, D. D. 2008. The adequacy of response rates to online and paper surveys: What can be
407 done? *Assessment and Evaluation in Higher Education* 33(3): 301–314.
- 408 Perry, D., and G. Perry. 2008. Improving interactions between animal rights groups and
409 conservation biologists. *Conservation Biology* 22(1): 27–35.
- 410 Prager, K. C., J. A. K. Mazet, E. J. Dubovi, L. G. Frank, L. Munson, A. P. Wagner, and R.
411 Woodroffe. 2012. Rabies virus and canine distemper virus in wild and domestic carnivores
412 in Northern Kenya: Are domestic dogs the reservoir? *EcoHealth* 9(4): 483–498.
- 413 Rennekamp, K., K. K. Rupa, and N. Seybert. 2015. Impaired judgment: The effects of asset
414 impairment reversibility and cognitive dissonance on future investment. *Accounting Review*
415 90(2): 739–759.

- 416 Schwartz, S. H. 1973. Normative explanations of helping behavior: A critique, proposal, and
417 empirical test. *Journal of Experimental Social Psychology* 9(4): 349–364.
- 418 Stern, P. C., T. Dietz, T. Abel, G. A. Guagnano, and L. Kalof. 1999. A value-belief-norm theory
419 of support for social movements: The case of environmentalism. *Human Ecology Review*
420 6(2): 81–97.
- 421 Sudarshan, M. K., B. J. Mahendra, S. N. Madhusudana, D. H. Ashwath Narayana, A. Rahman,
422 N. S. N. Rao, F. X. Meslin, D. Lobo, K. Ravikumar, and Gangaboraiah. 2006. *An*
423 *epidemiological study of animal bites in India: Results of a who sponsored national multi-*
424 *centric rabies survey.*
- 425 Totton, S. C., A. I. Wandeler, J. Zinsstag, C. T. Bauch, C. S. Ribble, R. C. Rosatte, and S. A.
426 McEwen. 2010. Stray dog population demographics in Jodhpur, India following a
427 population control/rabies vaccination program. *Preventive Veterinary Medicine* 97(1): 51–
428 57.
- 429 Vanak, A. T., and M. E. Gompper. 2009. Dietary Niche Separation between Sympatric Free-
430 Ranging Domestic Dogs and Indian Foxes in Central India: Table 1. *Journal of*
431 *Mammalogy* 90(5): 1058–1065.
- 432 Vanak, A. T., and C. Home. 2018. Unpacking the ‘canine conundrum.’ *Animal Conservation*
433 21(4): 289–290.
- 434 Young, J. K., D. L. Bergman, and M. Ono. 2018. Bad dog: feral and free-roaming dogs as agents
435 of conflict. *Animal Conservation* 21(4): 285–286.

436 LIST OF FIGURES AND TABLES.

437 **Figure 1:** The number of respondents who like dogs vs who do not like dogs (Gray indicates
438 number of people who think dogs impact wildlife, while black indicates people who think dogs
439 do not impact wildlife)

440 **Figure 2:** (Left) Total number of responses for perceived impacts of dogs on wildlife. As the
441 respondents could choose more than one impact, the total numbers are summation of these
442 choices. (Right) Comparison between the severity of impacts of dogs on wildlife (X axis)
443 perceived by respondents who liked dogs (black) with those who did not like dogs (gray). The
444 exponential increase in percent responses (Y axis) by respondents who did not like dogs was
445 significantly higher ($P < 0.01$) than the increase in percent response by respondents who liked
446 dogs.

447 **Figure 3:** Perception on the different mitigation strategies to control free-ranging dogs and their
448 impact on wildlife and people

449 **Table 1:** Characteristics of survey respondents and their information base about free-ranging
450 dogs.