

A village dog is not a stray
Human-dog interactions in coastal Mexico

Eliza Ruiz Izaguirre

Thesis committee

Promotor

Prof. Dr I.J.M. de Boer

Professor of Animal Production Systems

Wageningen University

Co-promotor

Dr C.H.A.M. Eilers

Former Assistant professor, Animal Production Systems

Wageningen University

Other members

Prof. Dr H.G.J. Gremmen, Wageningen University

Dr B. Beerda, Wageningen University

Dr A. Ortolani, Utrecht University

Dr A. Ortega Pacheco, Autonomous University of Yucatán, Mexico

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Caminante no hay camino, se hace camino al andar,
al andar se hace camino y al volver la vista atrás
se ve la senda que nunca se ha de volver a pisar.
Caminante no hay camino, sino estelas en la mar...

- Antonio Machado -

Abstract

Dogs (*Canis familiaris*) are considered one of the most numerous carnivores worldwide. Although in the Global North dogs are popular companions, that live inside homes, about 80% of the dogs in the world are village dogs. Village dogs are typically free-roaming, scavenge refuse around human dwellings and are associated with one or various households. At present, village dogs in the Global South are a concern for (inter)national organizations and individuals, such as tourists. Concerns arise about: overpopulation, transmission of zoonoses, welfare of village dogs, and issues relating to dog-wildlife interactions, such as predation on wildlife. Dog culling has proved ineffective in managing dog populations, in controlling zoonoses, and preventing wildlife predation, but remains the dominant strategy to manage village dogs in Mexico. The objective of this thesis was to improve the understanding of human-dog interactions in coastal areas of Mexico in order to identify strategies - embedded in the social and cultural context - to manage village dogs. The Pacific Coast of Mexico was used as a case study area because of its high dog density and its importance for tourism and sea-turtle nesting. Village dogs interact with tourists and are known to scavenge sea-turtle nests. Conclusions presented are based on fieldwork conducted in three villages in Oaxaca and two in Michoacán. This fieldwork comprised, among others, interviews with villagers, dog behavioral tests, and radio-tracking of village dogs. Village dogs that live nearby nature protected areas are part of three main systems: the household, the village, and the nature protected area. Humans keep dogs mainly for guarding, as work companions and as children's playmates. At household level, dogs interact with familiar (i.e. caregivers) and unfamiliar humans (e.g. visitors). At village level, dogs interact with familiar humans from other households, or with unfamiliar humans, such as tourists. At all system levels, village dogs have experiences with humans that may range from positive to negative, and this may be reflected in their behavioral responses towards humans. Dogs reported to engage in human-dog play (mainly with children) were more likely to respond with tail wagging to a caregiver's call and to approach an unfamiliar human. Dogs can enter a nature protected area (i.e. sea-turtle nesting beach) by themselves or with other dogs or humans. Food is a central element in the above-described holistic system. Village dogs scavenge for food in proximity to humans, beg for food, or prey on sea-turtle eggs. Body condition of village dogs was in general close to optimal, and dogs maintained body condition also in the low season for sea-turtle nesting and tourism. Nest scavenger dogs, however, had a lower metabolic energy intake of tortillas, and a larger mean distance from home compared to non-nest scavengers. This suggests that nest scavenging is hunger-driven, and therefore, solutions need to focus on caregivers' feeding practices. The keeping of dogs in the above-described system, is subject to clashing perceptions and discourses of external (e.g. tourists, authorities) and internal (villagers) stakeholders. External stakeholders refer to village dogs as stray or abandoned, and any dog that is not totally dependent on humans (e.g. village dog) is considered out of place. Total dependence of dogs on humans is a logical ethical argument deriving from the idea that humans took dogs out of the wild (in line with the 'Pinocchio theory'). Villagers' narratives, in contrast, perceive dogs as autonomous and able to take care of themselves (in line with the Village Dog theory of dog self-domestication). Dog welfare problems (i.e. dogs being too thin or sick) in coastal Oaxaca were perceived more by international than by Mexican tourists. Dog predation of sea-turtle nests was an important concern for tourists, but not for internal stakeholders. In conclusion, the findings of this thesis show that village dogs in coastal Mexico are not 'stray', but interact with familiar humans from one or various households. Interactions of dogs with humans surpass a purely ecological relationship, as village dogs also fill a social niche and have important functions. Current policies and attempts to manage village dog populations in Mexico are derived from discourses and experiences largely disconnected from the village context. In order to find possible strategies to manage village dog populations, it is necessary to acknowledge the complexity of human-dog interactions, and include the views of both external and internal stakeholders.

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1

General introduction



1.1 Background

1.1.1 Village dogs

Dogs (*Canis familiaris*) are considered one of the most numerous carnivores worldwide with an estimated population of over 700 million (Hughes and Macdonald, 2013). They have been introduced into every continent and island where humans have settled (Wandeler *et al.*, 1993). Although in the Global North dogs are popular companions that live inside homes, about 80% of the dogs in the world can be classified as village dogs (Lord *et al.*, 2012). Village dogs are typically free-roaming animals that scavenge refuse around human dwellings, and associate with one or various households (Coppinger and Coppinger, 2001; Boitani *et al.*, 2007). Main characteristics of village dog populations are: 1) a high population turnover, 2) a male-to-female ratio skewed towards males, and 3) a high pup mortality of over 60% (Pal *et al.*, 1998; Pal, 2010). The high population turnover is due to a low life expectancy (of 3–4 years). The skewed male-to-female ratio is possibly anthropogenic, due to culling of female pups (Boitani *et al.*, 2007). At present, village dogs in developing countries are a concern for national and international organizations and individuals, such as tourists. Concerns arise about: overpopulation of village dogs, public health (e.g. dog bites or zoonoses), welfare of village dogs, and issues relating to dog-wildlife interactions, such as predation on wildlife.

Village dogs are prolific animals; females are capable of reproducing twice a year (Boitani *et al.*, 2007) and ovulate in spite of having a low body condition (Ortega-Pacheco *et al.*, 2007). Furthermore, dogs in general play a role in the transmission of more than 60 zoonoses, of which the most important ones are: rabies, echinococcosis, and leishmaniasis (Meslin *et al.*, 2001). The welfare of dogs in developing countries is a concern for international animal welfare organizations, such as Humane Society International or World Society for the Protection of Animals. Village dogs' life on the street is considered harsh, and dogs in many areas appear underfed or sick (WSPA, 2012). The sight of dogs on the street, furthermore, may give tourists from the Global North the impression that villagers do not care as much for their dogs as they do (Fielding, 2008).

Another concern is that of village dogs entering nature protected areas in tropical regions of developing countries. As the pressure on endangered wildlife increases and human settlements get closer to nature protected areas, village dog-wildlife interactions are likely to increase in the coming years (Butler and Du Toit, 2002). Village dogs enter the nature reserves, where they may act as competitors for wild scavengers (Butler *et al.*, 2004), prey on various

small mammals (Paschoal *et al.*, 2012; Silva-Rodríguez and Sieving, 2011), reptiles (Kruuk and Snell, 1981), and young ungulates (Manor and Saltz, 2004), and transmit diseases to wildlife (Butler *et al.*, 2004; Fiorello *et al.*, 2006).

Outbreaks of diseases or overpopulation of dogs in general have been controlled by dog culling since ancient times. In China, Ancient Greece, and the Roman Empire, dog raids occurred from 200 BC, whereas in Europe they have been occurring since the beginning of the 18th century (Meslin *et al.*, 2001). Main culling methods include: poisoning, drowning, and lately electric shock or lethal injection. At present, culling of dogs is generally not accepted, either by local people (Hsu *et al.*, 2003; Acosta-Jamett *et al.*, 2010) or by animal welfare organizations. Furthermore, culling is no longer recommended by the World Health Organization (WHO) because it appears useless— where dogs are removed, other dogs come to fill the ecological niche (WHO, 1988) or are reintroduced by villagers (Nunes *et al.*, 2008). Furthermore, female dogs' high fecundity enables village dog populations to recover from mortality and reach again the carrying capacity of their niche (Lord *et al.*, 2012). Nevertheless, dog culling continues to occur in developing countries, and not many alternative solutions have been proposed apart from dog sterilization programs, which are too costly to be implemented on a large scale (Ortega-Pacheco and Jiménez-Coello, 2011) and are not popular among local people in rural villages (Ruiz-Izaguirre, 2006).

One of the reasons why dog culling persists is that dogs on the street appear not to be cared for by humans. From a modern, ethnocentric perspective, these dogs appear lost or abandoned (Steeves, 2005; WSPA, 2012). In fact the term 'stray' is one of the most common terms used to refer to village and street dogs¹, even though this term has been labeled as misleading by the WHO (WHO, 1988). The proportion of dogs that have truly no association with humans (i.e. feral dogs) or are not cared for by humans (truly abandoned or lost) is approximately less than 10% (Matter and Daniels, 2001). The majority of village dogs associate with one or various households (Boitani *et al.*, 2007) that may provide different levels of care (e.g. food, shelter, veterinary care).

1.1.2 Human-dog interactions

In order to find alternative solutions regarding concerns around village dogs, insight into human-dog interactions in rural areas of developing countries is needed. Human-dog interactions can be traced to the emergence of the first

¹Street dogs here is used as the equivalent of village dogs, but in a city context.

villages. The earliest remains found of a domestic dog in Germany date back to 12,000 BC (Nobis, 1979), and the most accepted theory is that dogs descended from wolves (Vilà *et al.*, 1997). There are two main theories on dog domestication (Box 1).

The two theories fundamentally differ in the degree of influence humans had in the domestication process. The oldest theory, supportive of artificial selection, was first proposed by Charles Darwin (Darwin, 1858) and is also known as the 'Pinocchio theory' (Coppinger and Coppinger, 2001). This theory presumes that humans had a major role in dog domestication. The second theory presumes that it was wolves who initiated the process of self-domestication (Coppinger and Coppinger, 2001). Each theory leads to different interpretations of the nature of the human-dog relationship, relevant to understand the perception of local and external stakeholders in village dog-related concerns. At present, the more popular Pinocchio theory shapes current understandings about human responsibility for dog care. This is best exemplified by Matter and Daniels (2001, p 48) when they say: "With the creation of a new animal, for that is what resulted from the regimen of artificial selection, comes an obligation to care for

Box 1 Dog domestication theories

Pinocchio Theory

The habitat and hunting sites of humans and of the ancestors of dogs have overlapped for at least 150,000 years. At some point in time, human hunters must have killed wolves for skin and meat, and occasionally took their pups, which were kept and became tame. As the pups grew up, some of them stayed around human dwellings, and some returned to the wild. People saw the advantage of keeping wolves and started taking other pups from the wild. When there were enough tame wolves in the human settlement, breeding resulted in a next generation of even tamer wolves. Over many generations, wolves transformed into dogs.

Adapted from Clutton-Brock (1995)

Village Dogs' Theory

The dumps of the first human settlements created a new niche that could provide a regular supply of food year round. Here, a process of natural selection occurred in wolves that scavenged around human settlements. Escaping from humans used up too much energy. Wolves that were less afraid of humans could scavenge (search for food) and continue eating in proximity to humans. This adaptation thus allowed them to gain energy (by scavenging), but also to maintain energy (by not running away from humans). Small body size, teeth, and brains were an adaptive advantage in the village niche. Smaller brains required less energy, which wolves no longer needed for hunting in packs.

Adapted from Coppinger and Coppinger (2001)

that animal (Daniels and Bekoff, 1989)". The fact that village dogs are typically free-roaming and acquire food themselves, is therefore a direct contradiction of current understandings of external stakeholders from Global North about human responsibility for dogs.

1.1.3 Case study in Mexico

From studies in different countries in the Global South, it is shown that over 30% of households declare owning village dogs (Table 1). In Bolivia and Chile, for example, almost all households have dogs, whereas in other countries the number of households with dogs might be underestimated given that the association of village dogs with particular households may occur regardless of a

Table 1 Population data of *Canis familiaris* in rural areas of developing countries

Study	Place	Households with dogs (%)	Dogs per household ¹ (n)	Unrestricted (%)	Dog density (n/km ²)	Human:dog ratio
Mexico						
Ortega-Pacheco <i>et al.</i> (2007)	Yucatán, Mexico	67	2.2	77	75–390	2.8
Vázquez-Avila (2004)	Yucatán, Mexico	37	n.a.	61	n.a.	4.1
Ruiz-Izaguirre (2006)	Coast of Oaxaca, Mexico	67	1.8	80	n.a.	2–4.1
Orihuela and Solano (1995)	Morelos, Mexico	85	2.1	n.a.	n.a.	n.a.
Other countries						
Kitala <i>et al.</i> (2001)	Machakos District, Kenya	63	2.1	90	10	7.7
Butler <i>et al.</i> (2004)	Zimbabwe	62	2.5	>90	21	4.7
Fiorello <i>et al.</i> (2006)	Bolivia	99	3.8	n.a.	n.a.	n.a.
Acosta-Jamett <i>et al.</i> (2010)	Chile	89	2.2–2.7	n.a.	1–15	1.1–2.1

¹ household with dogs; n.a. = not available

declared ownership (Ortolani *et al.*, 2009). Human-to-dog ratios in rural areas range between one to five, and there are about two dogs per dog household. The Pacific Coast of Mexico is used as a case study area because of its high dog density (per human). Moreover, the Pacific Coast is home to important nature protected areas for sea-turtle nesting, where dogs from adjacent villages scavenge sea-turtle nests. In Mexico alone, there are over 30 important nesting beaches along the Pacific Coast and the Gulf of Mexico (CIPCTM, 2006). Some of the villages in the vicinity of nature protected areas are important for tourism – for example, the eco-tourist corridors known as Ventanilla-Puerto Angel in the state of Oaxaca and Costa Nahua in the state of Michoacán. The Pacific Coast of Mexico, therefore, enables in-depth study of human-dog interactions and related concerns, such as village dogs scavenging sea-turtle nests and the welfare of village dogs in tourist areas.

Dogs were among the few domestic animals present in Mexico before the arrival of the Spaniards in 1492. Since at least 6,000 years BC, dogs were kept for companionship, as a meat source and as a religious offering (Valadez-Azúa and Mestre-Arrijoja, 1999). Dogs were linked to the cycles of life and death; life related to their fertility, and death to the afterlife (Valadez-Azúa and Mestre-Arrijoja, 1999). They were believed to be guides of the dead in the afterworld, and therefore dog remains or dog figurines have been found in burials of the Aztec, Mayan, and Colima cultures (Valadez-Azúa and Mestre-Arrijoja, 1999). The dog would assist the dead in crossing a lake by swimming to the other side while carrying the owner. This and other dog myths continue to exist in many rural areas of Mexico (Valadez-Azúa and Mestre-Arrijoja, 1999; Vidas, 2002).

Today, throughout Mexico, village dogs are cared for by the lower social classes who cannot afford pedigree dogs or commercial dog feed, and often have unfenced households. Dogs on the street are, therefore, a common sight in any Mexican village. According to the Official Mexican Standard for prevention and control of rabies, a dog on the street without its owner can be removed by the authorities (DOF, 2011). At national level, this is a task of the Secretariat of Health (SSA), which aims for vaccination of owned dogs and the elimination of so-called *callejeros* (street dogs). The SSA captures dogs on the street and takes them to the *antirrábicos* (dog pounds). Dogs stay there for 72 hours, in case someone claims them, and otherwise they are killed, mostly by electrocution, but also by lethal injection. The SSA does not, however, have enough resources or infrastructure to work in every Mexican village. Thus, parallel to dog management by the SSA, mass killings financed by local governments occur

throughout the country, and so-called *redadas* (dog raids) are common in the villages.

1.2 Problem statement

1.2.1 Village dog system

Human–dog interactions are constituted by episodes of actions and responses between individual dogs and humans. These interactions are, however, subject to different views (perceptions) and voices (discourses) of local and external stakeholders. This complexity of human–dog interactions and related perceptions and discourses is presented in Figure 1.

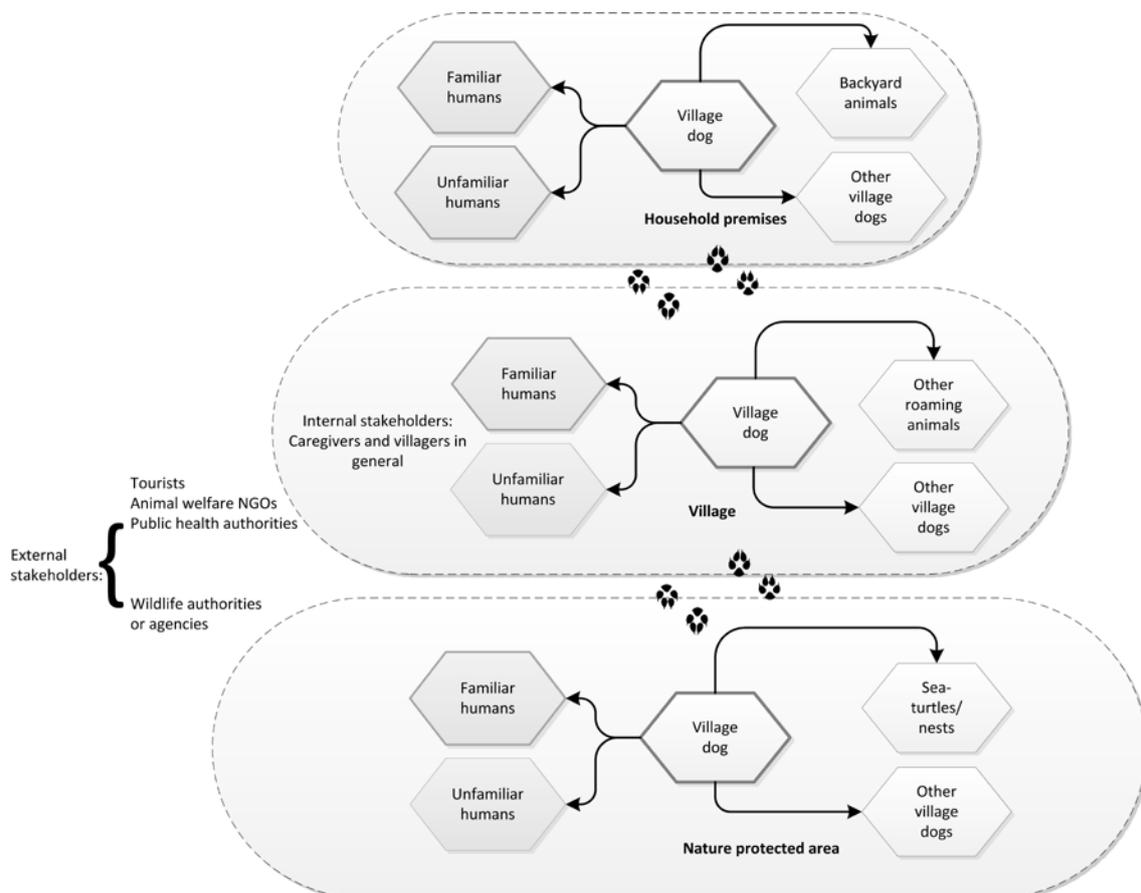


Figure 1 Human–dog interactions and village dog movements, showing internal and external stakeholders at household, village, and nature protected area level

Village dogs in our case study area are part of three main systems: the household, the village, and the nature protected area (Figure 1). At household level, dogs scavenge refuse and interact with other animals, and with familiar (i.e. caregivers) and unfamiliar humans (e.g. visitors, rabies campaign personnel). Caregivers generally provide village dogs with additional food, and have a main role in dog socialization. At village level, dogs interact with

familiar humans from other households where they might scavenge refuse. Village dogs on the streets may also need to interact with unfamiliar humans, such as tourists and strangers. Dogs can enter a nature protected area by themselves or with other dogs or humans. Once they enter a nature protected area, they can scavenge sea-turtle nests and/or may encounter unfamiliar humans, such as tourists or beach watchers. The presence of tourists at beaches creates alternative sources of food for village dogs, e.g. tourist refuse or handouts. At all three system levels, village dogs have experiences with humans that may range from positive to negative, and this may be reflected in their behavioral responses towards humans.

Food is a central element in the above-described holistic system. Village dogs scavenge for food in proximity to humans, beg for food, or prey on sea-turtle eggs. Do village dogs get food from one or various households? Is there a difference in body condition score between dogs scavenging at beaches with sea-turtle nests or at beaches with tourists? Is scavenging of sea-turtle nests affected by the amount of food provided by the caregiver? The keeping of dogs in the above-described system, moreover, is subject to the perceptions and discourses of relevant stakeholders. The perceptions of various stakeholders about village dogs concerns, however, might differ. For villagers (i.e. internal stakeholder) for example, dog predation of sea-turtle nests may be less relevant, whereas wildlife predation by village dogs might be an important concern for wildlife agencies. Villagers might perceive other problems, such as dog nuisance or dog culling, which might not be acknowledged by other stakeholders. If this complexity in human-dog interactions is not acknowledged, solutions regarding concerns around village dogs are likely to fail.

1.2.2 Objectives and thesis outline

The objective of this thesis was to improve the understanding of human-dog interactions in coastal areas of Mexico in order to identify strategies – embedded in the social and cultural context – to manage village dogs. To obtain a general overview of human-dog interactions in coastal villages, **chapter 2** starts by studying (a) the village dog-keeping system and (b) villagers and tourists' perceptions of dog-related problems in a coastal region with important tourist activity and sea- turtle nesting beaches.

To gain insight into village dog socialization with humans in areas with different food sources (i.e. turtle nesting beach and tourist beach), **chapter 3** aims to (a) assess behavioral responses of village dogs towards familiar and

unfamiliar humans, (b) assess the body condition of village dogs, and (c) identify which village or dog characteristics influence dog behavior and body condition.

In **chapter 4**, roaming characteristics and feeding practices of village dogs scavenging sea-turtle nests are investigated. The following research questions are addressed: 1) Is insufficient provision of food (i.e. tortillas) by humans a driving factor for turtle nest scavenging? 2) Do turtle nest scavengers travel longer distances than non-nest scavengers? 3) Do dogs visit the beach alone, or with other dogs or humans?

In order to understand why different stakeholder perceptions clash and how stakeholder discourses have actual implications in policy and village dog management, **chapter 5** aims (a) to unveil the discourses that sustain current policy regarding village dogs and (b) to compare these discourses with the narratives voiced at village level.

Chapter 6, the general discussion, starts by describing how village dog culling functions and is perpetuated by stakeholders. It continues with the main findings of this thesis and an assessment of village dog welfare. Options for village dog management that are accepted by relevant stakeholders are also discussed. This chapter ends with options for future research and a summary of the main conclusions.

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2

Perceptions of village dogs by villagers and tourists in the coastal region of rural Oaxaca, Mexico



Eliza Ruiz-Izaguirre¹ and Karen (C.) H.A.M. Eilers^{1,2}

¹Animal Production Systems Group, Wageningen University, Wageningen, the Netherlands

²Schuttelaar & Partners, a Communications Consultancy that gives strategic advice on sustainable agriculture and healthy food, Wageningen, the Netherlands.

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Abstract

The objective of this study was to gain an understanding of the village dog-keeping system, and of perceptions of dog-related problems by villagers and tourists, in the coastal region of Oaxaca, Mexico. We conducted a survey of the inhabitants of three villages (Mazunte, Puerto Angel, and Río Seco), whose main economic activities were tourism, fishing, and farming ($n = 99$), and a survey of tourists ($n = 151$). Dogs were the most commonly kept animals in all the villages. Cultural and economic aspects were reflected in dog-keeping practices. All dog owners allowed their dog(s) to roam free in the farming village (Río Seco), but not in the tourist villages (Mazunte and Puerto Angel). Significantly more dog owners in the tourist village of Mazunte mentioned companionship as a reason for keeping dogs than those in the farming village. All villagers perceived as a problem that there were too many dogs. The mean number of dogs per household was 1.8, and there were significantly more male dogs in the farming village than in the tourist villages. Efforts to control the dog population in the rural coastal region are aimed at rabies prevention or wildlife protection, whereas this study revealed that these issues were far less often mentioned by local people as other dog-related problems. Significantly more villagers in the tourist villages perceived there to be dog-welfare problems than those in the farming village. Significantly more North American and European tourists were concerned about dog welfare than Mexican tourists. Despite significant differences in dog-keeping between the tourist and farming villages, opinions of villagers in regard to dog breeding and methods of dog population control were similar. Villagers agreed on dog sterilization to control the dog population, but also considered that female dogs should breed at least once in their lifetime. Those living in tourist villages could benefit from improving dog welfare and implementing strategies to lessen the problems dogs cause tourists.

Keywords: dog, dog-keeping, dog welfare, Mexico

2.1 Introduction

Dogs that are free to roam outside household premises are commonly known as “village dogs” (Coppinger and Coppinger 2001; Boitani, Ciucci and Ortolani 2007; Ortolani, Vernooij and Coppinger 2009), and this could be the most common dog category in developing countries (Ortolani, Vernooij and Coppinger 2009). In rural areas of Mexico, for example, most households (60–85%) own dogs (Orihuela and Solano 1995; Ortega-Pacheco *et al.* 2007), which is different from other countries, where people do not acknowledge ownership of village dogs (Ortolani, Vernooij and Coppinger 2009). Village dogs in the coastal region of rural Oaxaca, Mexico roam the beaches and streets, just as in other parts of Mexico (Orihuela and Solano 1995; Ortega-Pacheco *et al.* 2007).

Tourism is an important economic activity for seaside villages of the coastal region, and it has brought an influx of foreigners who may have different perceptions of dogs (Plumridge and Fielding 2003). It is known locally that tourists interact with village dogs by feeding them and sometimes by adopting them. This coastal region of rural Oaxaca, furthermore, has gained attention from foreign veterinarians, who perform an annual dog sterilization campaign there (Borgal 2001).

Most studies regarding village dogs in developing countries have focused on rabies and other zoonoses (Slater 2001), whereas other dog-related problems that are also relevant, for example, overpopulation and free-roaming dogs, have received less attention. There are four main concerns regarding dogs in the coastal region of Oaxaca: overpopulation, welfare, free-roaming, and threat to wildlife. Dog overpopulation has been reported also in other parts of Mexico (Orihuela and Solano 1995; Ortega-Pacheco *et al.* 2007) and, in general, in areas of developing countries (Butler and Bingham 2000; Kitala *et al.* 2001; Fraser 2008). Dog welfare is regarded as poor not only in coastal tourist sites in the Caribbean (Grennan and Fielding 2008), but also in developing countries (Fraser 2008). Free-roaming dogs could give tourists a bad impression of the community (Plumridge and Fielding 2003; Alie *et al.* 2007), and this may affect the local economy (Plumridge and Fielding 2003). Dogs may pose a threat to wildlife in nature-protected areas (Slater 2001); in the coastal region of Oaxaca, for example, dogs are known to feed on sea turtle nests.

In the search for solutions to dog-related problems, opinions of stakeholders are rarely considered, unlike for some animal species, for example, dingoes in Australia (Burns 2003) and iguanas in Central America (Eilers *et al.* 2001).

Stakeholders are those individuals who can affect a “system,” in this case a “dog-keeping system.” A system is a construct used to understand complex reality in a particular context (Udo and Cornelissen 1998). A systems approach, therefore, takes into account how stakeholders, animals, and the environment interrelate. According to a systems approach, it is important to understand first the system before trying to change it (Udo and Cornelissen 1998). Often, solutions are designed with top-down approaches, not taking into account views of stakeholders who will be affected and who will have influence in the success or failure of a solution. For this study, we considered two groups of stakeholders: villagers and tourists. The objective of this study was to gain further understanding of the dog-keeping systems in villages, and of perceptions of dog-related problems by villagers and tourists in the rural coastal region of Oaxaca, Mexico. We studied dog-keeping systems and the opinions of villagers in three different villages: one farming village and two tourist villages. We hypothesized that perceptions of village dogs by tourists would influence the perceptions of dogs by villagers—for example, making them more aware of dog-welfare problems.

2.2 Methods

2.2.1 Study sites

The coastal region of the State of Oaxaca is located on the South Pacific Coast of Mexico. This region is known for its sea turtle nesting sanctuaries: La Escobilla and Morro Ayuta (SEMARNAT and CONANP 2006), and for its tourist resorts: Bahías de Huatulco and Puerto Escondido (Foucat 2002). Tourists visiting Bahías de Huatulco often visit the neighboring villages of Ventanilla, Mazunte, and Puerto Angel (Foucat 2002). Bahías de Huatulco generated 48% of the total tourist income for Oaxaca in 2006, and Ventanilla-Puerto Angel, known as the rural eco-tourist area, generated 3% (Boletín Estadístico 2006).

This study was conducted in January and February 2006. The Mexican Turtle Center (Centro Mexicano de la Tortuga: CMT) was concerned about dog-related problems, for example, dog overpopulation and predation of sea turtle (*Lepidochelys olivacea*) nests in rural villages of the coastal region of Oaxaca. To determine the influence of tourists on village dog-keeping systems, we selected two rural seashore villages with tourists—Mazunte and Puerto Angel—and one rural inland village without tourists—Río Seco (Figure 1). The villages are representative of rural communities with fewer than 2,500 inhabitants, and were known by the CMT to have problems with village dogs.

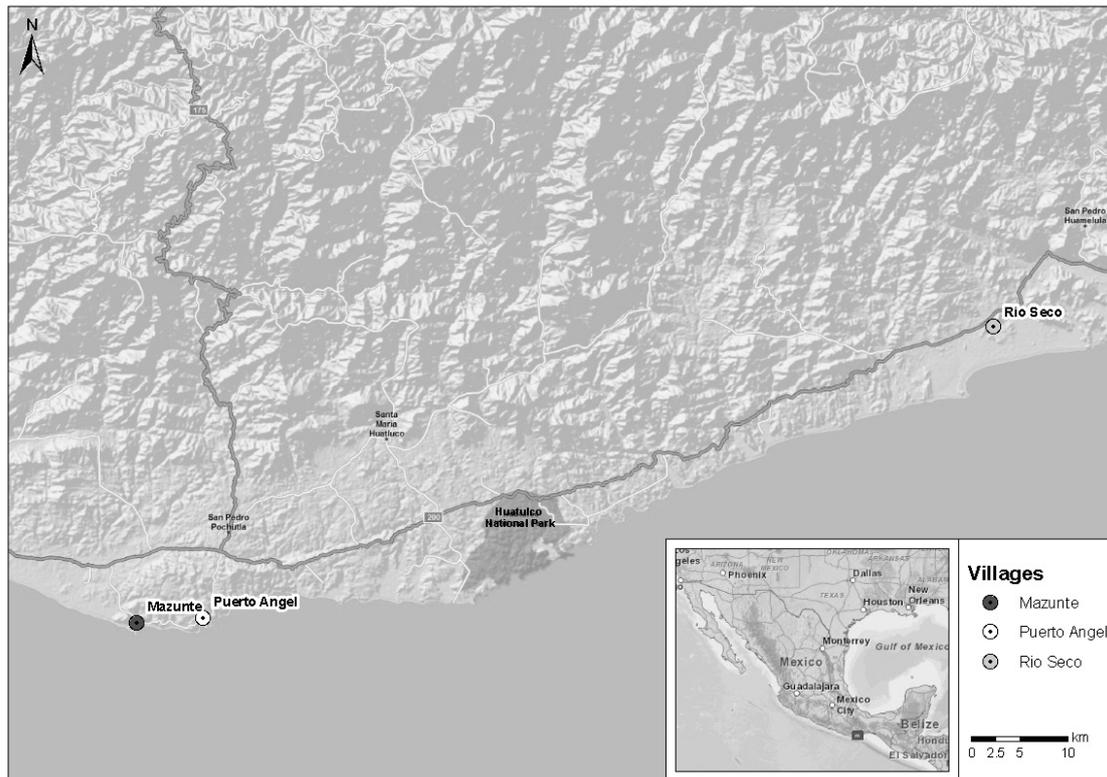


Figure 1 Villages surveyed in the Coastal Region of Oaxaca, Mexico

The main economic activities of the villages are tourism (Mazunte and Puerto Angel), fishing (Puerto Angel), and farming (Río Seco). The ethnic composition is mostly indigenous (Chontales) in Río Seco and mostly mestizo in Puerto Angel and Mazunte, the latter with growing numbers of European and North American expatriates. Río Seco is the most rural of the three villages, and Puerto Angel the least. According to the latest census (2005), Mazunte had 702 inhabitants and 153 houses, Puerto Angel had 2,440 inhabitants and 153 houses, and Río Seco had 647 inhabitants and 186 houses (INEGI 2005).

Río Seco is located 6 km from Morro Ayuta, a sea turtle nesting beach with more than 100,000 nests per year (CONANP 2007); the species status is “vulnerable” (IUCN 2010). Mazunte is located 25 km from La Escobilla, a protected federal beach that holds more than 500,000 nests per year (CONANP 2007). Since 2001, a group of North American veterinarians, with logistic support from the CMT, have held an annual dog sterilization campaign in Mazunte and Río Seco (personal communication, Richard Rodgers).

2.2.2 Questionnaire design and procedure

We used a two-step method to interview our stakeholders: key stakeholder semi-structured interviews and villager and tourist surveys. The objective of the

first step was to identify dog-related problems in the area and to develop the questionnaires for the villager (Table 1) and tourist (Table 2) surveys. Key stakeholders were individuals knowledgeable about the dog-keeping practices in the rural system and who considered that dog-related problems should be tackled. We interviewed key stakeholders including workers of the CMT, biologists, local authorities, and veterinarians working in this area.

The objective of the second step was to interview villagers in Mazunte, Puerto Angel and Río Seco, and tourists. We interviewed 99 villagers about the village dogs and keeping dogs. The structured interview consisted of 83 closed-ended and four open-ended questions for dog owners, and 33 closed-ended questions and four open-ended questions for non-dog owners, and lasted from 15 to 45 minutes. The interview covered aspects of village dog-keeping practices and opinions of villagers regarding dog-related problems (Table 1). The interview was initially tested on 10 villagers. Villagers to be interviewed were selected by dividing each village into four areas with the help of a map or, when a map was not available, local authorities. At least seven villagers were interviewed in each area. Two researchers approached every third household and asked the inhabitants to participate. We interviewed 37 villagers in Mazunte, 30 in Puerto Angel, and 32 in Río Seco.

We also surveyed tourists about dog-related problems on the beaches they visited and their interactions with village dogs (Table 2). A sign inviting tourists to participate in the survey was placed in the lobby of the CMT for six weeks in January and February 2006. The survey consisted of 11 closed-ended questions and one open-ended question. In total, 151 questionnaires were completed and analyzed. The complete villager and tourist questionnaires are available from the authors.

2.2.3 Analysis

The software package R (R Development Core Team 2010) was used for statistical analysis of the results. Frequencies and percentages of answers on the questionnaires were obtained to characterize the dog-keeping system and to quantify dog-related problems. Villages, dog-keeping systems, and the origin of tourists were analyzed for differences using the chi-square test (Siegel and Castellan 1998).

Table 1 Questions and possible answers during the surveys of the villagers

Background of Respondent

- Age (14-20/21-30/31-40/41-50/more than 50 years old)
- Gender (female/male)
- Nationality
- Number of years residing in the village
- Education level (primary/secondary/high school/university)
- Do you own land for farming? (yes/no)
- Is your salary enough to maintain your family? (yes/no)
- Do you own animals? (yes/no)
- Animal species owned (dogs, cats, birds, poultry, cattle, sheep/goats, horses)
- If you own animals, which animal species is the most important for the household?

Problems and Opinions Regarding Village Dogs

- Which is the most important problem in the village? (open question)
- Do you consider that there are problems in regard to village dogs? (yes/no)
- Which problems do you experience with village dogs? (open question)
- Have you ever been bitten by a dog? (yes/no)
- Have you lately been chased by a dog or a group of dogs? (yes/no)
- Have you ever owned a dog? (yes/no)
- If yes, what was the cause of death or disappearance of your most recent previous dog?(open question)
- Do visiting dogs come into your family premises? (yes/no)
- Do you feed visiting dogs? (yes/no)

Opinions

- Do you agree that dogs should be left free to roam? (yes/no/do not know)
- Do you agree that female dogs should be sterilized? (yes/no/do not know)
- Do you agree that male dogs should be sterilized? (yes/no/do not know)
- Would you be willing to pay for a sterilization surgery? (yes/no/do not know)
- If yes, how much? (in pesos)
- Do you agree on poisoning as a dog population control method? (yes/no/do not know)
- Would you agree on euthanizing a sick dog with a lethal injection? (yes/no/do not know)

Additional Questions for Dog Owners

- Number of male dogs owned
- Age of each male dog (< 1/1-3/4-6/> 6 years old)
- Number of female dogs owned
- Age of each female dog (< 1/1-3/4-6/> 6 years old)
- What breeds do you have? (local village dog/ resembling purebred or purebred/ both)
- How did you obtain your dog(s)? (gift/bought/ found/ from own litter)
- Why do you keep a dog? (guarding/ protection, companionship, state other functions)
- How often do you feed your dog(s)? (daily/less than daily)
- What does your dog(s) eat?(tortillas, family leftovers, commercial dog food, what is scavenged)
- Do you have a water tray for your dog (s)? (yes/no)
- How often do you replenish the water tray? (daily/every other day/less than every other day)
- Do you let your dog(s) roam free? (yes/no)
- Have you ever given veterinary treatment your dog(s)? (yes/no)
- Do you bathe your dog(s)? (yes/no)
- Are your dog(s) rabies vaccinated? (yes/no) (yes means all dogs in the case of multiple dogs)
- How many of your dog(s) are sterilized?
- Who sterilized your dog(s)? (local vet/ foreign vet campaign)

Table 2 Summary of the questions (and possible answers) asked of the tourists

Gender (female/male)
Age (in years)
Nationality
For how long have you been in the coastal region of Oaxaca? (1-7 d/8-15 d/16-30 d/>30 d)
Places visited (Bahías de Huatulco, Puerto Escondido, Mazunte, Puerto Angel, other)
Do you consider that there are problems related to dogs in the places you have visited? (yes/no)
If yes, which dog-related problems? (select from a list, for example, dogs barking at night, threat to wildlife, bitten by a dog)
Do you consider that something has to be done to control the dog population in this region? (yes/no)
If yes, what can be done? (open question)
Have you fed any dogs during your stay in this coastal region? (daily/sometimes/never)

2.3 Results

2.3.1 Villagers

Almost all villagers were Mexican, except for an Italian and a North American who had lived in Mazunte for more than five years. We did not count the number of people who refused to be interviewed, but this was minimal (less than 10%), and mainly occurred in Puerto Angel and Río Seco. Some villagers in Puerto Angel were too busy and some in Río Seco did not feel comfortable talking to strangers. There was no significant difference in the distribution of interviewees' ages among the villages (Table 3). We interviewed more women ($n = 65$) than men ($n = 34$), with no significant difference in distribution of gender among villages (Table 3).

In the tourist village Mazunte and the farming village Río Seco, more villagers owned land for farming than in the tourist village Puerto Angel, where fishing was the (other) main economic activity ($\chi^2 = 24.3$, $n = 94$, $df = 2$, $p < 0.001$) (Table 3). With regard to household economy, fewer villagers in Puerto Angel and Río Seco considered family income sufficient than in Mazunte ($\chi^2 = 10.6$, $n = 94$, $df = 2$, $p < 0.01$). Approximately one-third of villagers had completed high school or higher education, with no significant difference in distribution of education level among villages (Table 3).

2.3.2 Tourists

In regard to origin of tourists, 67 were Mexican (44%), 46 North American (United States and Canada) (31%), and 38 European (25%). The mean age of tourists was 33 years ($SD = 13$), ranging from 13 to 69 years ($n = 143$), and there were 90 women (61%) and 57 men (39%). Most tourists ($n = 122$, 81%) had

Table 3 Villagers' background characteristics

Characteristics	Level	Mazunte <i>n</i> (%)	Puerto Angel <i>n</i> (%)	Río Seco <i>n</i> (%)
Gender	Female	27 (73)	16 (53)	22 (69)
	Male	10 (27)	14 (47)	10 (31)
Age	14–30 years	15 (41)	9 (30)	11 (34)
	31–50 years	13 (35)	11 (37)	10 (32)
	> 50 years	9 (24)	10 (33)	11 (34)
Owns land for farming ^{***}	Yes	18 (51)	3 (10)	22 (73)
	No	17 (49)	23 (90)	8 (27)
Considers income sufficient ^{**}	Yes	20 (57)	7 (23)	7 (24)
	No	15 (43)	23 (77)	22 (76)
Education	None or incomplete primary	12 (34)	5 (17)	6 (19)
	Primary	9 (26)	9 (31)	5 (16)
	Secondary	4 (11)	4 (14)	9 (29)
	High school or above	10 (29)	11 (38)	11 (36)

^{**}Different among villages at $p < 0.01$;

^{***}Different among villages at $p < 0.001$

visited Mazunte, but fewer had visited Puerto Angel ($n = 65, 43\%$). More than half of the tourists ($n = 82, 58\%$) had been in the area for less than one week.

2.3.3 Dog-keeping systems

Dogs were the most commonly owned animal species in the three villages, with no significant differences in distribution of species among villages (Table 4). There were, however, differences among villages in the keeping of farm animals, with higher percentages of poultry, horses, pigs, and cattle in Río Seco, reflecting the economic activities of the villages. Villagers were asked which of their animals were most important for the household. Importance could be in relation to utilitarian or affection aspects. Dogs were most important for 22% of villagers, with no significant difference among villages. Horses and poultry were also mentioned as most important, mainly in the farming village. Other animal species were rarely mentioned.

2.3.4 Dog owners and their dogs

Most dog owners ($n = 50, 78\%$) owned local village dogs of no specific breed and had acquired their dogs as gifts ($n = 50, 82\%$). In the farming village Río Seco, all dog owners ($n = 24, 100\%$) allowed their dogs to roam free, but not in Mazunte ($n = 15, 71\%$) or Puerto Angel ($n = 16, 84\%$). Dog owners gave more

than one reason for keeping dogs (Table 5), but almost all mentioned guarding/for protection. Possibly due to the influence of tourists, in Mazunte, more dog owners ($n = 18$) mentioned companionship than owners in the farming village Río Seco ($n = 9$) ($\chi^2 = 7.1$, $df = 1$, $n = 48$, $p < 0.01$). Other reasons for keeping dogs were: playmates for children, protection of backyard animals (mainly in Mazunte and Río Seco), herding (mainly in Río Seco), and as pest deterrents. Villagers also often mentioned that dogs came along to the fields or followed fishermen to the shore and waited for them until they returned (Table 5, “Work companions”).

2.3.5 Feeding of dogs

Almost all dog owners (98% of 65 replies) fed their dogs daily. All (66 replies) had a water tray for their dog and most owners (86% of 60 replies) replenished the tray every day. In the farming village Río Seco, all dog owners ($n = 25$) fed their dogs maize tortillas with family leftovers, whereas 32% ($n = 7$) of owners in Mazunte and 13% ($n = 2$) in Puerto Angel fed their dogs commercial dog food, exclusively or in addition to leftovers. More than half of villagers (55% of 95 replies) had regular visits by dogs that did not belong to the household (“visiting dogs”), with no significant difference in the distribution of these dogs among villages (Table 8), and 21% of villagers (95 replies) also fed visiting dogs. Non-dog owners ($n = 25$, 83%) were more likely to have visiting dogs than dog owners ($n = 27$, 41%) ($\chi^2 = 12.8$, $df = 1$, $n = 95$, $p < 0.001$), and non-dog owners ($n = 13$, 43%) were also more likely to feed visiting dogs than dog owners ($n = 7$, 11%) ($\chi^2 = 11.2$, $df = 1$, $n = 95$, $p < 0.001$).

Table 4 Domestic animals kept by the villagers (%)

Animal Kept	Mazunte $n = 37$	Puerto Angel $n = 32$	Río Seco $n = 30$
Dogs	62	59	78
Poultry*	57	30	72
Birds	35	23	16
Cats	27	23	34
Horses*	10	0	56
Pigs*	8	0	47
Cattle*	0	3	22
Small ruminants	6	0	22

*Different among villages at $p < 0.05$

Table 5 Reasons for dog-owning villagers to keep dogs (%)

Reason	Mazunte <i>n</i> = 23	Puerto Angel <i>n</i> = 19	Río Seco <i>n</i> = 25	Total <i>n</i> = 67
Guarding/protection	100	95	100	98
Companionship*	78	58	36	57
Playmates for children	45	42	28	38
Protection of backyard animals*	36	10	36	27
Herding cattle or small ruminants*	4	0	28	13
Pest deterrents	36	26	16	26
Work companions	78	52	72	67

*Different among villages at $p < 0.05$

2.3.6 Dog health care

In the tourist villages Mazunte ($n = 15$, 65%) and Puerto Angel ($n = 10$, 53%), more dog owners gave veterinary treatments to their dogs than owners in the farming village Río Seco ($n = 4$, 17%) ($\chi^2 = 11.3$, $df = 2$, $n = 65$, $p < 0.01$), possibly due to Río Seco not having veterinarians nearby. Veterinary treatments included preventive treatments such as deworming and vaccinations other than rabies. Dogs in Mexico are vaccinated against rabies at no cost during the yearly national rabies campaign (SSA 2001). Possibly due to better vaccination coverage, in Puerto Angel, more dog owners ($n = 16$, 84%) had all their dogs vaccinated against rabies than owners in the farming village Río Seco ($n = 9$, 43%) ($\chi^2 = 5.6$, $df = 1$, $n = 40$, $p < 0.05$). In Mazunte, more dog owners ($n = 19$, 95%) bathed their dogs than owners in Río Seco ($n = 15$, 63%) ($\chi^2 = 4.8$, $df = 1$, $n = 44$, $p < 0.05$).

2.3.7 Causes of dog deaths

Most villagers ($n = 81$, 83%) had kept a dog at some point in their lives, with no significant difference in the distribution of dog-keeping among villages. Causes of death or disappearance of the most recent previous dog were: poison (32%), disease (19%), old age (17%), hit by a car (9%), given away (8%), lost (4%), or "other causes" (11%), with no significant difference in the distribution of causes among villages.

2.3.8 Village dog population demographics

We estimated the village dog populations from 121 dogs owned by 67 dog owners (Table 6). The mean number of dogs per household was 1.8. In the farming village Río Seco, there were more male dogs ($n = 38$, 84%) than in the tourist villages Puerto Angel ($n = 21$, 60%) and Mazunte ($n = 21$, 51%) ($\chi^2 = 11.4$, $df = 2$, $n = 121$, $p < 0.01$). This was reflected in an unequal male:female ratio for Puerto Angel and Río Seco (Table 6). In Río Seco, reasons given by villagers to

Table 6 Estimated dog population demographics in the three villages

Demographics	Mazunte	Puerto Angel	Río Seco
Mean no. of dogs/ dog-owning household	1.6	1.8	1.9
Dog male:female ratio**	1:1	1.5:1	5.4:1
Total number of dogs ^a	152	668	276
Human:dog ratio ^b	4:1	4:1	2:1

**Different among villages at $p < 0.01$; ^aTotal number of dogs was calculated by multiplying the mean number of dogs per household by the estimated number of households owning dogs (number of households in 2005 by % of households with dogs in the survey) in the village; ^bThe human:dog ratio was calculated by dividing the total village population by the estimated number of dogs (see ^a)

cull newborn female pups were: preference for male dogs as work companions and dislike of “breeding nuisance” – having several males roaming around the household when a female dog is in heat (see Table 8). In total, few dogs (19% of males, 12% of females) were sterilized, most at no cost during the dog sterilization campaign.

The distribution of ages of the dogs was: 25% under 1 year of age, 40% between 1 and 3 years, 22% between 4 and 6 years, and 13% over 6 years ($n = 118$), with no significant difference in distribution of ages among villages. Most dogs (80%) over 6 years of age were males.

2.3.9 Opinions of villagers on the dog-keeping system

Villagers gave their opinion about various issues regarding dog breeding and methods to control the dog population (Table 7). Opinions of villagers did not differ significantly between dog owners and non-dog owners, or among villages. Most villagers (98%) agreed on sterilization of female dogs, but to a lesser degree on sterilization of male dogs (74%) and of dogs of both sexes of a specific breed (59%) (Table 7). Villagers who disagreed with sterilizing males mentioned one or more reasons, including that guarding behavior will diminish (38%), dog will get lazy (19%), sterilization will be painful (14%), dog will lose masculinity (4%), and sterilization is unnatural (4%).

In regard to female dogs, 61% of villagers agreed they should be allowed to breed, and about half agreed that it should occur at least once in the dog’s lifetime. Some villagers explained that “female dogs deserve the opportunity to experience being a mother.” Most villagers ($n = 87$, 88%) mentioned willingness to sterilize their dog if it was offered at low cost. Villagers mentioned being able to pay about 20 to 40 pesos (1 Mexican peso = 0.069 EUR, average exchange rate 2006), which was the price of a boar castration. Local veterinarians charged

between 300 (male) and 1000 pesos (female) for the surgical sterilization of a dog.

Most villagers (82%) did not agree with allowing dogs to roam free. Those who agreed mentioned that it was natural for a dog to live this way, and that chained dogs became aggressive. Villagers were asked about two methods of dog culling: poisoning to control the dog population, and euthanasia for sick dogs (with lethal injection). Most villagers (81%) were in favor of euthanasia, whereas a few ($n = 17$) were in favor of poisoning. Dogs that spill garbage, steal food, and kill poultry (see Table 8) were described by villagers as “destructive dogs” (our translation from *dañeros*). Villagers in favor of poisoning mentioned being extremely annoyed by “destructive dogs.” Villagers who disagreed with poisoning were annoyed that baits were eaten by dogs that were owned and

Table 7 Villagers’ opinions ($n = 99$) on dog breeding and other issues (%)

Do you agree?		Yes	No	Do not know
With sterilization of:	Female dogs	98	1	1
	Male dogs	74	21	5
	Specific breeds	59	24	17
That female dogs should breed ($n = 97$)		61 (50) ^a	37	2
That dogs should be free to roam		17	82	1
With poisoning as a method of dog population control		17	81	2
With euthanasia of sick dogs		81	17	2

^aVillagers considered breeding necessary at least once in the dog’s lifetime

well cared for, and they were afraid that baits could be eaten by small children.

2.3.10 Damage to sea turtle nests

In Río Seco, villagers reported the presence of *perros salvajes* (feral dogs), described as dogs that avoid humans and live independently on the beach Morro Ayuta, which is a sea turtle nesting site. Villagers mentioned that feral dogs dig out and eat sea turtle eggs, and this was confirmed by one of the authors (E. R.).

2.3.11 Perceptions of dog-related problems by villagers and tourists

Villagers were asked about the main village problems, to place dog-related problems in a wider socio-economic context. The main village problems included drug addiction and drug trafficking (Mazunte), bad drainage systems (Puerto Angel), and lack of jobs (Río Seco). None of the villagers considered dog-related problems as major, but when asked if there were dog-related problems, most villagers answered “Yes” (Mazunte $n = 31$, 86%; Puerto Angel n

= 29, 96%, and Río Seco $n = 23$, 74%), with no significant difference in the presence of dog-related problems among villages. Perceptions of villagers and tourists, and respondents' interactions with village dogs, are in Table 8. Two main dog-related problems in all villages were that there were too many dogs ($n = 48$) and that there were aggressive dogs ($n = 33$). Too many dogs or overpopulation was also perceived by one-third of tourists. In regard to experience with aggressive dogs, a few villagers were chased by dogs ($n = 6$), and more than one-third of villagers ($n = 35$, of 96 replies) had been bitten by a dog during their lifetimes. A few tourists ($n = 12$) also reported that dogs had chased them, and five tourists (of 149 replies) had been bitten by a dog during their stay.

With regard to dog-welfare problems, we refer to dogs with a visible disease or who are very thin. Dog-welfare problems were reported by villagers and tourists, with differences among villages and among origin of tourists. In the tourist villages, more villagers (Mazunte $n = 15$, Puerto Angel $n = 12$) perceived dog-welfare problems than villagers from Río Seco ($n = 3$) ($\chi^2 = 9.8007$, $df = 2$, $n = 99$, $p < 0.01$). More North American ($n = 31$) and European tourists ($n = 22$) perceived dog-welfare problems than Mexican tourists ($n = 22$) ($\chi^2 = 14.4021$, $df = 2$, $n = 151$, $p < 0.001$). One-third of villagers were concerned about feces on streets and beaches, whereas almost half of tourists were concerned.

More non-dog owners ($n = 9$, 28%) were disturbed by barking at night than dog owners ($n = 6$, 9%) ($\chi^2 = 4.8$, $n = 99$, $df = 1$, $p < 0.05$). More North Americans ($n = 19$) were disturbed by barking than Europeans ($n = 5$) or Mexican tourists ($n = 8$) ($\chi^2 = 16.0$, $n = 151$, $df = 2$, $p < 0.001$). One-third of tourists ($n = 48$) were concerned about the risk of acquiring zoonotic diseases from the dogs, but zoonoses were not considered a problem by most villagers ($n = 14$). A few villagers in Mazunte ($n = 7$) and Puerto Angel ($n = 3$) mentioned that free-roaming dogs show the community in a bad light to tourists.

One-third of tourists ($n = 45$) found it annoying to see dogs beg for food in restaurants. More than one-third of tourists ($n = 58$), nonetheless, gave food to village dogs during their visit ("daily" or "sometimes"). Possibly because there were plenty of fish leftovers, more villagers in Puerto Angel ($n = 12$) fed visiting dogs than villagers in Mazunte ($n = 3$) ($\chi^2 = 7.3$, $df = 1$, $n = 65$, $p < 0.01$), and fewer villagers in Puerto Angel were concerned with dogs stealing food ($n = 2$) than villagers in Mazunte ($n = 12$) and Río Seco ($n = 11$) ($\chi^2 = 7.9$, $df = 2$, $n = 99$, $p < 0.05$).

Table 8 Dog-related problems according to villagers and tourists, and respondents' interactions with village dogs (%)

Problems	Villagers				Tourists			
	Mazunte <i>n</i> = 37	Puerto Angel <i>n</i> = 32	Río Seco <i>n</i> = 30	Total <i>n</i> = 99	Mexican <i>n</i> = 67	European <i>n</i> = 38	North American <i>n</i> = 46	Total <i>n</i> = 151
Too many dogs	46	60	41	48	25	45	37	34
Aggressive dogs	38	33	28	33	-	-	-	-
Dog welfare	40**	40**	9**	30	33***	58***	67***	50
Dog feces	30	30	25	28	43	45	48	45
Dogs spill garbage	35	33	16	28	-	-	-	-
Dogs steal food	32*	7*	34*	25	12	5	9	9
Dogs beg for food	-	-	-	-	27	32	33	30
Breeding nuisance	27	23	22	24	16	5	15	13
Barking at night	19	10	16	15	12***	13***	41***	21
Zoonoses	24	7	9	14	27	34	37	32
Threat to wildlife	0	0	3	3	15**	8**	37**	20
Bad image	19	10	0	10	-	-	-	-
Dog poisoning	11	3	6	7	-	-	-	-
Dogs kill poultry	3	0	19	7	-	-	-	-
<i>Respondents Interactions with Village Dogs</i>								
Have visiting dogs ^a	51	70	37	55	-	-	-	-
Feed (visiting) dogs ^b	9*	40*	17*	20	42	47	31	40
Chased by a dog	8	0	9	6	9	6	7	8
Bitten by a dog ^c	35	47	25	36	3	0	7	3

*Different among villages at $p < 0.05$; **Different among villages or origins of tourists at $p < 0.01$;

***Different among villages or origins of tourists at $p < 0.001$; ^aTotal n for villagers = 95; ^bTotal n for villagers = 95, total n for tourists = 145; ^cFor villagers (total $n = 96$), the question referred to whether they had been bitten by a dog during their lifetime, whereas for tourists (total $n = 149$), the question referred to being bitten during their stay in the coastal region of Oaxaca

concerned about the risk of acquiring zoonotic diseases from the dogs, but zoonoses were not considered a problem by most villagers ($n = 14$). A few villagers in Mazunte ($n = 7$) and Puerto Angel ($n = 3$) mentioned that free-roaming dogs show the community in a bad light to tourists. One-third of tourists ($n = 45$) found it annoying to see dogs beg for food in restaurants. More than one-third of tourists ($n = 58$), nonetheless, gave food to village dogs during their visit ("daily" or "sometimes"). Possibly because there were plenty of fish leftovers, more villagers in Puerto Angel ($n = 12$) fed visiting dogs than villagers in Mazunte ($n = 3$) ($\chi^2 = 7.3$, $df = 1$, $n = 65$, $p < 0.01$), and fewer villagers in Puerto Angel were concerned with dogs stealing food ($n = 2$) than villagers in Mazunte ($n = 12$) and Río Seco ($n = 11$) ($\chi^2 = 7.9$, $df = 2$, $n = 99$, $p < 0.05$). A few villagers, especially in Mazunte, were concerned about dogs being poisoned en masse. More North Americans ($n = 17$) were concerned about dogs being a

threat to wildlife than Mexicans ($n = 10$) or Europeans ($n = 3$) ($\chi^2 = 12.9$, $df = 2$, $n = 151$, $p < 0.01$). Only three villagers in Río Seco were specifically concerned that village dogs ate turtle eggs and hatchlings.

Tourists were asked if they considered it necessary to control the village dog population and, if so, to mention possible control methods. Most ($n = 121$, 83%) considered control of the dog population necessary, with no significant difference in opinion by origin of tourists ($n = 146$). Tourists ($n = 96$, 67%) suggested control methods, which were (in order of frequency): sterilize the dog, make owners responsible, build animal shelters, euthanize sick dogs, prohibit free-roaming, and allow only one or two dogs per household.

Figure 2 summarizes the dog-keeping system of the coastal villages studied. Village dogs get food from multiple sources, such as garbage and are given food from tourists and villagers (dog owners and non-dog owners), as well as from sea turtle nests. Village dogs get health care from veterinarians, Mexican health authorities, and their owners. Despite the various functions of village dogs, such as for protection and companionship, these animals cause various problems for villagers and tourists, such as defecating on the street and barking. Additionally, dogs may transmit zoonotic diseases to villagers and tourists, even though villagers do not acknowledge this as a problem.

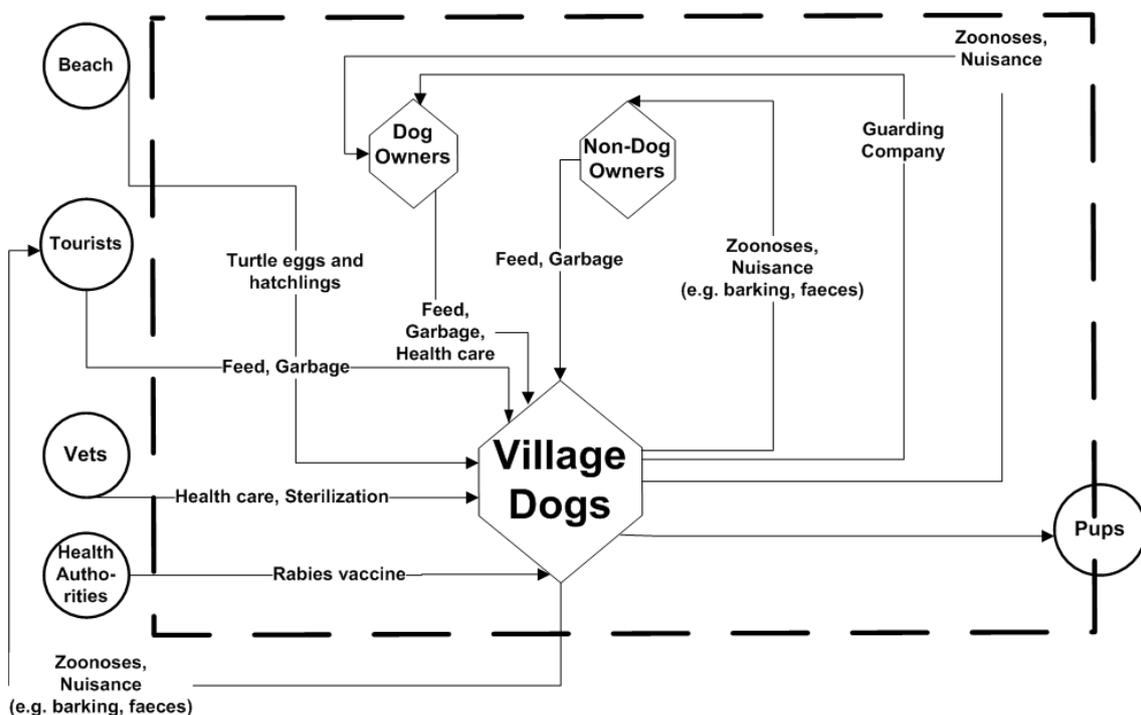


Figure 2 Village dog-keeping-system in rural Oaxaca, Mexico

2.4 Discussion

2.4.1 Village dog population demographics

The dog population demographics in this study are similar to those found in some other dog population studies: sex bias for males over females and low life expectancy (Orihuela and Solano 1995; Butler and Bingham 2000; Kitala *et al.* 2001; Ortega-Pacheco *et al.* 2007). The male:female ratio in Río Seco is higher than in other studies, but similar to what was found in rural areas of Chile (Acosta-Jamett *et al.*, 2010). In our study this is explained by the preference for male dogs and the culling of female pups. This finding supports the hypothesis that the sex bias in dogs may be anthropogenic in nature (Macpherson, Meslin and Wandeler 2000). The number of dogs per household (ranging from 1.6 to 1.9), and the human:dog ratio (ranging from 2:1 to 4:1) are similar to those found for rural villages in Yucatán, Mexico (Ortega-Pacheco *et al.* 2007).

Although in the tourist villages dogs got better health care (more visits to a veterinarian, vaccinations, and bathing) than in the farming village, there were very few dogs older than 6 years in all the villages, which indicates a rapid population turnover. A rapid population turnover is characteristic of village dogs with high fecundity and low survivorship (Kitala *et al.* 2001). It is possible that in all three villages, dogs are exposed to the risks of being poisoned or being hit by a car.

2.4.2 Free-roaming dogs

Village dogs have been present in Mexico for at least 4000 years before colonization by the Spanish (Valadez-Azúa and Mestre-Arrijoja 1999) and were most likely roaming free. Before Spanish colonization, the identity of a *perro callejero* (stray dog) did not exist or was not seen as disagreeable and giving a bad image (Valadez-Azúa and Mestre-Arrijoja 1999). This agrees with what we found in the (indigenous) farming village Río Seco, where all dogs roamed free and nobody was concerned with dogs projecting a bad image. We agree with Poss and Bader (2007), therefore, that the culture of Latin-American people may be an important component in allowing dogs to roam free, and it would be enlightening to study this relation between dogs and culture in more detail.

We believe that dog-keeping practices and perceptions in regard to free-roaming dogs are also influenced by current tourist development. In the tourist villages, unlike in the farming village, not all owners allowed their dogs to roam free, and some villagers were concerned about dogs giving the village a bad image. Allowing dogs to roam free may have advantages over keeping

dogs enclosed because it reduces the work, management, and costs of keeping dogs; for example, both dog owners and non-dog owners were involved in feeding visiting dogs. Allowing dogs to roam free, however, also has disadvantages for villagers: villagers complained about aggressive dogs and various other dog problems. Although a few villagers and tourists were chased and bitten by dogs, the problem of aggressive dogs seems to be of a lesser degree than was found in a Latino community in Texas, where most respondents (81%, $n = 165$) answered that free-roaming dogs prevented them from walking outside (Poss and Bader 2007). In New Providence, The Bahamas, dog barking at night was found as the most common and frequent nuisance for dog owners and non-dog owners (Fielding 2008a). In our study sites, nuisances related to free-roaming dogs, such as feces on the street and spilling of garbage, were more often mentioned, and barking was mainly a nuisance for non-dog owners and North American tourists. We found inconsistency in that although most dog owners (82%) let their dogs roam free, only 17% of villagers openly agreed with allowing village dogs to roam free. Villagers possibly answered in terms of what was considered to be appropriate to the outside world, rather than in terms of what they believed, which can occur with in-person surveys (Leggett 2003).

2.4.3 Perceptions of the dog-keeping system by villagers and tourists

Despite differences in dog-keeping practices, the perceptions of the villagers did not differ among villages. Different to Fielding, Samuels and Mather (2002), we did not find any gender difference in opinions about dog reproduction. Villagers were comfortable with the idea of sterilizing female dogs, but less comfortable with the idea of sterilizing male dogs, which agrees with Fielding, Samuels and Mather (2002). Half of the villagers, nevertheless, believed that female dogs should breed at least once in their lifetime. Breeding females, therefore, could be a pre-requisite for sterilization, which also agrees with Fielding, Samuels and Mather (2002), although wanting a dog to breed is different from wanting a dog to “come on heat” (Fielding, Samuels and Mather 2002). Consistent with the explanation given by various villagers, that female dogs deserve to experience mothering, it appears that villagers highly value motherhood, breeding, or both, and that villagers apply human concerns on reproduction to their dogs, which was also reported by Fielding, Samuels and Mather (2002).

Although many tourists suggested sterilization as a solution to dog-related problems, very few dogs were sterilized, probably because the cost of surgery

limits its use in coastal villages of Oaxaca. Sterilizations were offered at no cost, however, during the annual dog sterilization campaign by foreign veterinarians, so one would have expected more dogs to have been sterilized, given that most villagers agreed on sterilization. It is possible, therefore, that just as with allowing dogs to roam free, villagers answered in terms of what was considered to be appropriate to outsiders, rather than in terms of what they believed (Leggett 2003).

2.4.4 Dog welfare

We have three explanations for differences between tourist and farming villages in regard to perceiving dog-welfare problems. First, people in Río Seco suffer a lack of jobs and health services. According to the hierarchy of needs (Maslow 1943), fulfillment of lower-order needs is necessary before higher-order needs are fulfilled. It is possible, therefore, that people in Río Seco have not yet considered dog welfare to be relevant, because their own basic needs are not fulfilled. Second, tourist development and the influence of foreigners may have unbalanced the dog-keeping system in the tourist villages (Figure 2). The availability of food from the tourist industry may be seasonal, and dogs might find it difficult to obtain enough food when tourists are gone. Availability of food, together with a lack of control of the dog population, may result in a large population of poorly fed village dogs that are prone to disease. We did not, however, measure body condition score of the village dogs. Third, it is possible that tourists have influenced villagers' perceptions on the welfare of dogs and the keeping of dogs.

That more North American (67%) and European (58%) tourists perceived problems of dog welfare than Mexican tourists (33%) may be due to a different frame of reference (see Boogaard, Oosting and Bock 2006) based on different economic and socio-cultural backgrounds. Dog-keeping practices in the tourist villages of Mazunte and Puerto Angel most likely failed to meet expectations of foreign visitors, just as American tourists visiting the Bahamas probably got the impression that "Bahamians do not care as much for their pets as they do" (Fielding 2008b, p. 358).

In our study, compared with Plumridge and Fielding (2003), however, more tourists admitted giving food to dogs during their stay (40% compared with 1%), probably because of different tourist types: cruise ship passengers vs. alternative and backpacker tourists, and because tourists in our study had more opportunities to interact with village dogs. Village dogs with poor welfare may

contribute to an unpleasant experience, apart from other inconveniences that tourists may face during their stay in a rural coastal area. Tourists' opinions about dogs, therefore, may affect the local economy (Plumridge and Fielding 2003). We did not ask tourists, as Plumridge and Fielding (2003) did, if they owned a dog at home or if they were members of an animal welfare group, which could have also influenced tourists' opinions: pet owners and members of an animal welfare group could be more critical of dog-keeping practices. Boogaard, Oosting and Bock (2006) found that pet owners perceived the quality of life of farm animals less positively than non-pet owners.

2.4.5 Dog overpopulation and poisoning

It is evident that dog overpopulation is a problem in the studied villages, as shown by the human:dog ratio and as perceived by villagers and tourists. There is no indication of a cultural opposition to euthanasia, as reported by Hsu, Severinghaus and Serpell (2003) in Taiwan—most villagers agreed on euthanasia for sick dogs. Lack of veterinary services, together with lack of money, however, may account for why dog poisoning was a main cause of deaths in dogs, as seen in the village survey. Furthermore, 17% of villagers agreed on dog poisoning as a control method, whereas only 2.5% ($n = 6$) of respondents in a study in Dominica mentioned poisoning, among other solutions, to deal with animal overpopulation (Alie *et al.* 2007). It has long been known (WHO 1988) that culling dogs, be it humane or inhumane, is not a long-term solution to control dog populations; where dogs are removed, others migrate into the area to fill the ecological niche (WHO 1988). Rural villages in the coastal region, however, have no strategy or planning to solve their dog-related problems. Poisoning, therefore, is used as a fast, cheap culling method when overpopulation becomes too problematic.

2.5 Recommendations

It could become important to improve dog welfare, especially for residents of the tourist villages Mazunte and Puerto Angel. Villagers could benefit tourists and non-dog owners by implementing simple strategies to reduce problems caused by dogs, such as keeping their dogs restrained at night. This is contrary, however, to many villagers' idea of a guard dog. Thus, restraining dogs at night would only work if security in the area also improved.

Efforts to control the dog population in the rural coastal region are aimed at prevention of rabies and protection of wildlife, whereas this study revealed that these problems were mentioned far less by local people than other dog-related

problems. The extent of the damage caused by dogs to sea turtles and their eggs is unknown in this area and is a subject for further research. In other coastal areas, such as in the Yucatán Coast of Mexico (personal communication, Eduardo Cuevas, Pronatura) and in Costa Rica (Leslie *et al.* 1996), up to 30% of nests are predated by dogs.

A next step in the search for solutions to dog-related problems would be to involve villagers. There is an opportunity to involve villagers in cooperating with governmental entities or NGOs, if these organizations also target the dog-related problems that villagers and tourists experience, and if opinions of villagers are taken into account when choosing methods to control the dog population.

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3

Human-dog interactions and behavioral responses of village dogs in two villages of Michoacán, Mexico



Eliza Ruiz-Izaguirre¹, Karen (C.) H.A.M. Eilers^{1,4}, Eddie A.M. Bokkers¹, Alessia Ortolani², Antonio Ortega-Pacheco³, Imke J.M. de Boer¹

¹Animal Production Systems Group, Wageningen University, Wageningen, the Netherlands

²Department of Animals in Science and Society, Faculty of Veterinary Medicine, Utrecht University, Utrecht, the Netherlands

³Faculty of Veterinary Medicine, Autonomous University of Yucatán, Mérida, Mexico

⁴Schuttelaar & Partners, a Communications Consultancy that gives strategic advice on sustainable agriculture and healthy food, Wageningen, the Netherlands

Submitted

Abstract

In Mexican villages, most households keep dogs that roam freely. Therefore, socialization of village dogs occurs in a different context than that of companion dogs in developed countries. The objectives of this study were: (1) to assess behavioral responses of village dogs towards familiar and unfamiliar humans, (2) to assess body condition of village dogs, and (3) to identify whether village or dog characteristics influence dog behavior and body condition.

Two coastal villages in Michoacán, Mexico, were selected as case study sites. The sites differed in availability of food sources for dogs and had a high season for sea-turtle nesting and tourism at the same time of the year. Sea-turtle eggs and hatchlings were available in the nesting village, and tourist refuse and handouts in the tourist village. Fifty-nine dogs were initially visited, 35 of which were repeatedly visited during the high and low seasons. Caregivers were interviewed regarding human–dog interactions, and dogs were behaviorally tested and rated for body condition. Behavioral indicators were: 1) the dog's qualitative response to a caregiver's call and 2) the dog's willingness to approach an unfamiliar human. Additionally, a dog census per village was conducted to ascertain the dog population structure. Dogs were kept by over 60% of households in both villages. Body condition was optimal for 68% of the dogs. In the low season, dogs in the nesting village were in better body condition than dogs in the tourist village ($P=0.007$). Dog characteristics that influenced behavioral responses were: sex, age, and whether the dog played with humans. The most common response to the caregiver's call was tail wagging, shown by 83% of male dogs and 50% of female dogs ($P=0.021$). Pups generally approached the unfamiliar human completely (76%), compared with juveniles (24%) ($P=0.040$) and adults (26%) ($P=0.026$). Human–dog play occurred mainly with children (77%). The percentage of dogs that played with humans was higher in dogs responding with tail wagging (82%) than in dogs showing the rest of response categories (withdrawal, baring teeth, and other) (50%) ($P=0.012$). Human–dog play was reported for 85% of the male dogs compared to 55% of the female dogs ($P=0.036$). This study showed that village dogs were socialized to familiar humans but were not attracted to unfamiliar humans. Village dogs maintained their body condition in the low season. Child-dog play may have a role in shaping village dog social behavior towards humans.

Keywords: village dogs, *Canis familiaris*, dog socialization, human–dog play, behavioral tests, body condition

3.1 Introduction

In rural areas in Mexico, most households keep dogs (*Canis familiaris*) (Orihuela and Solano, 1995; Ortega-Pacheco *et al.*, 2007a), and about 80% of these dogs roam freely (Ortega-Pacheco *et al.*, 2007a; Ruiz-Izaguirre and Eilers, 2012). These dogs are known as village dogs (Coppinger and Coppinger, 2001). Because of their rather independent, unrestrained life, socialization of village dogs to humans occurs in a different context than in companion dogs, living, for example, in Western European countries. Village dogs scavenge around the household, in the street, and in the village outskirts. Obtaining food may involve different forms of interaction with humans, from scavenging at a distance, to actually begging for household leftovers.

Village dogs may associate with one or various households (Boitani *et al.*, 2007), and this relationship has been characterized as possibly being symbiotic by Coppinger and Coppinger (2001), implying that village dogs gain benefits from humans (e.g. household leftovers), and humans from dogs (e.g. guarding household). Such a relationship presupposes the existence of social relationships and mutual recognition between caregivers and particular animals (Waiblinger *et al.*, 2006). The way in which domestic animals respond to humans is influenced by experiences with humans, and their response toward familiar (i.e. caregiver) and unfamiliar humans may differ (Waiblinger *et al.*, 2006). In principle, village dogs may experience negative, neutral, or positive interactions with humans. Available descriptions of village dogs in Africa, suggest that experiences with humans are mostly of a neutral nature, resulting in a typical scavenging behavior in proximity to humans, but generally keeping a safe (flight) distance (Coppinger and Coppinger, 2001). Flight distances of village dogs in Ethiopia to an unfamiliar human ranged from 0 to more than 5 m, with one third of dogs keeping a distance of more than 5 m (Ortolani *et al.*, 2009). A safe distance might be shorter, or even unnecessary for begging dogs that naturally approach unfamiliar humans in tourist areas. Food appears to be a central component to the human-(village) dog relationship (Coppinger and Coppinger, 2001). Therefore, dogs that regularly receive food leftovers (by caregivers or tourists), may be more willing to approach humans in general, and, more food may be reflected in a better body condition.

Villages along the Pacific Coast of Mexico present a unique opportunity to study human-dog interactions, because of two factors that influence the regular availability of food sources and may consequently affect dog social behavior and

body condition. The first factor is the seasonal presence of tourists, who often interact with village dogs. In villages of Oaxaca, Mexico, 30% of the tourists were annoyed by dogs that begged for food in restaurants, but nonetheless 40% of the tourists fed village dogs (Ruiz-Izaguirre and Eilers, 2012). The presence of tourists, therefore, might result in more socialized village dogs. The second factor is the presence of sea turtle nests. Along the Pacific Coast of Mexico, there are various important nesting sites for endangered sea turtles. And, it is locally known that village dogs scavenge turtle nests and eat eggs and hatchlings (Ruiz-Izaguirre and Eilers, 2012). In villages where turtle nests are present, therefore, village dogs might be less dependent on humans, and, consequently less socialized.

The objectives of this study, were: (1) to assess behavioral responses of village dogs towards familiar and unfamiliar humans, (2) to assess body condition of village dogs, and (3) to identify if some village or dog characteristics influence dog behavior and body condition. Village characteristics explored were: seasonal presence of international tourists and presence of sea-turtle nesting, whereas dog characteristics explored were: sex, age, whether human-dog play occurred, type of care provided by humans (i.e. feed, restrain), and the dog's association to other households.

3.2 Materials and Methods

3.2.1 Study Sites

Two rural coastal villages of the state of Michoacán in Mexico were selected as case study sites, as they differed in presence of tourists and turtle nests. The study was conducted from September 2008 throughout June 2009. The villages are located along the Pacific Coast of Mexico, about 30 km from each other. La Ticla village (18°27 N, 103°33 W) has 415 inhabitants, and Colola (18°18 N, 103°26 W) has 477, according to the latest census (INEGI, 2005). La Ticla village, further called tourist village, has seasonal presence of international tourists with a capacity to accommodate at least 300 tourists, and has minimal sea-turtle nesting along the beach (approximately 60 nests/year). Colola village, further called nesting village, has occasional visits of tourists, and is adjacent to Colola Sanctuary, an important nesting site for endangered sea turtles (approximately 4000 nests/year). The high season of tourists and sea-turtle nests occurred in the same period: from November through February. The rest of the months were considered to be part of the low season.

3.2.2 Dog census

Since no dog population data were available in the study site, a dog census was conducted in June 2009 (only after all households of the behavioral study had been visited at least once). Two researchers covered all village households asking residents which species were kept in the households, and in households with dogs, dog population data were gathered (number of dogs, age and sex of each dog, and whether any dogs had died in the last month).

3.2.3 Experimental setup

Fifty-nine dogs of 56 households were prospectively recruited during 6 months by: approaching caregivers in their homes and asking them to participate, approaching people with dogs walking on the street or beach, and using the 'snowball' method (i.e. asking the participant to refer someone else who had dogs). First, an appointment was made with a household member to visit the household at a time when the dog was usually at home. After the first visit, we continued to visit caregivers once a month for a maximum of nine visits.

A pup was defined as younger than or equal to 16 weeks; a juvenile as a dog older than 16 weeks and younger or equal to 12 months; and an adult as a dog older than 12 months. This adult threshold was chosen because most village dogs reach maturity in approximately 12 months (Lord *et al.*, 2012), whereas the puppy threshold was chosen because pups older than 16 weeks are past their sensitive period of socialization (Coppinger and Coppinger, 2001). Only those village dogs that were at least 7 weeks old and which had at least one caregiver were included. Caregivers were defined as people from the main household, in which the dog is fed and is most likely to be located during the day. A maximum of two dogs per household were accepted. In case of two dogs, one was a juvenile or pup and one was an adult.

3.2.4 Interview

All visits started with an interview. The first interview lasted approximately 20 minutes, and subsequent interviews lasted about 10 minutes. During the first interview, dogs were identified by photographs, and description of: name, sex, birth date (approximate for older dogs), type and color of coat, as well as additional characteristics such as the presence of scars. The caregiver was interviewed in the backyard of the household, which is often characterized as an open area surrounded by bushes without any fences.

The interview covered questions regarding various aspects of human-dog interactions during the last month prior to the interview (Table 1). In the first interview, we collected information about human-dog play (i.e. gender and age of all people who played with the dog including other households), feeding and tethering of dogs, and whether dogs visited other households. In subsequent visits, we asked whether any of these aspects changed since the previous interview, and if yes, how. Answers were entered directly in a Palm Tungsten E2 PDA (Personal Digital Assistant) (Palm, Inc., Sunnyvale, CA, USA) with CyberTracker application (www.cybertracker.org). At the end of the interview, if the dog was not already in the backyard, the caregiver was asked to bring the dog to the backyard. Once the dog was in the backyard, and within the researcher's sight, the testing procedure started.

Table 1 Summary of interview questions with a dog named Aguinaldo as an example

	First visit	Monthly visits
Human-dog play		
Does someone from your household or outside the household play with Aguinaldo? (yes/no)	X	X
If yes, who plays with him? (gender and age of all who play)	X	
If yes, how do you (or someone else) play with him? (describe)	X	
Husbandry and Health		
How often do you feed him? (daily/every other day/less than every other day)	X	X
Does Aguinaldo eat in other households? (yes/no)	X	X
Has Aguinaldo been tethered for periods of the day or night? (yes/no)	X	X
Does Aguinaldo visit other households? (yes/no)	X	X
Have you had any problems with Aguinaldo in the last month? (yes/no)	X	X
If so, what type of problems?	X	X

3.2.5 Testing procedures

Due to the study conditions, it was necessary to test the dog as quickly and efficiently as possible to maximize the chances that the dog would display a normal response to the caregiver while minimizing any possible interference from the unfamiliar human (researcher). We therefore recorded dogs' responses towards humans in exclusive categories of behavior following Ortolani *et al.* (2009). The testing procedures attempted to represent a short visit from a stranger. During subsequent visits, if the initial caregiver was not at home, another family member was asked to call the dog. All tests throughout the study

period were carried out by a female researcher, who at the time of the first interview was unfamiliar to the dogs.

3.2.5.1 Familiar human test

The dog was in site in the backyard, and could be standing or laying. The unfamiliar human adopted a crouched position at one of the sides of an imaginary line crossing the caregiver and the dog, approximately 3 m away from the caregiver, which was also at least 3 m away from the dog. The caregiver was asked to call the dog (by name) using what was considered to be the usual friendly call. Human postures and vocalizations (tone and volume of voice, as well as additional accompanying sounds of a normal friendly call such as whistles) varied by each caregiver, and were not recorded. In case the dog did not acknowledge the call (i.e. by not rising his ears, and/or looking in the direction of the caregiver), the caregiver was instructed to call the dog again for a maximum of three times. The dog's response was rated within five seconds after the (acknowledged) caregiver's call. The response of the dog was rated in one of four exclusive categories: (1) tail wagging, (2) withdrawal, (3) baring teeth, or (4) other. Tail wagging was defined as repetitive wagging movement of the tail; withdrawal as moving away from the caregiver with the head or the body (irrespective of this being only a few centimeters, or meters); baring teeth as showing front teeth to the caregiver, and other as all other responses not fitting the three previous descriptions (e.g. standing or laying down still, approaching the caregiver without any of the previous descriptions).

3.2.5.2 Unfamiliar human test

Immediately after rating the reaction towards the caregiver's call, the unfamiliar human (i.e. researcher) stood up slowly, with her arms to her side, slightly leaning her head towards the dog, looking in the direction of the dog (but without staring at the dog's eyes), and called the dog by name using a friendly tone of voice, followed by the word *ven* ('come' in Spanish). For dogs that did not respond within five seconds, the researcher called the dog a maximum of three times before rating the response. The response was rated as: (1) complete approach (less than 20 cm), (2) partial approach (more than 20 cm to 3 m), and (3) no approach. After the first visit, it became apparent that there were also some dogs that fled when called. Given that this response had not been included in the response categories, dogs that fled were rated as 'no approach' in the unfamiliar human test. Only in the first visit was the researcher considered as an unfamiliar human. Dogs in the longitudinal study were tested during their last

visit using the same testing procedures as described for the unfamiliar human test. In this last visit, we did include as an additional category (4) “dogs that fled when called”, which was defined as the dog running away from the researcher. This category was included in the last visit in order to know how frequently this occurred in dogs that were possibly already habituated to the researcher.

3.2.5.3 Body condition score

After the two behavioral tests (i.e. familiar and unfamiliar human), body condition was rated using the 9 point Laflamme Scale (Laflamme, 1997). This scale is described in the Purina Body Condition System, and rates dogs ranging from emaciated to obese. A body condition score (BCS) of 1-4 is below optimum, a BCS of 5 is optimal, and a BCS of 6-9 is above the optimum (Laflamme, 1997). All scores were determined visually. In some cases the dog left the household after the behavioral tests, and the researcher had to look for the dog in the streets in order to rate body condition.

3.2.6 Statistical analysis

3.2.6.1 First visit

The software package R (R Development Core Team, 2010) was used for statistical analysis of the data. We used descriptive statistics for the outcomes of the behavioral tests, and for human-dog play data (i.e. type of games played, and age and gender of 98 human play partners). To analyze the relation between dogs' behavioral responses and interview items, the outcomes of the behavioral tests were expressed in binary notation. For the familiar human test, a dog responding with tail-wagging was coded as 1, and the rest of responses as 0, since tail wagging was considered an indicator of a positive social response to the caregiver (Scott and Fuller, 1965). When more than 50% of dogs showed a response different than tail wagging, a sub-categorization was used as well, i.e. if the dog responded with other (1) or not (0). All interview items were expressed in a similar notation (e.g. tethered=1; not tethered=0). Finally, the binary outcomes of the behavioral tests and the binary answers of the interview items were analyzed with the chi-square test, or the Fisher's exact test, when minimal cell size was less than 5 (Siegel and Castellan, 1988). The same was done to analyze the effect of dog sex and village. To account for habituation of the dogs to the researcher, the response to the researcher's call (which in the first visit was the unfamiliar human) was compared between the first and last visit, using the McNemar test for correlated proportions.

3.2.6.2 Monthly visits

The analysis of the monthly visits for 35 dogs was done in two steps because the data were unbalanced (e.g. dogs died, or were not found during some visits). Criteria to include dogs in the longitudinal analysis were: they had at least three visits and two behavioral tests (one during the high season and one during the low season). Based on the date of the visit, each visit was classified as belonging to the high or low season. First, we calculated the proportional occurrence of tail wagging and interview items for each study dog per season (i.e. high and low), and total (both seasons). For BCS we computed the overall mean per season and total, corrected by the number of visits.

The proportional occurrence of tail wagging and interview items and the mean BCS were not normally distributed, and therefore nonparametric tests were used. A Kruskal-Wallis test was used to find out whether the proportional occurrence of total tail wagging (i.e. both seasons) differed in dogs that were tested with one, two, three, or four caregivers. A dependent two-group Wilcoxon Signed Rank Test was used to compare the proportional occurrence and mean BCS between the high and low season. Within season, the effect of dog sex and village on the proportional occurrence of tail wagging and of interview items were analyzed with independent group Mann-Whitney U tests.

3.3 Results

3.3.1 Dog census

Dogs were kept in 64% of the households in the tourist village (N=89) and 62% in the turtle-nesting village (N=85), with no differences between villages. Other animal species kept were: poultry (57%), pigs (23%), cats (22%), and parakeets (11%); other animals like horses or goats were owned by less than 10% of households. Table 2 shows the dog census demographics of the turtle-nesting (Colola) and tourist (La Ticla) villages. In both villages the male to female dog ratio was 2:1. The human to dog ratio was higher in the turtle-nesting village because there were fewer dogs, and there was a tendency to have more dogs per household in the tourist village. The dogs had an average age of 3.8 (\pm 3.1 SD) years, and 39% of the dogs were younger than one year.

3.3.2 First visit: Characterization of human-dog interactions, and dog behavioral responses

Most caregivers were women (Table 3). The majority of the female caregivers, were mothers or grandmothers, whereas the majority of the male caregivers

Table 2 Dog population demographics in two coastal villages in Mexico

	Turtle-nesting n=83	Tourist n=111	Total n=194^a
Dog characteristics (%)			
Males	68	65	66
Females	32	35	33
Younger than 1 year	32	44	39
Mortality in last month	9	2	11
Population parameters			
Mean no. of dogs per household ^b	1.6	1.9	-
Male:female ratio	2:1	2:1	-
Human:dog ratio ^c	5.7:1	3.7:1	-

^a Total number of dogs kept by 110 households, 53 in the nesting village and 57 in the tourist village

^b Refers only to households that reported to have dogs, and the difference between the two villages is marginally significant (Two sample t-test, $p=0.078$)

^c The human:dog ratio was calculated by dividing the total human population per village, by the total number of dogs per village in our census

were children living with parents. No dogs were sterilized nor belonged to a specific breed. More male (69%) than female (31%) dogs were included in the study (Table 4). The age of dogs ranged from 1.8 to 119.8 months.

Table 3 Family characteristics of caregivers based on first visit

	Men n=11	Women n=45
Parent (%)	27	67
Child living with parents (%)	64	14
Grandparent (%)	9	17
Couple (no children) (%)	0	2
Age mean (SD) ^a (y)	23.7 (18.9)	35.4 (16.5)

^a Significant difference between means at $p<0.05$

There were no differences between villages regarding interview items or body condition. Ninety-six percent of the studied dogs, were fed daily by their caregivers, 68% visited other households, and 28% were fed also in other households. Tethering for periods of day or night occurred in 28% of the dogs, of which 35% were males and 6% females (Fisher's exact test $p<0.05$). BCS ranged from 4 to 6 in the nesting village, and from 1 to 7 in the tourist village, with 68% of the dogs having an optimum or higher BCS (≥ 5) (Figure 1).

Seventy-six percent of dogs played with someone from the household or outside the household, and there were no differences per dog age group. For each dog

Table 4 Age category and sex of village dogs for the first visit

	Adults	Juveniles	Pups	Total
Males (n (%))	20 (65)	13 (72)	8 (80)	41
Females (n (%))	11 (35)	5 (28)	2 (20)	18
Total (n)	31	18	10	59
Age mean (range) ^a	31.7 (12.6-19.8)	6.5 (3.74-12)	2.7 (1.78-3.64)	-

^a In months, the cutoff for 16 weeks is 3.70 months (obtained by dividing 16 weeks into a 4.3 weeks)

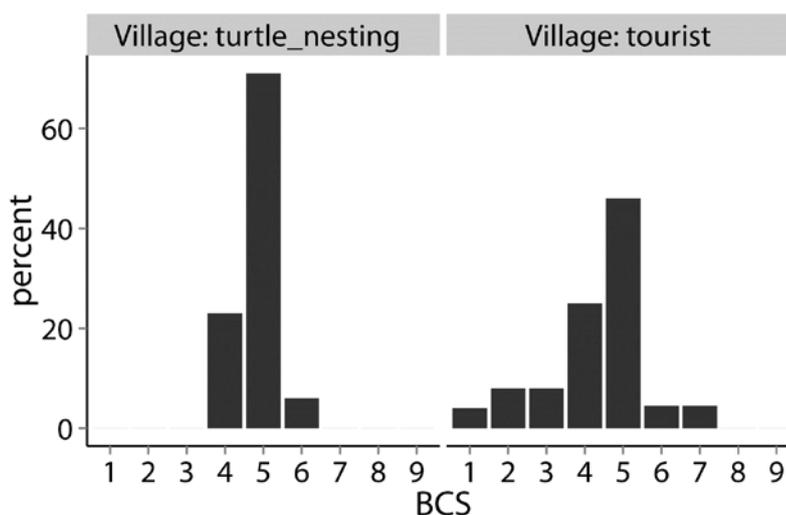


Figure 1 Body condition score (BCS) for turtle-nesting and tourist villages on a 1-9 scale. A score of 1-4 is below optimum, a score of 5 is optimal, and a score of 6-9 is above the optimum

reported to engage in human-dog play, one to five humans were reported to play (58% were men, 42% were women, and 77% were younger than 10 years old, $M=4.3$ years \pm 2.7 S.D.). Human-dog play was reported in 85% of the male dogs compared to 55% of the female dogs ($\chi^2=4.38$; d.f.=1; $p=0.036$). One or more of the following games were mentioned by caregivers: chase (57%), rough and tumble (23%), fetch (14%), and other (25%) (asking the dog to jump or give a paw, or riding on the dog like a horse). Chase was described by caregivers as dog and human chasing each other. Rough and tumble was described as dog and human wrestle. Fetch was described as playing with a stick or stone. Eight caregivers reported having the following problems with their dogs' behavior: aggressiveness ($n=2$), chasing away passer-bys ($n=2$), killing sea-turtles ($n=1$), temporarily leaving household because of mating ($n=1$), bringing down clothes (to sleep on them) ($n=1$), and spilling the garbage ($n=1$).

3.3.3 Behavioral tests during the first visit

Table 5 shows the responses to the familiar and unfamiliar human tests during the first visit by age group. There was no age effect regarding the response to the familiar human test; pups, juveniles and adults responded mainly with tail wagging. The rest of responses included the categories: 'other' (16%), 'withdrawal' (8%), and 'baring teeth' (3%). Tail wagging was shown by 83% of male dogs compared to 50% of female dogs ($\chi^2=5.3$, d.f.=1; $p=0.021$), and within the rest of response categories, fewer male (14%) than female dogs (89%) responded with 'other' (Fisher's exact test, $P=0.001$). The percentage of dogs that played with humans was larger in dogs responding with tail wagging (82%), than in dogs responding with the rest of response categories (50%) ($\chi^2=6.2$, d.f.=1; $p=0.012$). Similarly, the percentage of dogs that played with humans tended to be larger in dogs that completely approached the unfamiliar human (94%), than in dogs that did not (67%) (Fisher's exact test $p=0.073$).

Age had an effect in the test with the unfamiliar human. Most pups approached the unfamiliar human completely (76%), compared with juveniles (24%) ($P=0.040$) and adults (26%) ($P=0.026$) (Table 5). Instead, most juveniles responded with a partial approach (range of 1 to 3 m), or no approach, whereas

Table 5 Behavioral responses of village dogs for the first visit by age group

	Adults n (%)	Juveniles n (%)	Pups n (%)	Total n (%)
Familiar human test (n=59)				
Tail wagging	21 (68)	13 (72)	9 (90)	43 (73)
Rest ^a	10 (32)	5 (28)	1 (10)	16 (27)
Unfamiliar human test (n=50) ^b				
Complete approach	6 (26)	4 (24)	7 (70)	17 (34)
Partial or No approach	17 (74)	13 (76)	3 (30)	33 (66)

^a The rest of responses included the categories: other, withdrawal, and baring teeth

^b Significant difference between pups and juveniles (Fisher's exact test, $P=0.040$), and between pups and adults (Fisher's exact test, $P=0.026$)

most adults did not approach at all (Figure 2). The percentage of dogs that completely approached the unfamiliar human was higher in dogs that showed tail wagging to the caregiver (94%), than in dogs showing the rest of response categories (6%) (Fisher's exact test $p=0.004$). There was a tendency for dogs' responses to the unfamiliar human to change after several visits: 11 dogs that were not willing to completely approach in the first visit (n=25), eventually did

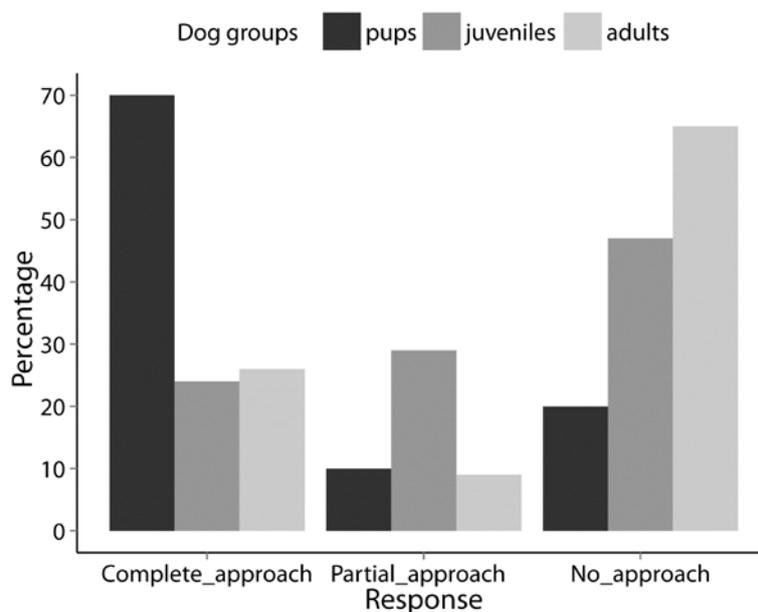


Figure 2 Response to the unfamiliar human test by age group

so in the last visit (McNemar test, $\chi^2=3.5$, d.f.=1; $P=0.061$). Nevertheless, during the last visit, 53% of dogs still did not approach completely the unfamiliar human, and 2 of these actually fled.

3.3.4 Longitudinal study and impact of season

Dogs included in the longitudinal study (N=35) were sometimes tested with different caregivers: 42% were tested always with the same caregiver, 27% with two caregivers, 21% with three caregivers and 10% with four caregivers. There were no differences in the proportional occurrence of tail wagging response (familiar human test), between dogs tested with one caregiver, and dogs tested with more than one caregiver (Kruskal-Wallis test, $\chi^2=0.101$, $p=0.992$). The proportional occurrence of tail wagging reflects the average number of times a dog responded with tail wagging in all testing sessions per season (familiar human test).

Table 6 shows the median proportion of tail wagging and interview items, differentiating between village and dog sex, per season. There were no differences between seasons on any interview item, or behavioral test and BCS, but there were differences within season with regard to village and dog sex. During the low season, the dogs of the turtle-nesting village had a higher proportional occurrence of tail wagging (median 1), than dogs in the tourist

village (median 0.66) ($U= 205.5$, $z=2.332$, $p= 0.019$), whereas there were no significant differences in the high season. Also during the low season, dogs in

Table 6 Median proportion of tail wagging (familiar human test) and interview items, by village and sex in the high and low season of sea-turtle nesting and tourism

	High				Low			
	Village		Sex		Village		Sex	
	Nest	Tourist	Male	Female	Nest	Tourist	Male	Female
Tail-wagging	1	0.67	0.75	0.58	1 ^a	0.66 ^b	1	0.87
Play	1	0.75	1 ^c	0.33 ^d	0.92	0.75	1 ^a	0.33 ^b
Tethered	0	0	0	0	0	0	0	0
Visits other	0.83	0.70	0.66	1	0.75	0.75	0.75	0.75
Fed daily	1	1	1	1	1	1	1	1
Eats in other	0.33	0.50	0.33	0.33	0.20	0.25	0.20	0.20
Problem	0.16	0	0.33 ^a	0 ^b	0.08	0	0	0

^{a,b} Significant difference between columns at $p<0.05$

^{c,d} Significant difference between columns at $p<0.01$

the turtle-nesting village had a higher BCS (median 5) than dogs in the tourist village (median 4.33) ($U= 218$, $z=2.633$, $p= 0.007$). With regard to sex, human-dog play was more reported in male (median 1) than in female dogs (median 0.33) during both the high ($U= 63$, $z=-2.815$, $p= 0.004$) and the low season (males median 1, females median 0.33) ($U= 80.5$, $z=-2.126$, $p= 0.033$). In the high season, caregivers reported more problem behaviors for male dogs (median 0.33) than for female dogs (median 0) (chasing passer-bys, domestic animals, trying to bite, etc.) ($U= 69$, $z=-2.588$, $p= 0.009$). This included three male dogs who actually were reported to bite.

3.4 Discussion

In this study Mexican village dogs responded most frequently to their caregiver's call with tail wagging. Dog tail wagging towards humans is generally indicative of an emotionally friendly response (Scott and Fuller, 1965; Rappolt *et al.*, 1979; Vas *et al.*, 2005; Tami and Gallagher, 2009). Our results differ from behavioral observations in Pemba, an African island, where dogs did not respond at all to a caregiver's call, and village dogs there did not even have a name (Coppinger and Coppinger, 2001). The fact that dogs in our study site had names and played with humans may indicate a different attitude towards dogs, typical of traditional Mexican culture, in which dogs have been historically relevant as companions and mythical symbols (Valadez-Azúa and Mestre-Arrijoja, 1999). That dogs play a role in the area is further confirmed by

the fact that dogs were the most common animal species kept by households in our study site. Consistent with other other village dog studies (Ortega-Pacheco *et al.*, 2007a; Boitani *et al.*, 2007; Ortolani *et al.*, 2009; Ruiz-Izaguirre and Eilers, 2012), our dog census also revealed a skewed male:female ratio of 2:1. Reasons for the skewed sex ratio include high pup mortality (Lord *et al.*, 2012), and culling of female pups by humans in Mexican villages (Ruiz-Izaguirre and Eilers, 2012). It was not possible to include equal numbers of males and females in our study, and this is especially noticeable in the pups age group (8 males and 2 females).

In interpreting the behavioral test results, certain factors that could have influenced the responses should be considered. For example, dogs were free to leave household premises at any time, or could be distracted by other dogs, backyard animals or humans. Another factor to consider is the motivation of an animal to have social contact with familiar and unfamiliar humans (Waiblinger *et al.*, 2006). Therefore, it would have been useful to know if dogs were hungry (e.g. hungry dogs could have been more motivated to respond with tail wagging and approach the unfamiliar human), or if dogs were exhausted from walking outside the household (e.g. exhausted dogs might not have been motivated to respond with tail wagging or to approach the unfamiliar human).

In regard to the unfamiliar human test, most adult dogs were not willing to approach the unfamiliar human, and although there was a tendency to approach after repeated visits, still more than half of the dogs did not approach during the last visit. It is difficult to contextualize our results given the dearth of other behavioral village dog studies. Our results are not comparable to the only other study available (Ortolani *et al.*, 2009), because our unfamiliar human test quantified attraction to humans, rather than measuring the maximum approach distance (i.e. dogs were approached by an unfamiliar woman in the street or outside households). Nevertheless, we would like to propose two explanations for village dogs' unwillingness to approach. One is related to the local practice of tethering pups (for some hours during the day) to teach the dog to stay at home. Tethering is also a common punishment for unwanted conduct (e.g. chasing, biting). Isolating dogs during sensitive periods for social development limits their experience with other humans and may therefore contribute to avoidance behavior (Appleby *et al.*, 2002). This appears, however, not have been the case in our study site, since pups were socialized with humans and reported by their caregivers to engage in human-dog play. Our expectations were that juveniles

and adults would also approach the unfamiliar human, as usually dogs that have been handled during the sensitive period of socialization do (although with some variation) (Scott and Fuller, 1965). Our test results also showed that there was a relation between test responses to familiar and unfamiliar humans. The percentage of dogs approaching the unfamiliar human was higher in dogs that responded with tail wagging to the caregiver, than in dogs showing the rest of response categories. Nevertheless, not all dogs that were socialized to their caregivers approached the unfamiliar human. Therefore, a second more probable explanation for the unwillingness to approach may be that the dogs in our study site may not associate positive experiences with unfamiliar humans. It is possible that as pups grow up and start roaming in the streets, experiences with unfamiliar humans range from neutral to negative. Ortolani *et al.* (2009) found that 70% of Ethiopian village dogs on the street, ignored the majority of passer-bys, including the unfamiliar woman (before she approached the dog). Dogs in our study interacted with other people in the village outside from those of their household, e.g. by regularly visiting and playing with people from other households. Pups in this study visited other households as much as juveniles and adults. Visits were in general to neighboring households or those of the relatives of caregivers. It is therefore possible that interactions outside the household occur mainly with specific people. For Mexican village dogs, socializing with specific people may involve less risks, because not all villagers like dogs and some may consider them a nuisance (Ruiz-Izaguirre and Eilers, 2012).

Contrary to what we expected, body condition was not related to behavioral responses or to dog characteristics. Most village dogs were in optimal (5), or close to optimal (4-6) body condition score. This corresponds with what was reported for village dogs in Ethiopia, where 96% of dogs were in a fair body condition (Ortolani *et al.*, 2009), but differs from street dogs in the city of Merida, Mexico, where 60% of dogs were underweight and only 36% of dogs were in an ideal state (Ortega-Pacheco *et al.*, 2007b). In general, it appeared that village dogs in both villages were able to maintain their body condition also in the low season. The fact that dogs in the turtle-nesting village had a better BCS than dogs of the tourist village during the low season, could be related to higher quality food from caregivers in the turtle-nesting village, when food outside the household is scarce. In the tourist village, there were more dogs per household (as shown in the dog census), so there may be less food available per dog. Contrary to our initial hypothesis that dogs in the nesting village would be less

socialized than in the tourist village, our results did not find any difference in neither the first visit or the longitudinal study. In fact, dogs in the turtle-nesting village responded more with tail wagging during the low season. Dogs in the turtle-nesting village are important as wildlife deterrents in the farming fields, and thus are taken out daily for long walks with various members of the household. This contributes to regular and positive experiences with caregivers in the low nesting season, whereas dogs may be spending less time with caregivers in the high season due to the availability of sea turtle nests. There was no village difference in the responses of dogs to unfamiliar humans, which could mean that begging food from tourists is not widely practiced by the dog population, but only by a few dogs, as perhaps tourist handouts and refuse, cannot support more begging dogs in this small tourist village.

Dog characteristics that influenced the behavioral responses were age, sex and whether the dog played with humans. Pups were more willing to approach the unfamiliar human than adults, this could be explained by the fact that pups are in their sensitive period for socialization (Scott and Fuller, 1965), and their motivation to flee unfamiliar humans is not strong (Freedman *et al.*, 1961). The fact that more male than female dogs responded with tail wagging, could be due to both biological and human factors. Female dogs in our study site may have less experiences with humans (either of positive or negative nature), because caregivers interact less with them (e.g. less female dogs were reported to play with humans). Furthermore, female dogs may spend less time with humans due to reproductive investment. Ghosh *et al.* (1984), for example, reported that estrus females spend more than 70% of the time in association with male conspecifics, and often leave their own locality to seek males.

The fact that playing with humans was related to the response to familiar and unfamiliar humans, shows that play interactions occur regularly and are of a positive nature. Male dogs were more reported to play with humans than females both in the first visit and in the longitudinal study. In village-dog pups in India, male pups initiated more play interactions with other pups (65%) than females (45%) (Pal, 2010), but no data exists for adult village dogs, and human-(village) dog play. Sex differences in human-dog play could be explained by the overt preference of villagers for male dogs, reflected in the skewed male:female ratio. The finding that most dogs play with children younger than 10 years old was unexpected and is worth of further study. To our knowledge, this has not been investigated for village dogs elsewhere, although there are anecdotal

reports (Coppinger and Coppinger, 2001). In other countries, like Germany, 66% of children play with companion animals; the most common animal being the dog (Rost and Hartmann, 1994). In the U.S.A., where dogs are also the most common companion animals, children play with animals several times per week (Melson, 1988). The influence of child-dog play on dog behavior is however unknown. Although human-dog play appeared to be a positive aspect for dog socialization in our study site (since this was related to tail wagging), it is widely known from other studies that children are a high risk group for dog bites (Kahn *et al.*, 2003). Three dogs in this study were reported to bite adult villagers, but we were informed of other dog bite incidents which involved children also. Some of the games described may at times be too harsh for the dog, and children (particularly toddlers) were at times seen riding their dogs. Training children on how to safely approach and interact with dogs could be beneficial to them. Since children enjoy playing with dogs, they could be motivated to help in turtle predation prevention strategies, such as by temporarily restraining dogs (e.g. at night when sea-turtles arrive on the beach), by training dogs not to leave family premises, or even by discouraging them from digging turtle nests.

3.5 Conclusion

This study showed that village dogs in two coastal villages of Michoacán, Mexico with seasonal influence of tourists and sea-turtle nests are socialized with familiar humans. Female dogs were less reported to engage in human-dog play, and did respond less with tail wagging to the caregiver's call. Village dogs older than 16 weeks (both males and females) were reluctant to approach the unfamiliar human. Most dogs were in optimal body condition, which was not related to the behavioral response to the caregiver. During the low season, dogs in the turtle-nesting village had, however, a better body condition than dogs in the tourist village. According to our results, it was mainly children who played with village dogs, and we believe that they may play an important role in shaping village dog behavior.

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4

Roaming characteristics and feeding practices of village dogs scavenging sea-turtle nests



Eliza Ruiz-Izaguirre¹, Karen (C.) H.A.M. Eilers^{1,2}, Sip E. van Wieren³, Arthur van Woersem³, Guido Bosch⁴, Akke J. van der Zijpp¹, Imke J.M. de Boer¹

¹Animal Production Systems Group, Department of Animal Sciences, Wageningen University, Wageningen, the Netherlands

²Schuttelaar & Partners, a Communications Consultancy that gives strategic advice on sustainable agriculture and healthy food, Wageningen, the Netherlands.

³Resource Ecology Group, Department of Environmental Sciences, Wageningen University, Wageningen, the Netherlands

⁴Animal Nutrition Group, Department of Animal Sciences, Wageningen University, Wageningen, the Netherlands

Submitted

Abstract

Village dogs are reported to prey on sea-turtle nests at various beaches worldwide. Sea-turtle species present in Mexico include six out of seven species worldwide, all of which are listed under the IUCN Red List of Threatened Species. So far however, it is not clear why dogs scavenge and how they are introduced into nesting areas; this hinders effective management of dogs at sea-turtle nesting beaches. Hunger, for example, could be a driving factor for village dogs to scavenge sea-turtle nests. Mexican village dogs are usually fed corn tortillas, which may be insufficient to provide energy and essential nutrients. A prerequisite for nest scavenging is traveling to the beach. Nest scavengers, therefore, are expected to travel longer distances than non-nest scavengers. Furthermore, it is relevant to know the extent to which dogs are introduced onto nesting beaches by humans, or if dogs travel alone or with other dogs. The aim of this study, therefore, was to gain insight into roaming characteristics and feeding practices of dogs scavenging sea-turtle nests. Movements of 19 village dogs (9 nest scavengers and 10 non-nest scavengers) at Colola village and beach (an important nesting ground for the black turtle: *Chelonia mydas*) were monitored through radio-tracking and direct observations. Using these data, we computed 'distance from home to beach' and 'the activity range' of nest scavengers and non-nest scavengers. Furthermore, caregivers were interviewed regarding feeding practices. Nest scavengers had a lower metabolic energy intake of tortillas (296 kJ/kg BW^{0.75}) than non-nest scavengers (464 kJ/kg BW^{0.75}) (2 sample *t*-test= 2.67, *p*=0.017). Moreover, 39% of caregivers reported that they provided turtle eggs or egg shells to their dogs at least once. Nest scavengers had a larger mean distance from home (494 m) than non-nest scavengers (307 m) (2 sample *t*-test, *t*=-3.72, *p*=0.002). Dogs were generally found at the beach at night (42%) and dawn (34%), whereas they generally were in the village during the day (50%). Seventy-eight percent of nest scavengers were accompanied by other dogs at least once at the beach, compared to 30% of non-nest scavengers (Fisher's exact test, *p*=0.046). The present findings have implications for the management of dogs at sea-turtle nesting beaches. We recommend that dogs' movements should be restricted between night (21.00 hours) and dawn (06.00 hours) and that sufficient and adequate feeding of dogs should be promoted among caregivers; in particular, sea-turtle eggs and shells should be excluded from the dogs' diet.

Keywords: village dogs, *Canis familiaris*, activity range, home range

4.1 Introduction

As humans live closer and closer to nature protected areas (Manor and Saltz, 2004), the potential negative effects of accompanying dogs (*Canis familiaris*) on native wildlife are a current global concern (Hughes and Macdonald, 2013). In tropical areas, dogs from nearby villages are known to enter nature protected areas where they can prey on endangered wildlife (Butler and Toit, 2002; Paschoal *et al.*, 2012; Silva-Rodríguez and Sieving, 2011). With a global population of around 700 million, dogs are considered one of the most numerous carnivores worldwide (Hughes and Macdonald, 2013). Around 80% of these dogs can be categorized as village dogs (Ortolani *et al.*, 2009; Lord *et al.*, 2012). Village dogs are typically free-roaming and scavenge refuse around human dwellings, but may also get additional food from humans (Boitani *et al.*, 2007).

Village dogs' access to wildlife does not necessarily require hunting, for which dogs are not specialized (Coppinger and Coppinger, 2001; Boitani *et al.*, 1995). Dogs, like other canids (e.g. foxes and coyotes), can be opportunistic feeders at sea-turtle nesting areas because of their great olfactory capacity and because digging is part of their natural behavior (Odendaal, 1997).

Since the 1980s, village dogs have consistently been reported as posing a threat as scavengers of sea-turtle nests on various beaches worldwide (Ruiz-Izaguirre and Eilers, 2012; Patino-Martinez *et al.*, 2008; Hitipeuw *et al.*, 2007; Ordoñez *et al.*, 2007; Newbury *et al.*, 2002; Andrews, 2000; Broderick and Godley, 1996; Fowler, 1979). Nest predation by dogs varies across sites and ranges from 5% to more than 50% of nests (Patino-Martinez *et al.*, 2008; Ordoñez *et al.*, 2007; Hitipeuw *et al.*, 2007; Fowler, 1979). In Mexico, there are over 30 important nesting beaches along the Pacific Coast and the Gulf of Mexico (CIPCTM, 2006). Sea-turtle species present in Mexico include six out of seven species worldwide, all of which are listed under the IUCN Red List of Threatened Species. The black turtle (*Chelonia mydas*) population is in danger of becoming extinct due to, among other things, overexploitation of eggs and killing of adult females at nesting beaches (Seminoff, 2012).

Although it is well known that village dogs prey on turtle nests, it is not clear why village dogs scavenge, and whether and how dogs arrive themselves or are introduced into nesting areas; this hinders effective management of dogs in sea-turtle nesting beaches. Hunger has been hypothesized as a driving factor for companion animals to prey on wild vertebrates (Kays and DeWann, 2004).

Mexican village dogs are usually fed corn tortillas (Orihuela and Solano, 1995; Ruiz-Izaguirre and Eilers, 2012), which may be insufficient to provide energy and essential nutrients (Orihuela and Solano, 1995). Poorly fed dogs were more likely to prey on wild vertebrates in Southern Chile (Silva-Rodríguez and Sieving, 2011). Whether feeding also has a role in dog scavenging of sea-turtle nests is not known.

Another factor that could influence nest scavenging is resource distance. In this context, dogs partly behave like Central Place Foragers (Houston and McNamara, 1985). Like Central Place Foragers, village dogs generally return every day to a particular household (i.e. a central place), and every trip to the beach can be considered as a round trip. We hypothesize that non-nest scavengers can either find or get enough food close to their household; this may be reflected in shorter travel distances from home.

Although traveling to the nesting beach is a prerequisite for scavenging turtle nests, not all dogs found on the beach scavenge. Furthermore, it is known that village dogs do not only enter nature protected areas by themselves; they also do so by accompanying humans, for example, for hunting or company (Paschoal *et al.*, 2012; Silva-Rodríguez and Sieving, 2011). Therefore, it is important to know whether dogs are introduced onto nesting beaches by humans, or whether dogs travel alone or with other dogs. Socializing when searching for food is advantageous for dogs for example, because they learn where to find food and what to eat (Lupfer-Johnson and Ross, 2007). We therefore expected dogs to scavenge together with other dogs.

This study aimed to gain insight into roaming characteristics and feeding practices of dogs scavenging sea-turtle nests in order to understand why dogs do or do not scavenge. We have the following research questions: 1) Is insufficient provision of food (i.e. tortillas) by humans a driving factor for turtle nest scavenging?, 2) Do turtle nest scavengers travel longer distances than non-nest scavengers?, and 3) Do dogs visit the beach alone, or with other dogs or humans?

4.2 Materials and Methods

4.2.1 Study area

This study was conducted at the sea-turtle nesting beach of Colola Sanctuary, and the neighboring Colola village, from December 2010 to March 2011. Colola Sanctuary was chosen because of its ecological importance (Alvarado-Diaz *et al.*,

2003) and because up to now no dog management has been carried out (apart from beach watchers shooting a few dogs annually); this enabled the study of village dogs in their natural state. Colola Sanctuary is an important nesting ground for the East Pacific green turtle (*Chelonia mydas*), commonly known in Mexico as the black turtle. Female black turtles nest in Colola Sanctuary throughout the year, but have a high season from November through February. Colola Sanctuary contains approximately 2800 nests/year, which is 60% of all nests in the state of Michoacán, Mexico (Alvarado-Diaz *et al.*, 2003). Other species nesting at Colola include olive ridley turtles (*Lepidochelys olivacea*) (511 nests) and leatherback turtles (*Dermochelys coriacea*) (fewer than 20 nests).

The beach that runs from the village through Colola Sanctuary is 5 km long and delimited on the west and east by mountain rocks, on the north by the seashore, and on the south by the federal road. Colola village (477 inhabitants) is a Nahuatl indigenous community, with farming as the main livelihood. The main crops are tomatillo and maize. Around 60% of the households in Colola keep village dogs (chapter 3). Villagers are allowed to collect turtle eggs for household consumption only from the village beach, as it is a local custom to eat them, just like in other coastal communities of Mexico (Nichols and Palmer, 2006). The Sanctuary beach is patrolled for poaching every night during the high nesting season by beach watchers (male volunteers from the village), who have a camp inside the Sanctuary. Furthermore, beach watchers and international volunteers relocate nests to a protected area in the turtle camp.

4.2.2 Village dog selection and categorization

Village dogs were selected after a seven-week preparatory phase of this study. During this phase, two researchers walked daily along the beach to identify beach-visiting dogs and their caregivers. Twenty-five beach visiting dogs were selected, which is about 30% of the dog population in Colola (chapter 3). Selection criteria were: the dog was seen on the beach at least once without human company (during the preparatory phase), and a caregiver was found who agreed to have the dog radio-collared and to be interviewed. Dogs selected were local village dogs of no defined breed, or mixed breeds. All dogs were identified by photos and by individual characteristics such as age, sex, color, approximate body weight, and body condition score (BCS). BCS was rated using a 9-point scale (Laflamme, 1997), which rates dogs from being emaciated to obese. A BCS of 1–4 is below optimum, a BCS of 5 is optimal, and a BCS of 6–9 is above the optimum (Laflamme, 1997). After the study was finished, dogs were categorized as nest scavengers or non-nest scavengers. A dog was

categorized as a nest scavenger if one of the researchers saw the dog scavenge a turtle nest at least once during the whole period of study, including the preparatory phase. Nest scavenging dogs were either observed during the tracking sessions or photographed by researchers who encountered dogs in their trips along the Sanctuary beach (e.g. going from the turtle camp to the village or to monitor disturbed nests for another project).

4.2.3 Interview

All dogs belonged to different households, except for one household from which two dogs (Ulultik and Yapago) were selected. In total, therefore, 18 caregivers were interviewed regarding their dog-feeding habits. They were asked what, how often, and how much they fed their dogs on a daily basis. In addition, they were asked whether they had ever provided turtle eggs to their dogs, and they were questioned about their opinion on whether dogs should search for food themselves or whether it was acceptable for dogs to roam freely. Their opinions were elicited to improve characterization of their feeding habits, and to distinguish their attitude towards pups (defined as younger than four months) and juvenile/adult dogs. During this interview, the location of the household was recorded with a handheld GPS (Garmin GPS 60 Atlantic 010-00322-51).

4.2.4 Radio-tracking

Dogs were fitted with VHF radio-collars by their caregivers. A researcher instructed the caregiver about how to fit the collar and ensured that the collar was neither too tight nor too loose. Instead of using estimated triangulated polygons, actual dog locations were gathered following Meek (1999). Dogs were located with a radio receiver and a 5-element yagi directional folding handheld antenna. In the village, we tracked dogs by walking through the main village streets and passing by households of study dogs. On the beach, we tracked dogs by walking and/or driving (quad) along the shoreline. Once a dog was located by the receiver, the researcher walked in the direction of the dog until the dog was fully visible within approximately 20 m, or the beeping sound was strong and regular. For those fixes in which the dog was not clearly visible (e.g. dog inside a household or hidden in the bushes), we deem that fixes were at a maximum of 50m from the exact location of the dog. When the dog was fully visible, dog company (dog alone, with other dogs, or with humans) was recorded also. Locations were entered directly into the handheld GPS. From January to mid-March 2010, the dogs were tracked for a total of 45 days in two main areas: Colola village and Colola Sanctuary beach. Colola village included:

1a) the village (including two dogs that lived in the village outskirts) and 1b) the village beach. The village beach (1b) was defined as the beach corresponding to the village, delimited to the east by mountain rocks and to the west by a sign (used by beach watchers). Colola Sanctuary beach included the rest of the beach, delimited at its west end also by mountain rocks and for logistical reasons separated for tracking into zone 2a and zone 2b (Figure 1). Again for logistical reasons, Colola village (1a) and beach (1b) were considered as zone 1 for tracking. Tracking consisted of one-hour episodes, and only one fix per dog per hour was included. The latter was done to prevent correlation bias, which occurs when locations are too close in time and space (Andreka *et al.*, 1999). If a dog was located more than once during a tracking episode, the following criteria were used to select the fix: 1) a fix outside the household was preferred over a fix at the household and 2) a visual observation was preferred over a radio signal, even if the fix was at the household. If neither of these applied (e.g. two observations outside the household), the fix taken first was chosen. A measurement day consisted of 24 hours with three tracking times (one per zone, repeated daily in the same order). Every day the tracking hours were changed by adding one hour to the original time. For example: on day one, tracking occurred at 7:00, 15:00, and 23:00 hours, whereas the next day tracking

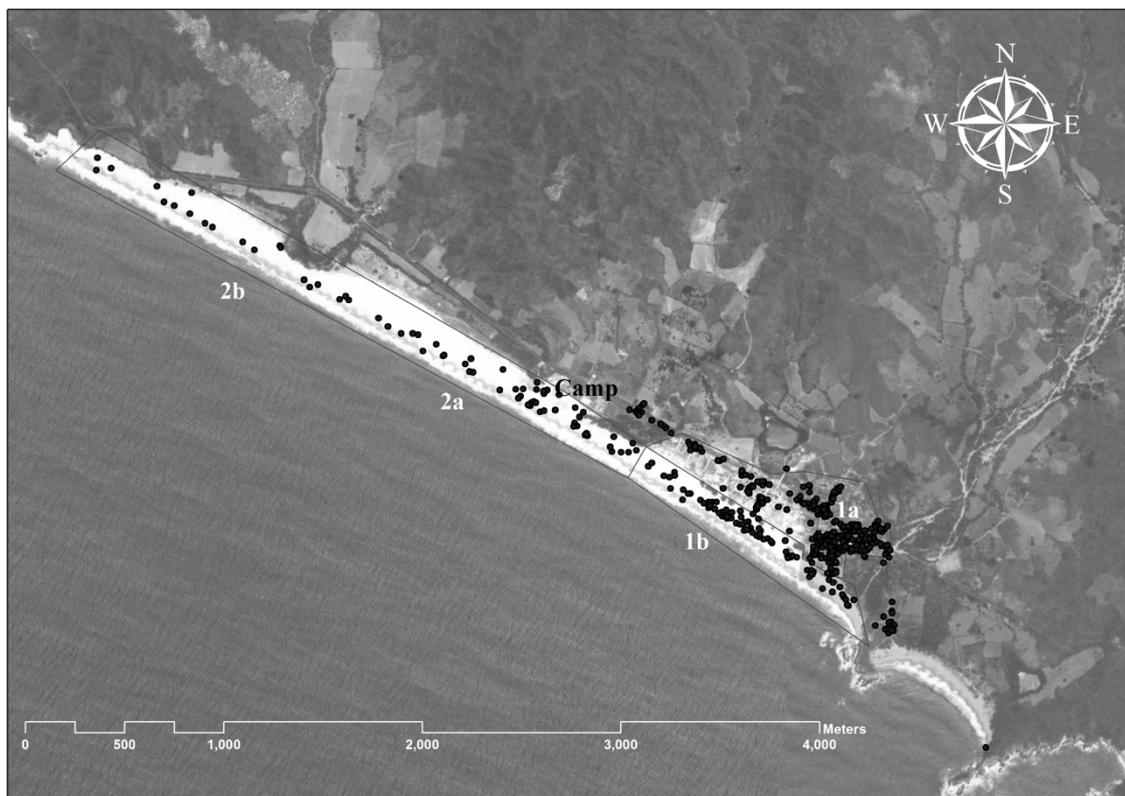


Figure 1 Zone boundaries, (1a) village, (1b) village beach, (2a and 2b) Sanctuary beach

occurred at 8:00, 16:00, and 24:00 hours. The locations stayed the same, corresponding to the three zones. This was done to ensure that zones were monitored at each hour of the day. This is referred to as the first tracking period. During the last three weeks, the late night tracking on zone 1 was suspended because of villagers' disapproval. In zones 2a and 2b, tracking episodes occurred only from 6:00 to 9:00 and 19:00 to 10:00 (as dogs were rarely seen on the Sanctuary beach other than at dawn and night hours). This is referred to as the second tracking period. During the course of the study, additional random observations were taken if studied dogs were encountered by the trackers outside fixed monitoring hours.

4.2.5 Parameter computation and statistical analysis

Of the 25 dogs that participated in this study, six were excluded from the analysis: two for losing their collar, three for not having a minimum of 30 fixes, and one because of failure of the collar. From 1002 fixes, 41 were excluded for exceeding the one fix per dog per hour, according to the aforementioned exclusion criteria, and 75 radio signals for lacking a strong and regular beep (indicating that the dog was within 50 m). A total of 886 fixes of 19 dogs, therefore, were included for the statistical analysis; of which 477 fixes included dog company (dog alone, with other dogs, with humans). For each dog, the Euclidian distance between its household and the closest beach area was calculated; this is referred to as 'distance home to beach'. Moreover, for each fix, the distance from the dog's household was calculated; this is referred to as 'activity range'. For each dog, the mean activity range was calculated, excluding the fixes at the household. The mean activity range of one dog (a Shepherd mix) was found to be an outlier (Grubb's test $Z=2.68$, $p<0.05$), and, therefore, was excluded from further analysis of activity ranges.

Unless otherwise stated, all statistical analyses were carried out with Statistical Analysis Software (version 9.2, SAS Institute Inc.). We determined the probability of a dog being found at a given activity range with a Kaplan-Meier survival analysis, treating distance as time (Jansen *et al.*, 2012). We determined the area that a dog covered with a kernel density home range based on a 90% contour in ArcMap 10.00. Home ranges were determined by a Gaussian Kernel Density Estimation performed in Geospatial Modelling Environment Version 0.7.2.0 (Beyer, 2012). After a visual review of several fixed bandwidths, a bandwidth of 5000 was used as it resulted in the most realistic shapes (not too small or elongated) for the home ranges. Based on the local time, each fix was categorized as dawn (6:00–9:59), day (10:00–17:59), dusk (18:00–20:59), or night

(21:00–5:59). Fixes taken during the second tracking period (when times were adapted) were not included in the analysis of time.

Villagers fed corn tortillas to their dogs daily. Other food items, such as fish or meat leftovers, were difficult to quantify and were not given on a daily basis, and therefore were not included in the analysis. As feeding practices are independent, data in the household with two dogs were only considered for one of the dogs (Ulultik). To approximate the metabolic energy (ME) content of tortillas, we assumed a chemical composition of: 11 g moisture, 8.5 g protein, 4.4 g fat, 2 g fiber and 1.6 g ash, per 100 g of corn flour (García Méndez, 2004). The nitrogen-free extract (NFE) was calculated as 100-moisture-protein-fat-fiber-ash contents in g/100 g flour (NRC, 2006). The ME content of tortilla flour was calculated using the modified Atwater factors (NRC, 2006); $ME (kJ/100g) = 14.6 \times \text{protein content} + 35.6 \times \text{fat content} + 14.6 \times \text{NFE content}$. The ME content in baked tortillas was corrected for the different moisture content, which was estimated to be 46% (García Méndez, 2004). The weight of the total number of tortillas per day was calculated assuming a weight of 50 g per tortilla, which was based on the average weight of tortillas at four households. The ME from the tortillas fed daily to each dog was then calculated and expressed in kJ ME per kg of $BW^{0.75}$. Student *t*-tests were used to find differences between nest scavengers and non-nest scavengers in: activity range, distance home to beach, daily amount of ME from tortillas fed, and number of beach visits. With regard to dog company, the percentage of fixes per company category (dog alone, with other dogs, or with humans) was calculated for each dog in the village and on the beach. The presence of dogs alone, or with other dogs or humans at the beach was analyzed with chi-square tests. Villagers' answers to the opinion questions were analyzed with chi-square tests (comparing answers given for pups with answers given for adults). Other answers are reported as percentages.

4.3 Results

Table 1 shows the total number of fixes at the household, the beach, and the village, and with and without data about company. Fixes at household comprised 19% of fixes. We had more data about company at the village (including fixes at household) (58%, $n=409$) than at the beach (36%, $n=68$) ($\chi^2 = 28.3$, $p < 0.001$). In 61% of fixes with company data, dogs were observed alone both in the village and beach. While visiting the beach, 78% of nest scavengers were seen with other dogs at least once, compared to 30% of non-nest scavengers (Fisher's exact test, $p=0.046$). The proportion of beach-visiting dogs

Table 1 Number of fixes at the household, per zone, and with and without data about company

Company	Village			Beach ¹	Total fixes (village + beach)
	Outside	At household	Total		
With	280	129	409	68	477
Without	249	42	291	118	409
Total	529	171	700	186	886

¹Includes the village beach (zone 1b) and Sanctuary beach (zones 2a and 2b)

(41%) that were seen at least once with humans at the beach, however, did not differ by nest scavengers or non-nest scavengers. From the preparatory phase, we know that dogs interact with other dogs on the beach via mating, playing, walking together, and digging out turtle nests. Dog activities on the beach with humans included: accompanying fishermen, accompanying people walking or jogging, and playing with children.

Nine out of 19 dogs included in our study were categorized as nest scavengers; five were confirmed by photos and four by observations (Table 2). Four out of 19 dogs were female. Age of dogs was on average three years. The total number of fixes ranged from 35–74, which on average implies one observation per dog per day. Mean activity range was 172 m to 995 m. Distances within village boundaries, village beach, and village outskirts did not exceed 1400 m (Figure 2). Although only three dogs did not move more than 1400 m from their household, the probability of finding a dog at a distance greater than 1000 m was less than 10% (Figure 2). Nest scavengers had a larger mean activity range (494 m) than non-nest scavengers (307 m) (2 sample *t*-test, $t=-3.72$, $p=0.002$). This is also reflected by the probability curves (Figure 2), which differed for nest scavengers and non-nest scavengers (Log rank test of equality across strata, chi-square=20.74, $d.f.=1$, $p<0.0001$). The home ranges of the two groups, however, did not differ. Both nest scavengers and non-nest scavengers had home ranges that did not exceed village limits (Figure 3). Distance from home to beach was not correlated with the number of beach visits. Moreover, nest scavengers and non-nest scavengers did not differ in their number of beach visits and in the distance from home to beach. Dogs were generally found at the beach at night (42%) and dawn (34%) (N=102 beach fixes of first tracking period), whereas they were generally found in the village during the day (50%) (N=285 village fixes of first tracking period) ($\chi^2=67.7$, $p<0.001$).

Table 2 Characteristics of beach-visiting dogs

Dog	Scavenging confirmed ¹	Sex	Age (y)	Total fixes (n)	Activity range (m)	Home range (ha)	Beach visits (n)	Home to beach (m)	Tortilla intake ²	BCS ³	BW (kg)
Non-(nest) scavengers											
Bulburi	-	m	1	40	285	11.16	2	48	487	4	17
Doggy	-	m	4	67	290	13.4	18	68	652	4	18
Manchas	-	m	10	59	351	13.31	12	166	258	5	20
Mesly	-	f	2	35	399	13.96	12	140	280	3	18
Mocha	-	f	1	36	446	16.6	3	214	584	5	17
Mojo	-	m	1.5	39	216	9.4	6	75	373	4	18
Paloma	-	f	7	39	172	9.47	7	44	583	6	18
Teddy ²	-	m	4	44	995	17.21	7	134	431	5	20
Ulultik	-	m	1	55	413	20.54	14	211	535	5	15
Yapago	-	m	1	41	195	8.15	2	209	-	5	16
Average	-	-	3.2	45.6	307	12.8	8.4	131	467	4.5	17.8
Nest scavengers											
Gaviota	P	f	3	52	470	9.59	13	122	301	6	20
Guantes	S	m	2	43	395	31.26	12	92	344	4	20
Lolo	S	m	3	56	481	39.74	17	149	153	3	16
Pinto	S	m	3	74	419	19.86	23	288	406	5	15
Popis	P	m	4	43	439	16.1	10	274	120	5	22
Pufy	P	m	1.5	38	589	20.68	14	125	186	4	18
Puja	S	m	1	41	745	8.28	8	120	344	5	20
Suki	P	m	8	43	400	17.3	2	249	290	4	10
Zorro	P	m	2	40	507	16.26	4	343	521	6	22
Average	-	-	3	47.7	494	19.8	11.4	196	296	4.6	18

1.-= information was not available, P= photo, S=sighting;² Metabolizable energy of tortillas in kJ adjusted per kg of BW^{0.75}; ³BCS= Body condition score, 5 is optimal;⁴Outlier for mean activity range (Grubb's test Z=2.68, p<0.05)

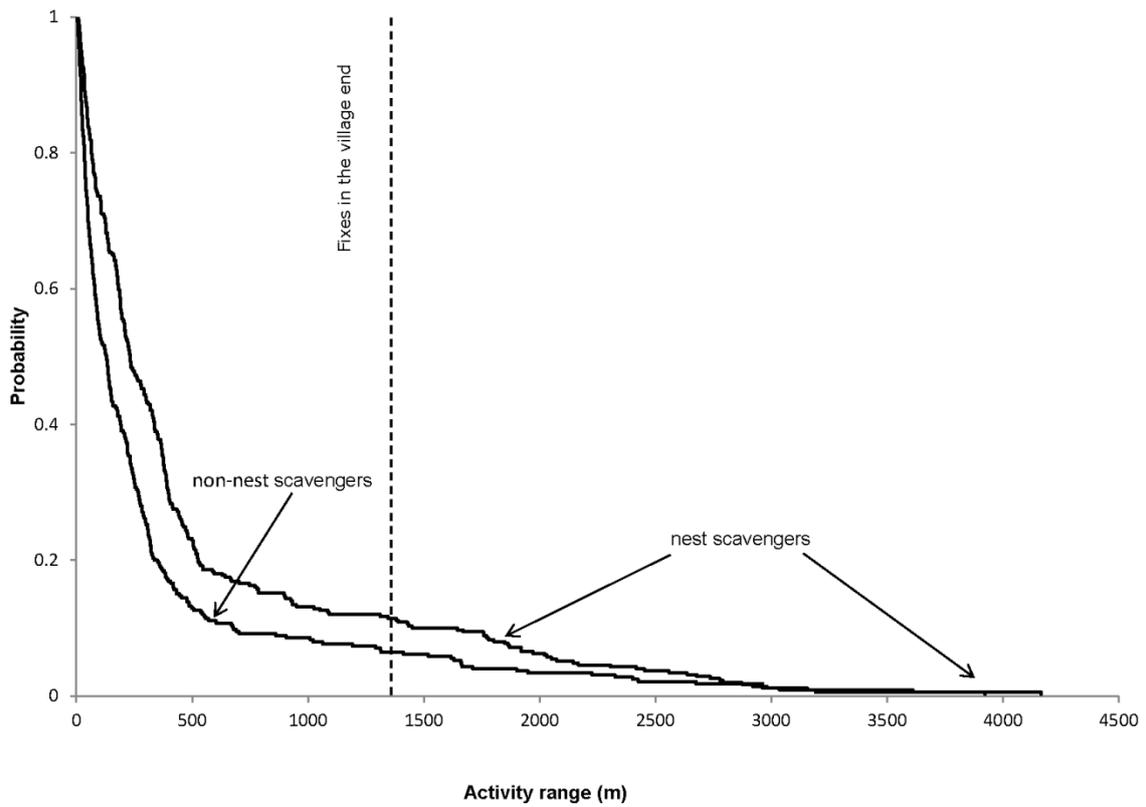


Figure 2 Kaplan-Meier survivorship curve showing the probability density of the activity range on the whole study area

Note: The dotted line marks where sightings in the village (including village beach) end

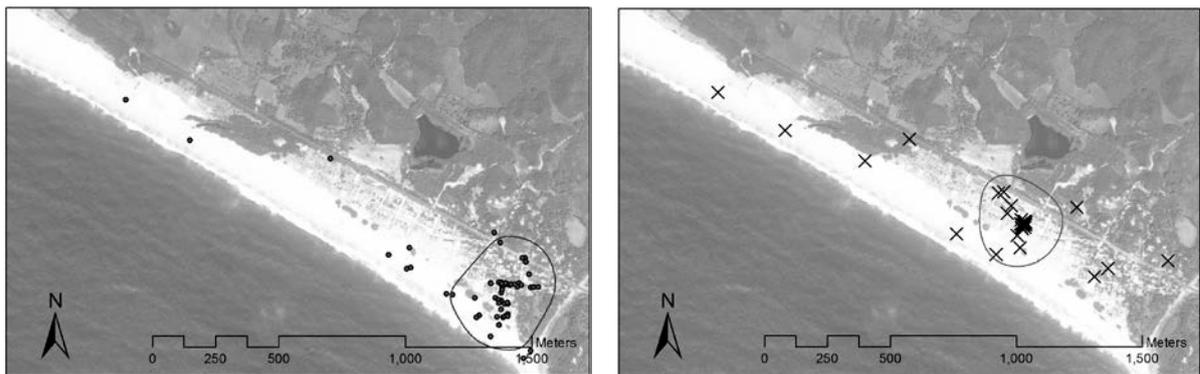


Figure 3 Home ranges of two dogs

ME from tortillas per kg expressed per $BW^{0.75}$ ranged from 120 to 652 kJ. Nest scavengers had a lower ME intake of tortillas (296 kJ) than non-nest scavengers (464 kJ) (2 sample t -test=2.67, $p=0.017$). Body condition, however, did not differ between them. In fact, except for two dogs, all dogs had a BCS of 4–6, which is close to optimal. Fourteen out of 18 dogs included in our feeding analysis

received, apart from tortillas, table scraps on a weekly basis. One or more of the following table scraps were mentioned by caregivers: fish leftovers (n=12), chicken leftovers (n=11), beef/pork leftovers (n=6), milk leftovers (n=5), and chicken eggs (n=1). Fish, beef, pork, and chicken leftovers included: broth, bones, and skins. Five dogs received chicken leftovers every other day, and only one dog (a nest scavenger) on a daily basis. The remaining table scraps were given only once or twice a week.

Caregivers' answers regarding opinions differed for pups and juvenile/adult dogs. Forty-three percent of caregivers considered that it was acceptable for dogs to search for food themselves, but 75% did not consider the same for pups (Fisher's exact test, $p=0.019$). With regard to free-roaming, 71% of caregivers considered that it was acceptable for dogs to roam freely, with no significant differences between pups and juvenile/adults (Fisher's exact test, $p=0.848$). Thirty-nine percent of caregivers indicated that they had at least once given turtle eggs or egg shells to their dogs, with no differences between nest scavengers and non-nest scavengers.

4.4 Discussion and conclusion

The aim of this study was to gain insight into roaming characteristics and feeding practices of dogs scavenging sea-turtle nests in order to understand why dogs do or do not scavenge. Nest scavengers and non-nest scavengers were classified on the basis of photos or personal observation. This type of classification is not 100% reliable for the non-nest scavengers' category. The probability of non-nest scavengers being wrongly classified is, however, low in that none of the five trackers saw them scavenging nests during the whole period of this study. Nevertheless, non-nest scavengers could still be at risk of becoming nest scavengers, as they fulfill a prerequisite for scavenging, which is visiting the beach.

Compared to non-nest scavengers, dogs that scavenged sea-turtle nests at Colola beach had a larger mean activity range and a lower ME intake from tortillas provided by humans. Living close to the beach (distance from home to beach) was not related to scavenging of dogs, or beach visits. Our results, therefore, indicate that some dogs intend to travel to the beach to scavenge. This intentional traveling to the beach to scavenge differs from egg predation of ground nesting birds (laying two or three eggs), which incidentally occurred when dogs were preying on other small mammals (see for example, Yanes and Suárez 1996).

We can conclude that lower provision of tortillas at the household might be one of the drivers for village dogs to scavenge sea-turtle nests. This conclusion is supported by the interview results, which suggest that once dogs are old enough to scavenge, they are fed only limited amounts of tortillas (i.e. 43% of caregivers considered it acceptable for juvenile/adult dogs to search for food themselves, but 75% did not consider the same for pups). Dogs are expected to scavenge additional food around their household or neighboring households. This may explain why even non-nest scavengers had a low ME intake of human-given tortillas (467 kJ/kg BW^{0.75}) compared to a moderately active medium-sized dog (e.g. Border Collie). Energy requirements of village dogs are not known, but a moderately active medium-sized companion dog of less than 25 kg, such as a Border Collie, has a maintenance energy requirement of 519 kJ/kg BW^{0.75} (NRC, 2006). The tortilla feeding level of the nest scavengers was considerably lower than that of the non-nest scavengers, indicating that these dogs need more energy from other food resources to meet their energy requirements. In addition, tortillas are low in protein and contain low amounts of essential amino acids, such as methionine and lysine (FAO, 1993). The minimal protein requirement for an adult dog for maintenance is 2.62 g/BW^{0.75}. An 18 kg dog requires 22.9 g protein, which can be met when 8.8 tortillas are fed (2.58 g protein per 50 g tortilla). In the latter case, the tortilla feeding level would be 414 kJ/kg BW^{0.75}. It should be noted, however, that the feeding level should be further increased to meet the requirement for methionine and lysine. Given the feeding level and nutrient content of tortillas in the current study, dogs would need to scavenge for specific food items to meet their energy and nutrient requirements. It has been shown that dogs of different breeds are capable of selecting specific foods differing in macronutrient composition and strive to obtain a macronutrient profile containing 30% of the ME as protein and 63% as fat (Hewson-Hughes *et al.*, 2013). Together with table scraps, sea-turtle eggs with a content of 28% protein and 67% fat (Craven *et al.*, 2008) may well balance out possible amino acid and energy deficiencies of human-given food in the studied dogs.

Furthermore, dog caregivers may inadvertently contribute to nest scavenging, as 39% admitted to giving turtle eggs or egg shells to dogs. In Mexico, turtle eggs are believed to cure many diseases (Nichols and Palmer, 2006), and, therefore, sick dogs are generally fed turtle eggs. Furthermore, they are given shells after humans have consumed the eggs. This might be one route for dogs to initially taste and become acquainted with the flavor and smell of turtle eggs.

This could be prevented by, for example, burning egg shells instead of feeding them to dogs. As long as pregnant or nursing females are scavenging turtle nests, however, unborn pups are exposed to turtle flavor in utero and, after birth, in maternal milk. This exposure might be another route for dogs to become acquainted with the flavor of turtle eggs, as it is known that pups acquire flavor preferences in utero (Wells and Hepper, 2006). Therefore, adequate feeding and supervision of pregnant or lactating females may be especially important, because pregnant and lactating females have also higher energy and nutrient requirements.

All dogs in this study can be classified as wanderers as defined by Meek (1999), because they walked more than 500 m from home. The probability of finding a dog at a distance greater than 1000 m from the household, however, was less than 10%; this means that dogs mostly roam in and around the village. This was reflected also in a similar home range for nest scavengers and non-nest scavengers, which was computed using a 90% probability density kernel density estimator. Again, thinking of dogs as Central Place Foragers (Houston and McNamara, 1985) elucidates why this may be so. The prerequisite for nest scavenging is traveling to the beach. We estimate that a round trip from the village to the nesting area requires at least 30 minutes of walking under temperatures ranging 25 to 30°C, with no shade (this explains also why dogs in general visited the beach at night and dawn). Once on the beach, dogs need to find a nest and finally dig it out. Although this has not been investigated for dogs, digging out turtle eggs buried at approximately 60 cm (Booth and Astill, 2001) involves some cost (in time and energy). High costs are reported for small rodents that forage in sea-turtle nests (Leighton *et al.*, 2009). This would explain why nest scavengers were accompanied by other dogs at the beach, enabling both the costs and the reward of scavenging to be shared. Furthermore, this confirms our expectation that socializing with other dogs is advantageous for nest scavenging, but not required (given that, in over 60% of observations, dogs were alone at the beach). The larger activity range of nest scavengers, however, is not only restricted to the beach, as their activity range in the village is also larger than that of non-nest scavengers. This could indicate that nest scavengers are not able to find enough food close to their household, and therefore need to scavenge further away from the household. Competition for food resources is possibly greater in the village than at the beach. There are no dumps in Colola (villagers usually burn their trash once a week, and edible trash is eaten by dogs and pigs). Sources of protein for dogs include bones and meat and fish leftovers. Only chickens are regularly slaughtered at some households, and fish is

available, but not regularly. Dogs need to travel long distances when there is not sufficient or adequate food available, or too much competition for food in the village.

The present findings have implications for the management of dogs at sea-turtle nesting beaches. There has been criticism of the fact that dog management in nature protected areas is routinely achieved by culling village dogs, which underestimates the value of dogs for local communities (Hughes and Macdonald, 2013). Dogs in Colola are, for example, important as household guardians, companions, and protectors of farming fields (Chapter 2 and Chapter 5). Beach watchers in Colola generally shoot dogs that scavenge nests, but this may occur only after dogs have already been scavenging for many months (e.g. two nest scavengers from this study were shot a year later). Caregivers in coastal villages of Mexico, however, may not agree with killing dogs to control the dog population, just as in other areas where dogs are kept unrestricted (Hsu *et al.*, 2003). As shown in the interviews, caregivers found it acceptable for dogs to roam freely, even from a young age. Nevertheless, this does not mean that measures (other than culling) cannot be taken to prevent dogs from scavenging turtle nests. On the basis of the present findings, we have two main recommendations. Firstly, dogs' movements should be restricted between night (21.00) and dawn (06.00). Secondly, sufficient and adequate feeding of dogs should be promoted among caregivers, e.g. an optimal number of tortillas based on approximate weight; in particular, sea-turtle eggs and shells should be excluded from the dogs' diet.

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5

**Dog free-roaming revisited:
The case of village dogs in the rural coast of Michoacán,
Mexico in the midst of a globalized world**



Eliza Ruiz-Izaguirre¹, Paul Hebinck², Karen (C.) H.A.M. Eilers^{1,3}

¹Animal Production Systems Group, Department of Animal Sciences, Wageningen University, Wageningen, the Netherlands

²Rural Development Sociology Group, Department of Social Sciences, Wageningen University, Wageningen, the Netherlands

³Schuttelaar & Partners, a Communications Consultancy that gives strategic advice on sustainable agriculture and healthy food, Wageningen, the Netherlands.

Submitted

Abstract

In rural Mexico, village dogs roam freely and have one or various caregivers. Village dogs do not fit concepts of care and ownership of Northern countries, and are thus seen as out of place. They transmit several zoonoses (e.g. rabies), are a threat to wildlife species, and appear as abandoned. Caregivers of village dogs are thus considered 'irresponsible'. These images are reflected on Mexican policy which groups street dogs and dogs belonging to an 'irresponsible' owner in the same category. Dog population control practices include capturing dogs on the street and killing them. Nevertheless, village dogs remain on the street and, in their daily encounters with humans, stories are woven. The local narratives from villagers in rural Mexico about 'their' dogs confront modern, ethnocentric conceptions about dog-keeping. Local narratives hinge on structurally different interpretations of human-animal interactions than those held by experts, policymakers, and animal welfarists.

Keywords: Human-animal relationship, Village dogs, Local narratives, Policy discourse

5.1 Introduction

Dogs in rural Mexico are an integral part of village life and the natural environment. They are found on the streets, in schools, and even in church. They wander by themselves, with other dogs, or humans. Although in the Global North dogs are popular companions that live inside homes, about 80% of the dogs in the world can be classified as village dogs (Lord *et al.*, 2012). Village dogs are typically free-roaming animals that scavenge refuse around human dwellings and associate with one or various households (Coppinger and Coppinger, 2001). Village dogs do not belong to any human-fabricated breed but are local breeds or mixes that are physically quite homogeneous (Ortolani *et al.*, 2009). Human-dog interactions in villages are conceptually better explained as a village-dog-keeping system (Ruiz-Izaguirre and Eilers, 2012), in which village dogs are either tolerated or cared for in different ways by society (i.e. individuals, households, authorities). Today, the number of village dogs, which the Secretary of Health in Mexico classifies as *callejeros*, is estimated at 10 million, and they account for about 62% of the Mexican dog population (including street dogs in cities) (SSA, 2001). Village dogs have for thousands of years co-existed with humans. In an increasingly globalizing world, contemporary village dogs are, however, no longer part of a local environment with fixed boundaries. Their well-being, treatment, and identity have over time been subjected to a variety of – often sharply contrasting – discourses. These are formulated at different levels of social life and governance (the state, NGOs, villages).

Spain's colonization of Mexico marked a new era in regard to village dogs. The identity of the *perro callejero* (literally street dog) did not exist before or was not widely shared (Valadez-Azúa and Mestre-Arrijoja, 1999). In 1792, after the introduction of public lighting, the then King Revillagigedo ordered the killing of any dog roaming the streets of Mexico City, just because there were too many (AHACM, 1792). Although this was not the first massive killing by the authorities, it was one of the most intensely felt by inhabitants (Payno, 1891/2003). There are cases in other countries of village dogs being killed to control the numbers. The 'canicide' in Little Bess, South Africa in 1893 (Van Sittert, 2003), and the extermination of 30,000 dogs in 1910 (Avédikian, 2010), are well documented. Mass dog killings are not something of the past; they occur currently for various reasons. Village dogs are perceived to pose various risks regarding public health (e.g. transmission of rabies and dog bites) (Matter and Daniels, 2001). In different areas of the world, village dogs have been reported to prey on wildlife (Young *et al.*, 2011), to act as food competitors

with wildlife (Campos *et al.*, 2007), or to carry disease to wild canids (e.g. foxes) (Acosta-Jamett *et al.*, 2010). In many instances, village dogs are killed simply because of aesthetics. Thousands of dogs were killed before the 2012 European Football Championship because local authorities viewed them as making Kiev look untidy for the visitors (Poole, June 1st 2012).

The aim of this article is twofold: first, to unveil the discourses that sustain current policy regarding village dogs and to compare these with the narratives voiced at village level. The main argument that we develop is that current policies and attempts to manage village dog populations in Mexico are derived from discourses and experiences largely disconnected from the village context. Secondly, the discourses that we have identified evolve around structurally different interpretations of human–environment interrelationships. Consequently, we distinguish three types of discourse that play different roles in the policy process regarding village dogs, in defining the problems of village and street dogs and how to deal with them. One type, the expert one, is nested in the animal and public health science domains, has become predominant, and has gradually begun to shape the public policy domain. A second type hinges on animal welfare approaches. These two have in common their rather ethnocentric orientation. The third type are those discourses or rather narratives produced at village level. We first examine the expert discourse and the underlying views of animal welfare and public health organizations, including those that intrinsically aim to control village dog populations, namely, experts and authorities, as well as current policies with regard to dogs. In the last section, villager narratives about the village dogs from two coastal villages in the Pacific Coast of Mexico are elaborated in some detail.

5.2 Methodology

This paper combines discourse analysis with policy analysis. Like Hajer (1995, p 44) we treat a discourse as “a specific ensemble of ideas, concepts, and categories through which meaning is given to physical and social realities”. For Long (2008), discourses are about the framing of an understanding of life by providing representation of what the actor sees as reality. Hajer’s (1995) work, like most of the discourse literature, is heavily influenced by the work of Michel Foucault who emphasized the plurality of discourses, which are at times interconnected and alongside giving birth to each other. Discourses together create and emerge in what Hajer (1995, p 47) has labeled as a huge arena of potentially conflicting discourses. Long (2008) similarly points out that it is quite possible to have conflicting versions of discourses for the same

phenomenon since the actors' ideological positions, their capacity to be creative, and their ability to translate a meaning may differ and change.

Both Long (2008) and Hajer (1995) argue that it is important to show that, and how, discourses are created and formulated in the interaction between social actors; discourses are not formulated by individuals but always in interaction with others in networks, in and by institutions like the World Health Organization (WHO). Discourses should not be treated as disconnected from the social practices in which they are formulated (e.g. policymaking, animal sciences, village life). Discourses are not just written texts like policy documents; discourses are also contained in peoples' narratives about certain aspects of their lives. McGee's methodological approach to studying policy processes differentiates between policy and discourse(s) and social action and narrative(s). Following Apthorpe (1996), Keeley and Scoones (1999), and McGee (2004), we argue that the framing of problems is derived from a distinct body or network of knowledge developed by experts (e.g. scientists, lobbyists), in turn feeding and shaping state-designed and state-administrated policies. Policies, and particularly those that are designed in a top-down manner, however, are seldom and linearly translated into action (Long, 2001); policies and the discourses that feed them are bound to encounter narratives that are significantly different from discourses that inform policy actions. The local narratives may very well impede and obstruct policy implementation. According to McGee (2004), the way experts identify problems and solutions is based on a necessary fiction that does not resonate with real life experiences at local level in our field studies.

The field research was conducted in two rural coastal villages, where free-roaming of dogs is normal, and to date no programs have been established to control the dog population. The villages, Colola and La Ticla, are not isolated from global exchanges as they are often visited by tourists, some homes have access to cable television, and young people can hire a computer with internet access in local shops. The villages are situated 30 km from each other along the federal road to Lázaro Cárdenas. Colola with 477 inhabitants (INEGI, 2005), is adjacent to a sanctuary for sea-turtle nesting, with approximately 4000 nests per year. Colola has a *parador* or tourist area consisting of cabins and a restaurant, to which tourists come, although mainly for one or two nights, in order to watch sea turtles lay their nests. La Ticla with 415 inhabitants (INEGI, 2005), has a *parador* with many cabins and camping places. This beach is famous among surfers, and tourists stay for periods ranging from days to weeks, and even

months. A few sea turtles (one or two per night) also nest in La Ticla in the high season (November through February).

The villages were regularly visited between June 2008 and June 2009 for four to seven days. During these visits, both dogs and people were observed; this included walking together with villagers and their dogs to the fields and the beach. Informal talks were held to capture people's narratives about how they relate to 'their' dogs as well as memories about them. Twenty-two dog stories were collected in total. This allowed us to order the narratives with a focus on how villagers think, feel, and talk about dogs. Hovorka (2008) considers these three elements as relevant to understanding how animals are included or excluded from the human spaces.

To gather the discourses regarding village dogs at a national and international level, the themes investigated were: public health, animal welfare, and damage to wildlife. Sources included: Mexican legislation, reports, scientific and technical articles, newspaper articles, theme-related books and documentary films, websites of animal welfare associations, and public health websites, such as that of the WHO.

5.3 Dog-related discourses

Below we describe two discourses that in different ways frame the village dog question. These have in common that they are usually formulated disconnected from local (e.g. village) contexts and differ (at the same time) about how to treat the dog problem. These two discourses also emerge from different networks.

5.3.1 Experts

The first type of discourse that plays a predominant role in the formulation of public policies regarding village dog issues is best labeled as modern and ethnocentric. Street and village dogs are seen as not belonging on the street; village or street dogs are positioned in the modern world as being out of place (Srinivasan, 2012; Philo and Wilbert, 2000). This 'out of placeness' is rooted in eighteenth century European ideas of domesticity, aesthetics, and sanitation, according to which the social and animal worlds are classified and ordered (Atkins, 2012). These ideas attune and find a place in positivist scientific understandings of public health and wildlife ecology. Expert discourses, in general, portray village dogs as vermin or victims, and their caregivers as irresponsible. We draw on the work of Irvine (2003), who made similar

analogies of villains and victims, to elaborate on how animal shelters in the USA think about dogs and their caregivers.

The institutionalized fight against rabies worldwide was not possible until the invention of the rabies vaccine by Pasteur in 1885. Mexico was to the forefront in producing its own anti-rabies vaccines around 1888 (Rodríguez, 1996). By 1950, Mexico started to collaborate with the Panamerican Health Organization (*Organización Panamericana de la Salud: OPS*) to control rabies. Parallel to massive wildlife culling (of coyotes and wolves), the strategy aimed to eliminate ownerless dogs and vaccinate owned dogs. Ownerless dogs were labeled as the best reservoirs and main components of the zoonotic chain, but also the most vulnerable (i.e. easy to target) for disease control (Malaga-Alba, 1962). It was here that perhaps for the first time, a translation problem emerged. The inability to classify the village dog as a companion or working animal, together with its out of placeness on the street, translated into ownerless or stray, in Spanish is simply called *callejero*, this term implying that the dog was not being cared for.

For Mexican public health officials, guided by the dominant ethnocentric discourses of developed countries, the proper place for dogs was now only inside the house; and, similar to problem pigeons in cities (Jerolmack, 2008), village dogs did not fit into modern conceptions of sanitation. This translated into management strategies that included culling of village dogs throughout the country. In the decade from 1980 to 1990, over 800,000 dogs were euthanized, mostly by electrocution, by the Mexican department of health (SSA) (SSA, 2001). By the late 1980's, the WHO had declared that culling dogs to control dog populations was useless because very soon other dogs would come to occupy those niches (WHO, 1988). By then, however, the elimination of the *callejero* was a goal of the Mexican health services and was integral to its institutional thinking (see Irvine, 2003).

To date, rabies control in Mexico is a task of the SSA. Their program includes the vaccination of owned dogs and the elimination of *callejeros*. *Callejeros* are further categorized as ownerless or as belonging to irresponsible owners. This 'irresponsible' label is so embedded at the uppermost levels of policy that in the Official Mexican Standard (for prevention and control of rabies), an animal on the street or of an irresponsible owner comes under the same categorization (SSA, 2011). The SSA captures dogs on the street and takes them to the *antirrâbicos* (dog pounds). Dogs stay there for 72 hours, in case someone claims

them, and otherwise they are killed, mostly by electrocution, but also by lethal injection. The SSA has not, however, enough resources or infrastructure to work in every Mexican village. Thus, parallel to the SSA dog management, mass killings financed by local governments occur throughout the country, and so called *redadas* (dog raids) are common in the villages. When there are complaints about dogs, authorities suddenly decide to capture and kill dogs, or to put out poisoned baits for them. The reasoning behind this is based mostly on public health risks (e.g. rickettsia, dog rabies, feces on the street). People are sometimes warned to keep their dogs inside, but most of the time these swoops are not widely announced, or it may not be feasible to do so, and people mourn their lost dogs. A villager in a local newspaper, after one dog raid:

Dogs are free! Why end with their lives? ... Hopefully nobody ever kills in such a cruel way, one of their [authorities] loved ones. I loved my dog, he did not do any wrong. (Juárez, 2012).

In the state of Sonora, Mexico, the mayor known as the *mataperros* (dog killer), a medical doctor concerned with public health, offered people a 200 peso discount on their electricity bill for every village dog surrendered, and more than 14,000 dogs were killed in the last two years (Zapata, 2012). The measure took on national and international importance, and spread rapidly through the media and social networks (Najar, 2011). Rabies today is no longer a danger in Mexico; the last human cases were reported in the year 2000 (SSA, 2001), and only bat rabies remains a problem. The OPS declared that, among other things such as vaccination, the success was due to the promotion of responsible ownership (PAHO/WHO, 2012).

Village dog elimination is now also a target in wildlife areas. In Mexico, the National Commission for Knowledge and Use of Biodiversity (CONABIO) has catalogued dogs as an invasive, exotic species with a high potential for damage (Medellín Legorreta, 2000). In the village of Celestún, adjacent to the Biosphere Ría Celestún, in Yucatán, Mexico, 450 village dogs out of a population of 1,200 were killed (Rodríguez-de-la-Gala-Mendez, J.B., 2005). The report is careful to mention that the *unwanted* dogs were *put to sleep* with a pentobarbital injection. In the same village, an NGO has the goal of eliminating 100% of *callejeros* (DUMAC, 2008).

5.3.2 Animal welfare discourses

The second type of discourse that exerts some degree of influence on public policy is produced by Mexican and international animal welfare organizations.

From an animal welfare perspective, concerns are formulated and questions are raised with regard to dogs. Animal welfare discourses hinge on the idea that dogs are owned, and owners are responsible for their welfare. These organizations raise funds for village dogs in developing countries in particular (Falconer, 2009). Mexican village dogs are visualized as being too thin or sick; and the methods for trapping and killing them (e.g. by electrocution) have attracted international attention (Buchanan, 2007). For a long time, animal welfare was not a political issue in Mexico, but, lately, animal welfare legislation has been enacted because of political pressure from a small Mexican minority, and international animal welfarists, and NGOs from Europe and the USA (Mena, 2010). Animal welfare organizations point out that village dogs are nonetheless on the street, raising questions about who cares or should care for them, who puts them on the streets, and who lets them reproduce in an uncontrolled manner.

Certain processes and animal science advances stimulated the emergence of an animal welfare discourse that led to the conceptual relocation of dogs from the streets to the home. During the mid-nineteenth century, the middle class for the first time had the possibility to buy breed dogs and keep them as pets (Irvine, 2004). Consequently, pet shops, dog food, and accessories appeared. These changes did not occur simultaneously in Mexico, and in many rural areas of Mexico have not yet occurred. Nevertheless, developing countries often look to developed countries for models (e.g. India towards UK) (Srinivasan, 2012). As a historian recalls of the 1910 dog massacre in Istanbul ¹: “The dog appeared to us as a symbol of oriental misery” (Avédikian, 2011). Today, dogs have become commodities (Haraway, 2008), and the pet industry (pet food, medicines, and accessories) reflects the capitalist way of living. In contrast, the sight of village dogs appears largely unappealing: “Emaciated dogs sleeping on rubbish piles, injured dogs limping across market squares, and dogs so afflicted with mange they’re basically scratching themselves to death.” (Falconer, 2009, p 14). The welfare of village dogs, however, to our knowledge has not yet been objectively evaluated to see whether their welfare status is truly bad, or whether its perception by foreigners is biased by culture and frame of reference. In tourist villages in Oaxaca, Mexico, more North American and European tourists perceived dog welfare problems than Mexicans (Ruiz-Izaguirre and Eilers,

¹In their attempt to modernize Istanbul, authorities brought experts from the Institute Pasteur in Paris to explore the options for getting rid of village or street dogs. After revising all available options, it became clear to authorities that simply killing them was too expensive. Some 30,000 dogs instead were captured and shipped to a desert island, where dogs ultimately died from dehydration and starvation (Avédikian, 2010).

2012). Steeves (2005, p 22) reflects on his first impressions of the street dogs of Venezuela: “I thought at first they were lost- a *gringo* assumption, I know now”. At international level, discourses on village dogs by animal welfare activists and public health experts appear to have unified:

Beyond protecting people from dog bites and transmissible diseases, sterilization programs can ease emotional suffering in the world’s poorest and most disenfranchised communities. (Falconer, 2009, p 17).

At the international technical forum on dog population management, public health experts and animal welfare activists, sum up efforts to control dog populations (Battaglia and Saldarriaga, 2011). Uniting at the extremes, even when different actors have different stakes, is a main characteristic in the definition of a social problem (Irvine, 2003). In this unified discourse, village dogs are no longer seen as vermin that must be culled, but as victims of people who abandon them, further reiterating the image of irresponsible owners as villains. Animal welfare organizations have in many instances stopped the fight to put dogs inside the home, implementing trap-neuter-release programs (e.g. HSUS in Ecuador and Costa Rica, and WSPA in India and Nepal). In India, by calling village dogs street dogs rather than strays, the Animal Birth Control rules recognize and legitimize this system of dog-keeping (Srinivasan, 2012). Nevertheless, from public health experts to animal welfare activists, the key word is responsibility. The WHO classifies dogs in terms of their dependence on, and restriction by, humans: restricted dogs, family dogs, community dogs or feral dogs (WHO, 1988); but, as Ortolani *et al.* (2009) note, this classification takes for granted that all dogs are or have been owned by humans, which is not the case in most areas of the developing world. According to the World Organization for Animal Health, a person who owns a dog is responsible to take lifetime care of the dog, and of any offspring, unless another owner is found, and it should be ensured that “the dog does not roam out of control in a manner that would pose a problem to the community and (or) the environment.” (OIE 2011, p 3).

According to the collective-responsibility argument Burgess-Jackson (1998), providing homes for “helpless pets” is “a burden of responsibility on us humans since to a great extent we created pets” (Fox, 1980, p 81). Furthermore, the human-dog relationship has been compared to the parent-child relationship, except that, unlike children, dogs never grow into completely autonomous beings that are able to make their own choices (Hens, 2008). In the frame of the collective-responsibility argument, failure to address these

obligations implies guilt because humans took dogs out of the wild and made them dependent. The 'Pinocchio theory' on dog domestication presumes that humans had a major role in dog domestication (Coppinger and Coppinger 2001). Village dogs from the point of view of ethnocentric discourse appear thus as abandoned and in need of rescue, and in some cases indeed are². This perception of dogs as abandoned appears at the highest levels of policy. Mexico City is to the forefront on animal welfare at a national level, and its legislation is the basis for legislation in other Mexican states. Under Mexico City's animal welfare law, a dog on the street without its owner is defined as 'abandoned' (Asamblea Legislativa del Distrito Federal II Legislatura, 2002, definitions). If dogs thus are abandoned, this renders irresponsible those who abandon them. Here, we come back to McGee (2004), trying to offer an alternative understanding to the problem. Village dogs are not abandoned because they have never been adopted as in-house residents in the first place. On the basis of Coppinger and Coppinger's Village dog Theory of dog self-domestication, it was not humans who took dogs from the wild, but dogs (i.e. wolves) who decided to enter human territory to exploit a new niche: the village dump, and gradually evolved as village dogs. Dogs are in this theory recognized as agents and co-producers in their domestication. The village is thus their natural environment, and village dogs today remain as agents that need to find their own ways and places in their environment.

5.4 Temporal-spatial relations of dogs and villagers in Colola and La Ticla

The third type of discourse is produced at village level by the caregivers of village dogs that interact in everyday life with them. These caregivers historically belong to the lower classes and most of them are poor. It is those discourses – or rather narratives – that are not being heard and voiced at public policy level. They cannot, as McGee (2004) and Long (2001, 2008) point out, exercise their agency in policy processes. If dog caregivers are not among the participants in the policy process, even less so are the village dogs, whose inclusion in policy is based only on animal welfare NGOs claiming to represent them. Village dogs' out of placeness has thus implications for policies, namely, in Mexican legislation, where village dogs are defined as abandoned, and as dogs of irresponsible owners. Paradoxically, in spite of their out of placeness, village dogs are an integral part of daily life in the villages. Along the Nahua

²See for example Haraway (2003, p.88) and other initiatives to import village dogs from Mexico and Puerto Rico into the U.S.A. (Strand, 2012), from Turkey into The Netherlands (TS, 2012), or from Thailand to worldwide (SDF, 2012)

Coast of Michoacán, there are various small rural villages. Most people subsist on small-scale tourism and farming. The main crops grown are corn, papaya, and tomatillo. Animals kept for consumption include pigs, poultry, and cows. Migration from the mountains to the coast occurred in the twentieth century and was the foundation for most coastal villages (De-Luna, 2004). In an excursion to the mountain and coastal areas in 1950, before there was a proper road, Brand (1960) and colleagues noted that indigenous people's only pets were dogs and parrots. In the village, dogs are not out of place, but are mobile delimiters of space and property for other dogs, animals, and people - for example, guarding the *solar*³ or farm fields. And in a village where the main means of transportation is still walking, dogs are naturally inclined to follow. This is sometimes welcomed and expected, and sometimes not (like when the whole family leaves). Dogs are less welcome in places like church, school (literally getting inside the school), or village parties. At La Ticla *parador*, tourists let their companion dogs off the leash as soon as they arrive. These dogs run excitedly, unable to calm down, jumping on anything or anyone, trying to get food from the tables. Their behavior contrasts with that of the village dogs. Solovino (Came by Himself) and Amigo were the only two dogs for which we found no caregiver, and they lived in the *parador*. They knew exactly with whom (people and dogs) and when they were welcome. They would walk slowly wagging their tail to approach any new visitor, and depending on the visitor's reaction they would come closer or not. If they were welcome, they would patiently wait for scraps; if not, they would carefully search the garbage. Solovino was extroverted, and therefore was given many names by visitors, including this one. Once he knew himself welcome, he had no inhibitions and would jump up and lick the face his new, temporary caregivers. Amigo was introverted and attracted a lot less attention, and no name. Solovino was dominant and chased Amigo away from his temporal territories, which usually included one or three tents, and lasted one to seven days. When the *paradores* were empty, the two dogs would hang around together again.

5.4.1 Finding a place in the household and village

Being free to come and go opens up many possibilities. Village dogs, for example, are adopted into a household as pups, but later can remain in this

³The solar is the typical rural household consisting of a house, surrounded by a garden with trees, plants and domestic animals. The solar is usually delimited (with sticks or branches) but not fenced. It is very easy for animals to get in and out of the solar. The dog keeps intruders out of the solar.

household or find another more suitable household. The caregiver may not like how this dog behaves or its temperament, and thus give it away; but the dog may come back, like in the case of Chispa, the dog of Erick, a 10-year-old boy. Erick brought Chispa as a pup and told his mother she was male. When the mother found she was a female, she got very angry. On two occasions, the mother tried to get rid of the dog, but twice Chispa came back. It can also happen that the dog chooses to live in another household. This has been the case for many of the dogs in Noemí's household, once they find the way into her mother-in-law's house, they don't want to come back. The mother-in-law, recalls:

You take pups from here, and it is useless, they always come [back] and stay here... Is it because, well I do not know, I also like puppies, right? I start to make them fond of me, and it seems that they do not forget.

Village dogs can choose to associate more with dogs than with humans, or vice versa. Dogs also need to discriminate between friendly and unfriendly people. People who do not like dogs, or are afraid of dogs, may throw a stone in the dog's direction. The idea behind this is not to hurt the dog (although this may also occur), but to scare the dog. Dogs also need to learn the places where they are welcome or not. In sum, village dogs must learn from an early age to evade danger, as well as their place in the household and in the village. Growing up free means learning about the human world and its rules, and this learning is inevitably linked to human interaction.

5.4.2 Dog functions and relationships with men, women, and children

People attribute various functions to village dogs. People want dogs that are naturally inclined to work and need little training. This so-called work is not very specialized but does require some training, which not everybody is prepared to give as, according to some of the men, 'good dogs are scarce', and pedigree dogs are better than plain village dogs. Mariano attributes the good working qualities of the special dog he had to the German Shepherd blood that his dog carried:

There seem to be dogs that are very intelligent, as if they were born with this [intelligence]... and other [dogs] who are not, there seem to be breeds of dogs, and this one was very intelligent.

He got this dog as a present from tourists. Before this, Mariano had no idea that dog breeds existed. Villagers refer to pedigree dogs as the *finos* (fine, special), *pura sangre* (pure blood), *sangre especial* (special blood), *de clase* (high class). The

common village dog is called *criollo* (mixed, used in colonial times to describe Spanish and Indian mix), or *corriente* (common and of little value); but according to Erasmo, any dog can be trained to guard, except that you need to start taking the dog early to the fields. Additionally, Antonio considers that:

You need to have patience to teach animals to work in the fields... it is just like us, if I call you 'hey stupid', and I treat you with anger, you will ask yourself why I treat you like this, but if I ask you kindly, of course you do [the work].

Dogs are required to protect the household and farm fields, to chase away animals like donkeys, to help in getting iguanas, and sometimes to gather up backyard chickens for slaughter. Often, children, or the whole family walk to the farm fields. Dogs are sometimes left to guard the fields during the night or various days during the most vulnerable periods, and, according to some villagers, their dogs like it so much there that they do not want to come back to the village. In this way, dogs' own interests and impulses are accommodated in what villagers need from the dogs. It is thus very important for the dog to be protective in order to defend the solar, as Noemí expressed:

She is the owner here [the solar], and she doesn't let anyone outside the household get in when we are not here.

This protectiveness also works outside the household and allows villagers to leave their belongings unattended on the beach or fields, knowing that the dog will take care of them, as Martín recalls: "Wherever I left my shoes [on the beach], the dog stayed there."

Antonio used to have a female dog named Mónica. She used to take care of the farm fields, chasing away parrots who ate the corn. Although he had a utilitarian reason to keep her, as the story unfolded, he did not speak of her as property, but depicted the freedom within which she works for him:

As dawn was breaking, what did she do? She threw herself loose in the fields, and when she found her [dog] friend, she would take her along... [Then she had puppies.] She took really good care of the little animals, and I was very fond of my dog because she was very well behaved and she would do all the jobs I would put her to do. Only and only that she... chased an animal down a hill, I just heard her barking, right? Well, she just never came back. Like they say: We never met Mónica again... I think that animals killed her, maybe a *jabalí* [wild swine].

Antonio acknowledges Mónica's freedom and her autonomy to decide where she wants to go, and with whom, and also her ability to care for herself and her pups. This freedom implies some risks though, like the fact that she might be killed by wild swine. In this type of human-dog relationship, the function of chasing parrots away is also accommodated. Antonio and Mónica meet every day as individuals until that day when she does not come back. Sometimes, a family member may not consider a dog useful, for example, Erasmo speaks of his current dogs: "These (dogs) are not useful to me for anything, just barking and barking." Not being useful to him, however, is not the end for the dogs, as this view was not shared by Erasmo's wife. In her view, the dogs protect her backyard chickens and have been trained to get them for her. Women also enjoy dogs for their company. Petra, for example, often walks in the afternoons to the farm fields (about two kilometers) to get firewood to cook, or fruits like mangoes and lemons. She was eager to demonstrate how, as soon as her two dogs saw her lifting up the *machete*, they stood up excitedly and were ready to go. The neighbor's dog also came along. Throughout the walk they ran, coming back and forth to Petra. Petra enjoys the dogs' company 'just because'. As a child, as far back as she can remember, dogs were always kept in her family and accompanied them to the fields. Village dogs are also kept to act as bodyguards for children. Antonio says, referring to his current dog:

If you put this dog to work (*cuichili cuichili*⁴) or if you start to talk a bit harder, what does this dog do? She lies down and closes her eyes [with her paws] like this, she huddles like this, she thinks I am scolding her... it is better for her to be the children's companion, she follows them, but not me.

Children also like to play with dogs, and it is perhaps children who on a daily basis interact the most with dogs. Children are sent to do errands, for example to buy milk for a younger brother or deliver a message to a friend, and parents feel safe when the dog goes along. Also, in the afternoons, children play on the water banks close to the shore, and dogs play at chasing children or other dogs. Pascual is a teenager who has had many dogs since childhood, and remembers each one dearly. He owned six dogs, and the six died tragically (poisoned, killed by cars, hanged for biting):

I like to play with the dogs, and they are my friends. We have to enjoy [them] now, maybe later they will not be here.

⁴This is the way he calls his dog when he wants him to go and chase away animals.

Villagers often talk about their dogs' affection with the word 'ingriar'⁵. They recognize how a dog gets excited greeting its chosen human friend, explicitly manifesting this with its whole body: jumping and wagging its tail; and, in the absence of this preferred human, how a dog may become sad, as used to happen with Zarco. When the man left in his vehicle, Zarco used to wait for him the whole day, looking in the direction of the road. When the man came back, Zarco would spot him from far away and come running to greet him. When the man went out drinking, Zarco would come back and forth to check on him. The woman of the house, who used to feed Zarco, wondered:

I think that animals also, who knows what they think, are they maybe the same as Christian men? Only because they do not talk, right? They do feel the same, or? ... I do not know why the dog grew [so] fond of him.

5.4.3 Unwritten rules

At first sight, there did not appear to be any order or regulation for dogs in the villages. We nevertheless gradually found out that, although it is socially acceptable for dogs to roam free, unwritten codes of conduct for village dogs do exist. Dogs are expected to behave well, not only at home, but also with neighbors. Dog caregivers are generally permissive, as this form of dog-keeping implies, and neighbors tolerant, but this tolerance has a limit. In general, dog-related problems (be this the problem for the caregiver or for neighbors) derive from unwanted dog behavior—for example, aggression (i.e. dogs that bite, fight with other dogs, or chase people) and mischievous dogs (i.e. steal food, kill poultry). Biting people is taken seriously, and consequences vary. Dogs are punished when they misbehave, for example, depending on the severity of the incident, dogs are tethered for a few days, or sometimes for weeks, and some are also beaten. Nicanora recalls how she beat her dog, who used to eat her chickens:

I beat him twice, we hit him very hard because he wouldn't understand... now he understands as if he were a child.

This type of punishment is common, in the belief that the dog will understand that he has done wrong and will not do wrong again. Guillermina recalls how her very dear male dog used to bite only women. She tried to correct this by

⁵Ingriar or Engriar, comes from the verb Engreír, which according to the Real Academia Española means: Encariñar, aficionar. In our stories the verb appears many times conjugated with the dog, less often from the human side. We understand this as a preference and loving of a specific human from part of the dog, and our best English translation is 'growing fond of'.

tethering the dog for a few days, but once he was free again: “He had no pity”. The end came when he bit a young girl. Guillermina, afraid that she would go to jail, asked her son-in-law to hang the dog. Similarly, María’s dog (Rallado) had bitten a young man, but they gave him an opportunity because he took such good care of the children, following them everywhere they went. Rallado also used to keep an eye on her husband when he got drunk. But then, he bit the neighbor’s boy. According to María, it was the fault of the boy, because the boy kicked the dog, but nonetheless she took the boy home and assured the boy’s mother that she would kill the dog:

We got him, he scratched and pulled the rope, we wanted to let him loose, but then, no, he will bite again, we better kill him, and we pulled hard on his neck, and he died.

All four children cried. Together they used to go to the farm fields, and Rallado helped them catch iguanas and *cuichis* (small squirrels). However, had the family insisted on keeping Rallado, the incident could occur again, and they would have to give money to the victim’s family. Furthermore, when the caregivers refuse to kill dogs themselves, neighbors usually poison these dogs. In yet another story, Macario’s dog bit an old woman. The dog foreseeing his fate, ran away and never returned to the household.

Or maybe he thought that I would hang him or something. He never came back home... he wouldn’t even get near, far, like this.

Less serious problems for neighbors are dogs that steal food from other households. Pachonota, Andrea’s female dog, used to come back from the street with bags of food (beans, sugar, and even meat) for the household. Andrea, being so poor, was actually happy with these presents. Andrea believes that with dogs one needs to have patience and love, and talk to them like you would talk a child.

That depends on us, if one teaches them, they also learn how to...It seems as if they didn’t have judgment⁶, but they do have judgment.

Manuel also knows that his dog, Paloma (female) steals food; however: “It is not her fault that she looks for food when she is hungry”. A very old lady wondered how her female dog was in good condition, and even got pregnant in spite of getting only a few tortillas a day. She says that the dog used to go

⁶Translation of *juicio*, which according to the Real Academia Española is defined as: Faculty of the soul, by which man can distinguish good and bad, true and false.

looking for food herself but does not know where; and this was a quality that she admired in her dog: “My little dog was a fighter”⁷

According to our stories, there are thus dogs that know they have done wrong, dogs that know that punishment exists, dogs that learn through punishment, dogs that in spite of punishment decide to keep doing wrong, and even a dog who decides to evade his punishment. Not all dog caregivers opt for punishment; there are dogs who are talked to, and dogs who decide to well behave. And caregivers and neighbors sometimes disagree on what constitutes a problem; the caregiver may justify the dog’s behavior (e.g. stealing food because of hunger or to please the caregiver, or biting boys because these have injured them). In the end, however, it is mainly the neighbors who have the last word on which dogs are welcome, or at least tolerated, and which dogs need to go. If a dog repeatedly breaks the rules, the dog will be killed, despite the caregiver’s resistance. If not killed by the caregiver, the dog will be poisoned by *someone*. The majority of caregivers accept the killing because, if dogs have judgment, it was ultimately the dog who chose this destiny when she decided to do wrong.

5.4.4 Care-giving

Caregivers in the villages provide food and water for their dogs, take care of them when sick, and decide on puppies’ fate. Most dogs get freshly baked tortillas or leftover tortillas with meat broth, plus other leftovers from fish and meat. Caregivers generally feed dogs according to their preferences:

But this is not a dog that you throw a tortilla and he will eat it. No, I bought him his plate, he eats from his plate, and I put broth in it, or milk when we have nothing else. He does not eat tortillas alone... From fish he likes only the bones, if we give him chicken skins, he will not eat them.

Dogs receive food from one or more households, but most dogs also scavenge for extra food, which may include wildlife, such as iguanas, squirrels, and sea-turtle eggs. Sick dogs additionally are given high protein foods such as eggs and milk. Common medical problems for village dogs include: mange, scorpion bites, pneumonia, road accidents, and poisoning. In the absence of veterinary services⁸, villagers apply local remedies. Angela had tried every known

⁷In Spanish: “*Era luchona mi perrita.*”

⁸The nearest veterinarian is 200 km away, and the bus takes three hours to get there, and three hours to come back, which means a whole day lost, plus the money spent on travel and medicine.

treatment to cure her dog Pinto of mange: bathing the dog in the sea, giving herb infusions, applying ointments with burned oil and diesel, and she was now saving money to buy chlorine, with which her friend's dog was cured. If none of these worked, she would have to kill him because of the severity of the disease.⁹ Other remedies include lemon necklaces for pneumonia and olive oil for any type of poison. In many instances, dogs are helped because they ask for help. Martín recalls when his dog Mocho had just been poisoned with papaya seed disinfectant:

I was sitting there, the dog came to me, he touched me, I think he wanted my attention, let us say, he was talking to me.

Another issue for caregivers is dog breeding. In Colola, perhaps because of its location close to a road that leads to the mountains where dogs are much appreciated for farming, pups are somehow easier to place. Mariano explains that even people from these mountain villages come to get pups from him when Paloma breeds:

People come and say: 'oh your dog has puppies! Can I have one? ...[he answers] Of course! And they take them, that's why I have no worries about her [Paloma] being female.

This, however, is more difficult in La Ticla. Here, Guillermina explained that it is common knowledge that it is not sinful to drown pups as soon as they are born, just before they start nursing. Nevertheless, at least in her case, she felt with much guilt and anxiety, as she recalls how she got 'a punishment from God'. Her three female dogs had bred all at the same time: "Only females puppies, oh my God! " One by one she passed each pup to her daughter who also verified the sex, and they killed them. But when they went to the beach to get rid of the corpses, they found out these were all male. Guillermina panicked and started crying. She promised San Lázaro¹⁰ that she would never kill a dog again.

5.5 Discourse interactions and controversies

5.5.1 On responsibility

To date, efforts to control dog populations in Mexico have relied mainly on the SSA, on the basis of rabies control. Policy in this regard refers to caregivers of

⁹Finally, this did not happen. Her son brought her a dewormer on a trip to the city and Pinto was cured.

¹⁰Not a canonized saint, but a popular saint in Mexico and Cuba. Lázaro is mentioned in a parable in the book of Luke. He is portrayed as a poor, old, and sick man with dogs licking his sores. Some people believe he is the protector of dogs.

village dogs as irresponsible owners. Our study revealed that labeling dog caregivers as irresponsible owners is not the appropriate way to address them, as this label goes hand in hand with being uneducated, careless, and of a low economic class (as clearly exemplified when a mayor offers a 200 peso discount on an electricity bill for every street dog surrendered). Furthermore, just as with caregivers of AIDS orphans, the label of irresponsible indicates the moral judgment that “those who should be responsible are failing in their duties of care” (Meintjes and Bray, 2009, p 151). Advocating for individual to individual responsibility (i.e. dog caregiver to dog), Burgess-Jackson (1998) argues that, by bringing animals inside the home, human beings close off those animals’ opportunities to fulfill their needs, and that this generates responsibility. In reply to this argument, we question what human responsibility should mean when dogs are not closed off from opportunities to fulfill their needs in places where dogs can still “*be* in the absence of a human owner” (Srinivasan, 2012, p 5). First of all, as Steeves (2005, p 22) points out, we can question how we define care and home, because “the neighborhood can be a home, a place to belong”. As exemplified in our case study, dogs are perceived as owners of their territory, which may include the *solar*, but also the street or various streets. Furthermore, villagers do care for dogs, in both moral and practical terms (by feeding them and caring for them when they are unwell). Caregivers are also faced with dilemmas in their duties of care, (like having to hang a biting dog, or having to kill female newborns), and contrary to the irresponsible label, caregivers assume responsibility, even when the execution of these decisions is not in any way pleasurable or easy, and may cause a great deal of distress for the dogs involved, the children, and the adults of the household. At least in the villages studied, the fact that dogs are on the street is not a matter of irresponsibility, but of a different perception of dogs, and the natural environment, the so-called ecology of difference (Escobar, 1998). Villagers perceive adult village dogs as mature beings, capable of decision making, as well as both having and being subject to judgment. Although dogs stand below and subject to the adults of a household, dogs are perceived as being able to care for themselves and others in the household (children, drunk men, and other domestic animals). In this way, dogs act as extensions of paternal protection, maintaining the safety feeling inside and outside the household. This perception thus differs from the idea that dogs never grow into completely autonomous beings capable of making their own choices (Hens, 2008). There are some risks inherent in this perception, and the position of dogs as guardians of the family may blur dogs’ own vulnerability to the dangers that the street, fields, or beach may offer. If next to their own household, the place for village

dogs is the street, the street should be a safe place for them. The problems that dogs may pose to neighbors could be discussed more openly, so that problem dogs do not simply end up being poisoned by someone. Furthermore, it is also true that many dog caregivers teach dogs how to behave by beating them, and the hanging of dogs must cause a great deal of distress and pain. We exposed these hanging cases not to condemn caregivers and victimize dogs, but in an effort to open the discussion to *other* critical points, where intervention and support from animal welfare NGOs may in fact be urgently needed, in providing veterinary care, dog behavior basics, and euthanasia for specific cases.

5.5.2 On public health

In regard to public health, modern preconceptions of sanitation can be critically evaluated in the village setting to determine whether village-dog-keeping systems are functional, and perhaps preferable to otherwise unrealistic impositions. There is, for example, less chance of zoonosis transmission (e.g. through dog faeces) in places with enough space than in crowded cities (Acosta-Jamett *et al.*, 2010). At least in Colola and La Ticla, villagers never mentioned having problems with defecation of village dogs, as most dogs can go to the bushes. It is also important for zoonosis control that there is at least one caregiver who is able to handle the dog, and contrary to the situation in cities, in the village setting, with a few exceptions, each dog is associated with a household (Acosta-Jamett *et al.*, 2010). Nevertheless, the lack of veterinary services in the villages does exacerbate illnesses, pain, and injuries, when they occur. Furthermore, village dogs are in great need of basic healthcare, such as treatment for mange.

In the current state of affairs, unless rural dwellers and the poor are deprived of having their village dogs, taking dogs off the street is costly and logistically unattainable, as it would mean changes in lifestyle, culture, and infrastructure – for example, having to fence all of the *solares* in areas where most people have metal roofs that fall off in the rainy season. Street lighting would be necessary, as well as police, so that dogs would be less needed as night guards. Dogs at home would then need to be provided with the food and protein for which they now scavenge themselves. Since dogs are not culturally welcome inside the home, many dogs would be permanently tethered, or sent to the roof of the house, as people in Mexican cities do.

5.5.3 On co-production

At present in these villages, just as in ancient villages where dogs were first domesticated (Coppinger and Coppinger, 2001), village dogs co-exist with humans as agents that find their place in the household and village. Placing a dog in a household is only the beginning of a dog's life history; staying with the household transcends the human sphere. Although in the villages caregivers call themselves owners, in practical terms they do not consider or treat their dogs as property. Dogs themselves are agents in finding their place in one or various households, and in the village itself. Dogs are held responsible, and killed when they bite a child, but no dog is put down for being ownerless. In the village setting, dogs have the freedom of mobility (Donaldson and Kymlicka, 2011), which most dogs in developed countries lack. And also in contrast to many dogs in developed countries, which are subjected to long periods alone inside a house on a daily basis (Rehn and Keeling, 2011), village dogs have more than enough space to wander, follow humans almost everywhere in the village, and select their companions be they human, or non-human. The possibility of finding (or not) the right place is thus also left for the dog to achieve through the building of both affective and convenience relations with humans. This therefore also provides plenty of opportunities for humans and dogs to see each other in mutual recognition, in what Haraway (2008, p 72) calls face-to-face. Nevertheless, a less favorable aspect of this co-production is the paradigm of village dog breeding. Dog breeding in dominant ethnocentric discourses tends to be selective (by humans) and limited. According to animal welfarist discourses, humans are responsible for controlling dog populations by sterilization:

“By preventing animals from being born, we prevent animals from being hit by cars, being infected with... diseases,... or simply stuck outside to die of starvation, exposure, or neglect.”(PETA, 2012)

Implicit in this is that these suffering dogs should simply not exist. Although animal welfare discourses are supposed to give a voice to the interests of village dogs, they ultimately end up reinforcing and complementing public health discourses, which find unacceptable the idea that this type of dog-keeping system is flourishing. Dog breeding in countries in the North goes hand in hand with sterilization, which according to Srinivasan (2012, p 8), is a “biopolitical act,” in that it intervenes in basic life processes on the basis of truth discourses about dog welfare. Villagers want to have dogs because they like them, and they need them for their livelihoods. Even if they want one, they cannot afford a pure-bred dog; but it does not really matter if the dog is pure bred, a village

dog can do the required jobs well (e.g. the well-experienced farmer who told us how any dog will learn to chase away parrots if people start taking the dog as a pup to the fields). In the villages, village dogs are thus free to choose mates, and female dogs can experience motherhood and thus portray 'fecundity and freedom' which according to Watts (2000, p 294) nature signifies. Nevertheless, this freedom, or perhaps more precisely the ambiguity of villagers towards their dogs' reproduction, results in more pups than needed, with the consequence that many pups will not survive because of natural causes (e.g. disease), but also because of extermination by humans. We thus question whether there is an alternative way in which village dogs may continue to flourish under not total human control. We consider this to be another important point that needs to be openly discussed in the villages, and at higher policy levels.

5.6 Conclusion

We have analyzed the village dog problematic by contrasting and comparing policy discourses with those formulated at village level. We have shown that these discourses hinge on different and contrasting images of human-dog interactions and impute different meanings to these. Expert and animal welfare discourses variously portray dogs as out of place either as vermin and a threat, or as victims in need of rescue. Villagers' narratives, in contrast, situate experiences with dogs in their social environment and impute various notions of sociability to their relationships with dogs. Village dogs learn from an early age how to make their living in the village and are agents in choosing human companions. Their caregivers value 'their' dogs as autonomous and as making their own judgments. Caregivers are often responsible for socially unwanted behaviors of village dogs. All this does not mean that village dogs are not vulnerable, and only well cared for. Certain facts such as hanging dogs, drowning pups, or beating dogs, need to be acknowledged. Although dog free-roaming has to date not been broadly or openly contested, many dogs die from poisoning. The latter is evidence for the urgency of discussing these issues in the many policy arenas in Mexico, and in the villages, to try and find alternative solutions to the problems that emerge.

Realizing that the dog question generates ambiguities and issues that cannot be resolved so easily, we consider that addressing the village dog question only from the point of view of modern, ethnocentric discourses is neither useful nor productive. These discourses have created a range of controversies and are too one-dimensional in their formulation. They nevertheless are currently the basis

for dog management policies, and the label of irresponsible owners prevents the inclusion of village dog caregivers as legitimate participants in policy processes, leaving the decisions to experts and NGOs, who, albeit well-intentioned, may have no first-hand experience of village dog life and base their judgments on preconceptions of sanitation and dog welfare. Although we do not provide solutions, we do question whether there is an alternative way to deal with village dogs. As basing policy only on dominant ethnocentric discourses denies the possibility that this way of dog keeping is another way to relate and live with dogs, with its own drawbacks and benefits – a way in which, although they are not inside the home, dogs still play a central role for the household, where a function is accommodated in the dog's interests in everyday life (chasing away, protecting). Accepting this as a different but viable dog-keeping system, stakeholders can still try to improve it, as it is less than perfect. However, not acknowledging this system as legitimate, but viewing it as a failed version of dog-keeping in developed countries, to date has in many instances resulted in partial, unsustainable, foreign-imposed 'solutions', and mass killings of village dogs.

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6

General discussion



6.1 Introduction

The objective of this thesis was to improve the understanding of human–dog interactions in coastal areas of Mexico in order to identify strategies – embedded in the social and cultural context – to manage village dogs. At present, village dogs in these coastal areas are a concern for national and international organizations and individuals, such as tourists. Concerns arise about: overpopulation of village dogs, transmission of zoonoses, welfare of village dogs, and issues relating to dog–wildlife interactions, such as predation of wildlife. This general discussion starts with a visual presentation of the current dynamics of a village dog population and related concerns. Subsequently, the main findings of this thesis relating to human–dog interactions are incorporated in this visual presentation. This extended visual presentation in combination with an assessment of dog welfare concerns feeds into the identification of alternative strategies, embedded in the social cultural context, to manage dog populations. Finally, strategies to manage village dog populations, other than dog culling, are discussed, and the main conclusions are presented.

6.2 Dog population dynamics and the role of human–dog interactions

Figure 1 summarizes the dynamics of a village dog population and related concerns. Dogs enter a village via introduction by humans or arrive naturally to occupy an ecological niche. They typically roam freely; this raises concerns about public health, bad image, and dog welfare. Allowing dogs to roam free is considered as irresponsible ownership (Chapter 5). Furthermore, the street is considered as a harsh environment for dogs, because they are vulnerable to disease, car accidents, animal cruelty (e.g. dogs hit by humans), or poisoning (WSPA, 2012). Dogs on the street, furthermore, give a bad image to tourists, because dog free-roaming is considered as a sign of underdevelopment (Avédikian, 2010). Public health concerns are about dog bites or zoonoses (e.g. rabies, echinococcosis, leishmaniasis). High dog fecundity together with uncontrolled reproduction results in dog overpopulation and in dogs being prone to disease and malnutrition, thus posing additional concerns about dog welfare. Village dogs scavenge around human dwellings, but may also receive food from humans. In villages near nature protected areas, food may include wildlife; this raises concerns about wildlife predation. In urban areas, culling is a planned strategy to control dog overpopulation (e.g. street dogs are collected

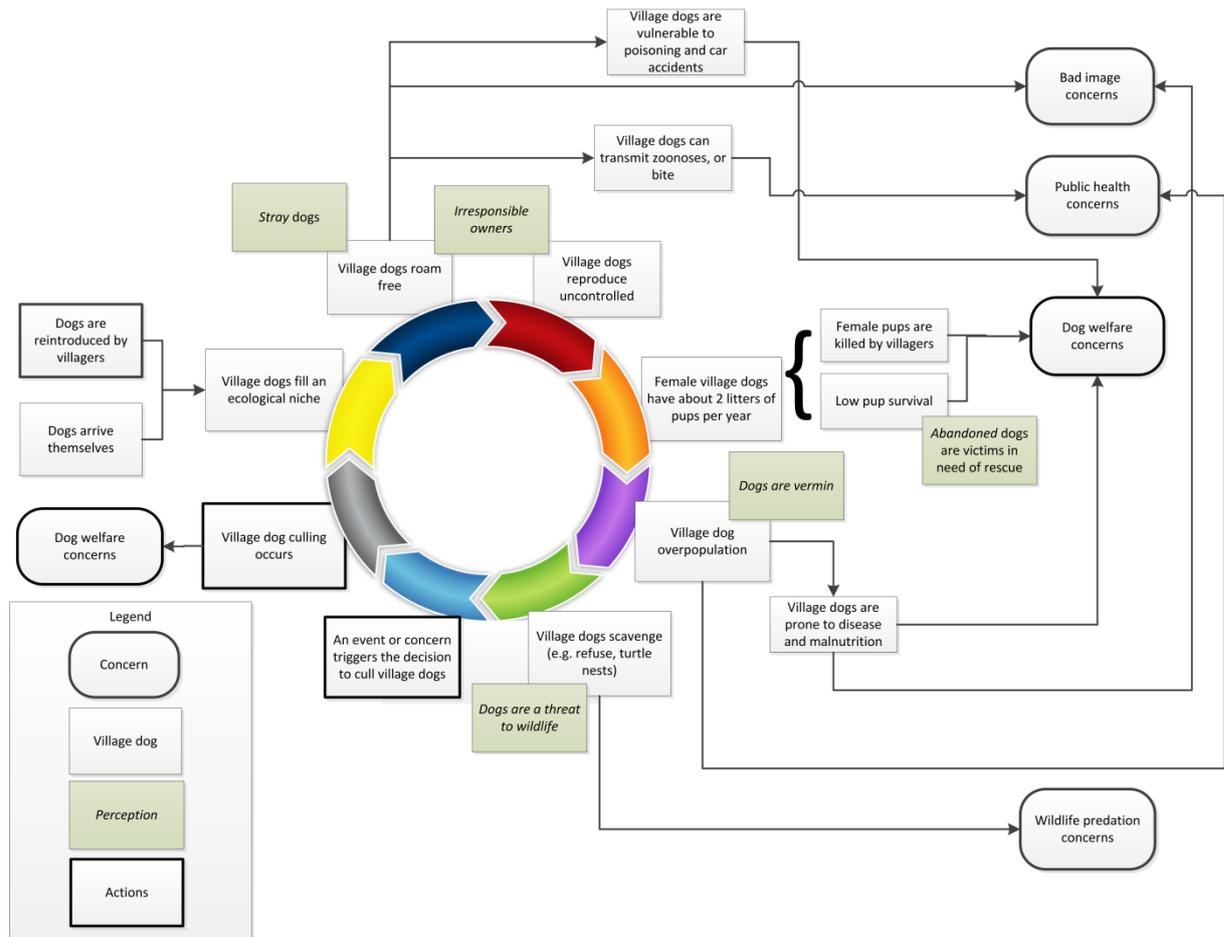


Figure 1 Dog population dynamics and village dog-related concerns

daily). In rural areas, however, certain events trigger the decision to cull dogs; for example: tourism, important international events that attract foreign visitors (e.g. football championships), or problems with wildlife predation or public health concerns (e.g. dog bites, zoonoses) (Chapter 5). When this happens, any dog on the street is subject to dog culling. Culling methods used are: poisoning, shooting, or electrocution; these also raise welfare concerns. After culling occurs, new dogs arrive or are reintroduced (WHO, 1988).

Perceptions and discourses of stakeholders in village dog-related problems have actual implications for dog management policy. The 'Pinocchio theory' (Clutton-Brock, 1995; Coppinger and Coppinger, 2001) on dog domestication presumes that humans had a major role in dog domestication. This theory shapes modern understandings about human responsibility for dog care under a concept of dogs' total dependence on humans. Total dependence on humans is a logical ethical argument deriving from the idea that humans took dogs out of the wild. In modern ethnocentric discourses of external stakeholders, therefore, any dog (e.g. village dogs) that is not totally dependent on humans is

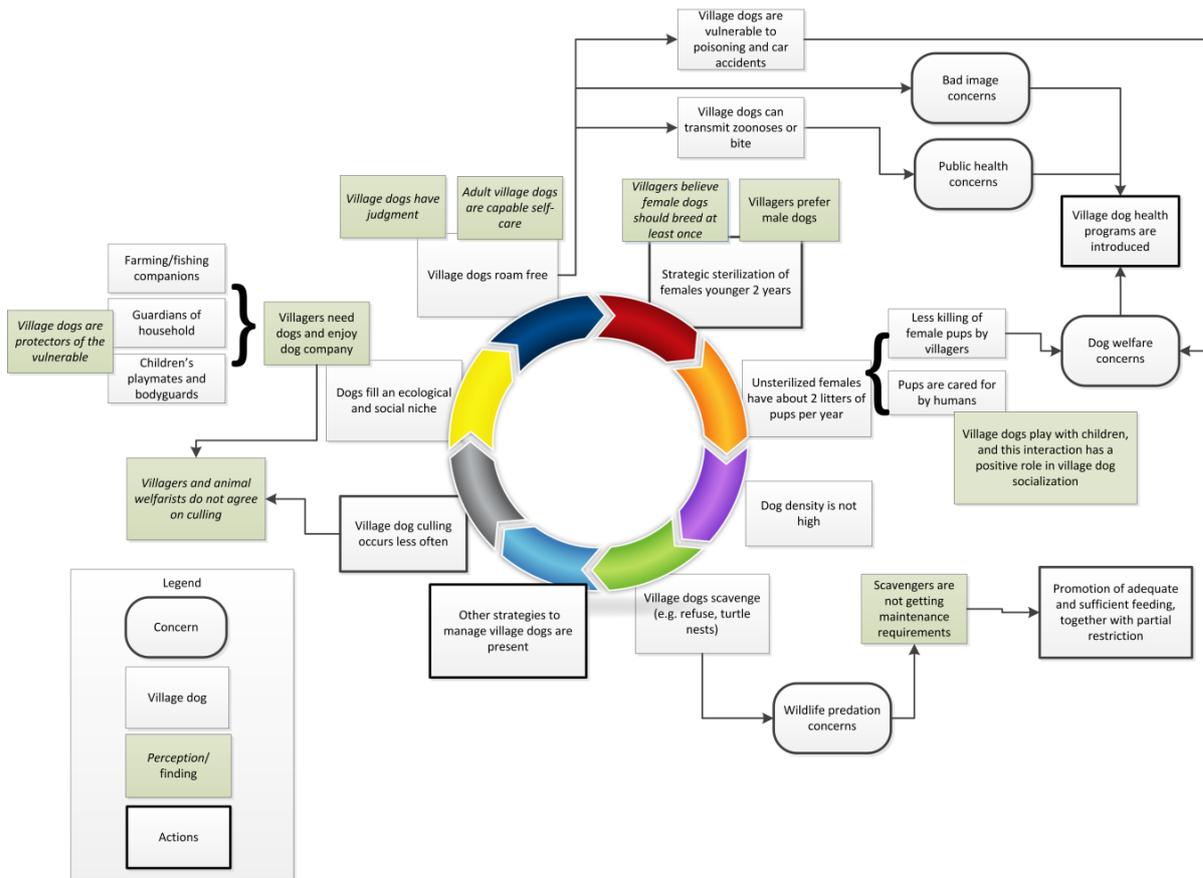


Figure 2 Dog population dynamics incorporating human-dog interactions

considered out of place. Village dogs are perceived either as victims in need of rescue or as vermin and a threat (Chapter 5) (Figure 1). The implications of these modern understandings, furthermore, render dog caregivers as non-existent (as clearly implied in ‘stray dogs’) or as irresponsible owners (Chapter 5) (Figure 1). This thesis, however, demonstrates that aspects of human-dog interaction have been overlooked in external stakeholder views (Figure 2).

It has been confirmed that village dogs gain benefits from their interaction with humans (e.g. food), and humans from their interaction with dogs (e.g. guarding households) (Coppinger and Coppinger, 2001). This interaction surpasses a purely ecological dimension; it also includes a social dimension. Our findings (Chapter 2 and Chapter 5) confirmed earlier results that guarding was the main reason for keeping or tolerating village dogs (WHO, 1998; Kitala *et al.*, 2001; Acosta-Jamett *et al.*, 2010). Additionally, however, village dogs were valued for their company and were confirmed to be playmates for children (Chapter 2 and Chapter 3). This would not be possible if socialization of village dogs did not occur from an early age and was not reinforced throughout life. Village dogs engage daily in social interactions with familiar or unfamiliar humans, for example in: human-dog play, begging for food, or following humans (e.g. to

the beach, farming fields, and anywhere in the village) (Chapter 3). These social interactions shape experiences of village dogs with humans, which can range from positive to negative, and to which dogs respond accordingly (e.g. approaching or avoiding). In The Bahamas, for example, it was hypothesized that the limited interaction between dogs and humans made roaming dogs shy and wary of humans (Fielding *et al.*, 2005a). In coastal villages of Michoacán, Mexico, most adult and juvenile dogs did not approach an unfamiliar human either. Village dogs, however, were socialized to familiar humans and regularly visited other households in the village (Chapter 3). Although not approaching the unfamiliar human could be related to negative experiences on the street, it is not likely to be due to a lack of interaction with humans in general. It is possible that, through experiences on the streets, village dogs learn to ignore unfamiliar humans in general, and only some dogs take advantage of begging for food from tourists. Although ascertaining this was not a main aim of this thesis, very few aggressive dogs were encountered in the studied villages; this differs from cities in the USA, where free-roaming dogs prevented people from walking on the streets (Poss and Bader, 2007).

The findings of this thesis support Poss and Bader's (2007) idea that allowing dogs to roam freely has a cultural component. Investigating this component was, however, not straightforward, given that villagers know about what is acceptable to the outside world (i.e. tourists, authorities). Villagers' answers to undesirable aspects of dog-keeping (e.g. roaming of dogs), therefore, may not match reality. In Oaxaca, for example, only 20% of villagers openly admitted that they let their dogs roam freely, whereas in fact over 80% of dogs were allowed to do so (Chapter 2). This is known as social desirability bias in face-to-face interviews (Leggett, 2003). Social desirability bias was found in respondents in villages with a high institutional presence (i.e. the Mexican Turtle Centre) or a high tourist presence (Chapter 2). To avoid this bias, in villages in Michoacán, ethnographic methods were used. This led to the finding that free-roaming of village dogs was generally accepted by villagers, and unwritten rules for societal living existed (e.g. biting dogs are not tolerated). External stakeholders' perceptions are in line with the Pinocchio theory (i.e. total dependence on humans), whereas perceptions of villagers are more in line with the Village Dog theory of dog self-domestication (Coppinger and Coppinger, 2001). In this theory, dogs are recognized as agents and co-producers of their domestication. The logical ethical argument of total dependence on humans cannot be derived from this theory. Villagers, in fact, impute to dogs notions of autonomy by perceiving them as having judgment,

capable of caring for themselves (i.e. self-care), and protectors of the vulnerable (Figure 2). Nevertheless, these perceptions of dogs by villagers also blur dogs' own vulnerability on the streets (e.g. accidents), which is a main concern for animal welfarists.

6.3 Concerns around welfare of village dogs

To identify concerns around village-dog welfare, first, the welfare of village dogs was assessed by combining results of this thesis with the so-called five freedoms (FAWC, 2012). These freedoms cover the animal's basic needs and can be used as an adequate and appropriate basis to assess animal welfare (De Boer, 2012). Second, results from this welfare assessment are discussed using Fraser *et al.*'s (1997) integrative model, see Table 1. This model confronts the adaptations that the animal possesses with the challenges faced by the animal in its current circumstances. This confrontation enables the identification of animal welfare concerns. Three types of adaptation to a situation can be distinguished: 1) adaptations to a situation that no longer serves an important function, such as rapid ingestion of large amounts of food by companion dogs that are fed *ad libitum*; 2) adaptations to a situation that still serve an important function, such as scavenging for food by free-roaming village dogs; and 3) situations to which an animal cannot adapt, such as car accidents.

1. *Freedom from Hunger and Thirst* - "by ready access to fresh water and a diet to maintain full health and vigor" (FAWC, 2012). About 95% of caregivers feed

Table 1 Village dog welfare assessed in terms of the five freedoms of animal welfare and Fraser *et al.*'s (1997) integrative model

Freedom	Adaption	Is this a welfare concern?
1 From hunger and thirst	Scavenging and begging from humans	No
2 From discomfort	Capacity to look for shelter in human (e.g. using cars) and natural surroundings (e.g. digging a den)	No
3 From pain, injury, or disease	Adaption lacking re avoiding car accidents and coping with high incidence of disease	Yes
4 To express normal behavior	Capacity to perform natural behavior in the village environment	No
5 From fear and distress	Socialization towards humans, not adapted to killing methods used by villagers or to culling village dogs	For killing methods only

their dogs daily in coastal villages in Mexico (Chapter 2 and Chapter 3). They, however, provide mainly corn tortillas. The amount of food provided does not always meet energy requirements for maintenance (Chapter 4). Some village dogs, therefore, possibly experience hunger, which may drive them to search for additional food. If additional food is not available around the household, dogs might travel long distances to search for food (Chapter 4). In villages near nature protected areas, searching for additional food appears to result in predation of wildlife, such as sea-turtle nests (Chapter 4). In coastal villages of Michoacán, however, over 60% of village dogs were in optimum body condition (Chapter 3). Similarly, in Ethiopia, 96% of village dogs were in a fair body condition (Ortolani *et al.*, 2009). These results support Fielding *et al.*'s (2005b) conclusion that a low body condition in street¹ dogs is most probably associated with disease, and not with a lack of food. The fact that village dogs maintain a body condition score (BCS) close to optimal, in spite of insufficient human-given food, supports the assertion that scavenging is an adaptation to the village niche (Coppinger and Coppinger, 2001). According to Lord *et al.* (2012), village dog high fecundity is another proof that dogs are well adapted to survive on human refuse. In conclusion, village dogs do not suffer from hunger and thirst, i.e. this first freedom is not a concern for village dog welfare.

2. *Freedom from Discomfort* - "by providing an appropriate environment including shelter and a comfortable resting area" (FAWC, 2012). This aspect is not fully met by humans. Nevertheless, their freedom of mobility (Donaldson and Kymlicka, 2011) enables village dogs to look themselves for shelter and resting areas. Especially in coastal areas, dogs need shaded spots to rest. Particular problems with shade or shelter were not observed in any of the coastal villages or reported by the villagers at the Pacific Coast of Mexico (Chapter 2 and Chapter 5). Bushes are abundant, as is shade from trees or houses. Dogs additionally use vehicles as shelters, as also reported for street dogs in Baltimore, USA (Beck, 2002). In coastal villages of Michoacán, village dogs were also regularly seen resting beneath or on trucks. Female dogs usually made dens in the bushes surrounding households, where pups were kept during the first weeks. Village dogs apparently are adapted to finding shelter in the human environment. Freedom from discomfort is therefore not a welfare concern for village dogs.

1 Street dogs is used here as the equivalent of village dogs, but in a city context.

3. *Freedom from Pain, Injury, or Disease* - “by prevention or rapid diagnosis and treatment” (FAWC, 2012). Local village dogs, like the ‘Potcake’ in The Bahamas, are referred to as ‘survivors’, because they seem better able to cope with living on the streets than, for example, purebred dogs that are allowed to roam freely (Fielding *et al.*, 2005c). Although village dogs may indeed be better adapted to their life on the streets of coastal areas than introduced purebreds, they are also exposed to a high incidence of diseases and injuries due to car accidents. Village dogs lack the adaptation to avoid car accidents. Car accidents were mentioned by 9% of villagers in Oaxaca as the cause of death for their most recent previous dog (Chapter 2). Dogs often learn not to approach vehicles only after they have been hit, which can leave them with permanent injuries. One of the most common diseases among village dogs worldwide is mange (Rodriguez-Vivas *et al.*, 2003; Fielding and Mather, 2008; Constable *et al.*, 2012; Totton *et al.*, 2011). In Celestún, a coastal village in Mexico, about 23% of village dogs had mange (Vázquez-Ávila, 2004). Mange is caused mainly by the mites *Demodex canis* and *Sarcoptes scabiei*; infection by the latter can cause a zoonosis. Dogs with mange generally have a poor body condition (BCS 2–3) (Rodriguez-Vivas *et al.*, 2003). Besides mange, village dogs living in areas where mosquitoes are present, such as the coast, generally have blood-borne diseases, such as heartworm. A prevalence of 19% to 60% is reported for coastal areas in Mexico and South America (Labarthe and Guerrero, 2005; Caro-Gonzalez *et al.*, 2011).

Village dogs generally are not adapted to resist diseases, such as mange or heartworms. Treatment for mange with ivermectine, for example, is not costly and very effective (Paterson *et al.*, 2009). In some cases, however, complete recovery may take several months, and the disease may reappear (Paterson *et al.*, 2009). The lack of veterinary services in coastal Mexico even results in villagers’ applying various ointments and bathing dogs with substances that may be toxic to them, such as chlorine and petrol (Chapter 5). In conclusion, freedom from pain, injury, or diseases is a welfare concern for village dogs as they are not adapted to avoid car accidents, and insufficient affordable veterinary care is available.

4. *Freedom to Express Normal Behavior* - “by providing sufficient space, proper facilities and company of the animal’s own kind” (FAWC, 2012). The ability for dogs to express natural behavior is an important welfare indicator (Haupt *et al.*, 2007). Natural behavior of dogs is best expressed in natural environments, where dogs can for example, dig, roll over in particular scents, mark with urine, and scavenge food. The village environment in rural areas enables dogs to

express their natural behavior and to have enough movement. Furthermore, village dogs are able to express their natural breeding behavior. Thus, for village dogs, freedom to express normal behavior is not a welfare concern.

5. *Freedom from Fear and Distress* - “by ensuring conditions and treatment which avoid mental suffering” (FAWC, 2012). Given that dogs are highly social animals, mental suffering might result from experiencing periods of enclosure in isolation, which is related to separation anxiety (Rehn and Keeling, 2011). Village dogs are not confined to one household only, but are free to visit other households, play with children from other households, and socialize with other dogs (Chapter 3). Current methods of killing village dogs both by authorities (poisoning, shooting, and electrocution) and villagers (e.g. hanging), however, are known to cause fear and distress. For example, strychnine, a common substance used for poisoning, causes violent convulsions and painful muscle contractions (Ortega-Pacheco and Jiménez-Coello, 2011). Electrocution may cause severe pain before onset of unconsciousness and may not be effective if insufficient current is applied (Ortega-Pacheco and Jiménez-Coello, 2011). Village dogs are not adapted to avoid these killing methods with accompanying stress and fear. Freedom from fear and distress is a welfare concern for village dogs in relation to killing methods only.

This analysis of village dog welfare shows that, in respect of various aspects of animal welfare, village dogs are adapted to some of their life conditions on the street; this is reflected in a close to optimum BCS and breeding up to twice per year. Village dogs, however, are exposed to a high incidence of diseases, like mange, and to injuries due to car accidents, which diminish dog life expectancy (Fielding and Mather, 2008). Furthermore, because of the lack of veterinary services in coastal areas, health problems may easily become complicated and suffering may be prolonged. The fact that diseases are easily visible (because sick dogs are on the street) may give the impression of more welfare problems than are actually present at population level.

6.4 Village dog management strategies

If village dogs are viewed only from the perspective of the Pinnochio theory (i.e. considering only the perceptions and discourses of external stakeholders), the cycle of dog culling is inadvertently reinforced, even by animal welfarists who are concerned with culling (Figure 1). From the Village Dog theory perspective (i.e. considering only the perception of internal stakeholders), village dogs' ability to take care of themselves (self-care) is recognized, but not their vulnera-

Table 2 Evaluation of strategies for the management of village dogs

Strategies	Description	Aim	Addresses the following						Effective
			Dog welfare	Wildlife predation	Public health	Bad image	Respect for dog free-roaming	Considers internal stakeholder perceptions ²	
Dog culling	Involves capturing dogs on the street, taking them to dog pounds for 72 hours, and finally killing them (DOF, 2011), or putting out poison baits on the street.	To prevent spread of rabies in high density dog populations.	No	No	No	No	No	No	No
Surgical sterilization campaigns	A group of veterinarians and assistants visit a community and perform surgical sterilization on dogs brought by caregivers.	To reduce dog overpopulation	Yes	No	Yes	Yes	Yes	No ¹	Yes, with a condition
ABC program	Involves the capture, surgical sterilization, and rabies vaccination of dogs on the street (Totton <i>et al.</i> , 2011).	To reduce population growth by replacing a population of unvaccinated, fertile dogs with vaccinated, infertile dogs.	Yes	No	Yes	Yes	Yes	No	Yes, under certain circumstances
Non-surgical methods	Involves the use of single injection sterilization agents for males or contraception for females.	To reduce population growth through less invasive and less costly procedures than surgical sterilization.	Yes	No	Yes	Yes	Yes	No ¹	Possibly, needs further study

Dog registration and fees	Each dog is identified by a tattoo or microchip and registered to one owner. Additionally, fees can be charged for owning a dog.	To ensure that each dog is linked to a human that will be responsible for the dog and that dogs that are on the street can be returned to an owner.	No	No	Yes	No	No	No	No
Dog adoption	Involves taking a dog into the home environment and assuming responsibility for all of the dog's needs.	To take dogs off the street.	Yes	No	No	Yes	No	No	No
Rabies vaccination	Dogs are vaccinated against rabies at local clinics or house to house.	To reduce rabies prevalence	No	No	Yes	No	Yes	Yes	Yes
Health program	Workshops are held with villagers to rank the most important dog-related problems. A community member is trained to cure most common dog health problems (Constable <i>et al.</i> , 2012).	To tackle dog-related problems relevant at a local level.	Yes	No	Yes	Yes	Yes	Yes	Yes
Night restriction	Involves restricting dogs from night to dawn in order to prevent scavenging of wildlife or avoid nuisance to tourists.	To reduce wildlife predation (e.g. sea-turtle nests).	No	Yes	Yes	Yes	Yes	Yes	Possibly, needs further study
Promotion of sufficient, adequate feeding	Involves providing information to caregivers about quantities dogs need of locally available foods (e.g. tortillas, leftovers).	To reduce wildlife predation (e.g. sea-turtle nests).	Yes	Yes	No	Yes	Yes	Yes	Possibly, needs further study

¹Although internal stakeholders' perceptions (F) are not taken into account, success depends on internal stakeholder's cooperation, ²and opinions

bility on the street. In order to find possible strategies to manage village dog populations, we need to acknowledge the complexity of human-dog interactions, and include the views of both external and internal stakeholders. Table 2 shows the main strategies available in the literature, as well as strategies derived from the findings of this thesis. Each strategy is evaluated in regard to the aspects addressed: dog welfare, wildlife predation, public health, bad image, its respect for dog free-roaming, and its consideration of internal stakeholders' perceptions and opinions.

Dog culling is the dominant strategy deployed to manage village dogs in Mexico (Chapter 5), even though it has not been proven that rabies is density dependent (Morters *et al.*, 2013). Dog culling has proved ineffective in managing dog populations (WHO, 1988); in controlling rabies (Morters *et al.*, 2013) and leishmaniasis (Nunes *et al.*, 2008); and in preventing wildlife predation, such as predation of gazelles (Manor and Saltz, 2004). After culling, new dogs arrive themselves or are introduced by humans to fill an ecological and a social niche (Figure 2). Villagers need dogs as guardians and work companions, or simply enjoy dogs (e.g. children's playmates). Furthermore, culling does not respect free-roaming of dogs and does not consider stakeholder perceptions. On all aspects evaluated, culling of dogs, therefore, is ineffective.

Dogs are sterilized to reduce dog overpopulation, and consequently reduce the magnitude of other concerns such as dog welfare, public health, or bad image. Different sterilization methods or programs are available, such as: surgical sterilization campaigns, Animal Birth Control (ABC) programs, and non-surgical sterilization methods. Surgical sterilization can be performed only by licensed veterinarians (of whom there are none in remote communities), and require a sterile working area and sterile materials, all of which is costly, but can be financed by, for example, non-governmental organizations. A main limitation of **surgical sterilization campaigns** is still, however, their acceptability by the local society. Masculinity of males, for example, is largely valued if dogs have a guarding function (Fielding, 2008), whereas motherhood is valued for females (Chapter 2). Therefore, villagers might not be willing to bring their dogs to be sterilized. In villages in Oaxaca, very few dogs were sterilized in spite of a yearly one-week sterilization campaign (Chapter 2). Surgical sterilization campaigns, therefore, can be effective, with the condition that internal stakeholder perceptions are considered.

ABC programs differ from sterilization campaigns in that dogs are routinely vaccinated against rabies and are not brought by caregivers but are collected from the street. ABC programs do address concerns around dog welfare (i.e. incidence of disease, see Table 1) and public health, and respect free-roaming of dogs. ABC programs' proven efficacy in reducing disease incidence, however, is low (Kumarapeli and Awerbuch-Friedlander 2009; Morters *et al.*, 2013), and internal stakeholders' perceptions are not respected (e.g. acceptance of sterilization). ABC programs are currently operant in urban areas of India with high dog densities (Totton *et al.*, 2011). This is perhaps a strategy that might work in large urban areas of Mexico (e.g. Mexico City, Monterrey, Guadalajara). In villages of the Pacific Coast, however, villagers may be upset if just any dog can be collected from the street. Villagers who do not agree on sterilization, may keep their dogs inside during collection days, or bring other unsterilized dogs to the village. Although the ABC program could be effective in Mexico under certain circumstances, it does not respect internal stakeholder perceptions, and this may render the program ineffective.

Unlike surgical sterilization, **non-surgical methods**, such as contraception for females or sterilization agents for males, are still underdeveloped or too expensive to be applied on a large scale in the Global South (ACC, 2013). As with surgical sterilization, the effectiveness of non-surgical methods depends on whether or not they respect local stakeholder perceptions. In Oaxaca, for example, although 98% of all villagers agreed on female dog sterilization, 50% also considered that female dogs should breed at least once in their lifetime to give them the opportunity to experience mothering (Chapter 2). Breeding at least once, therefore, appears to be a precondition for female dog sterilization. The efficacy of contraception is limited to only some months. Female village dogs in an indigenous reserve in Canada had a contraceptive implant inserted under the skin that lasted only 18–24 months (CBC News, 2013). Contraception of females may possibly be effective, given that this matches internal stakeholders' opinion about the need to breed females at least once. Nevertheless, its efficacy will also depend on having sufficient economic resources to sustain its application to the village dog population. In regard to males, male dogs were sterilized with a single intratesticular injection in different Mexican cities with high population densities (Esquivel-LaCroix, 2006). This was done with owner consent, but the degree of acceptability by local people is not known. Furthermore, its effectiveness in diminishing the dog population has not been measured. At this moment, it is not possible to evaluate its effectiveness.

A disadvantage of sterilization in general (regardless of the method used) is that, just as with culling, the demand for dogs by communities may result in an increase in the reintroduction of dogs, improved care of dogs, and reduced competition for food (Morters *et al.*, 2013). All of this may be counterproductive to the sterilization efforts or may rapidly restore the dog population to its level before the intervention. Totton *et al.*'s (2010) model predicts that it takes 13 to 18 years for sterilization to be effective in reducing the dog population, and that the population returns to previous levels within three to four years of ceasing the program. Dog sterilization programs can be more effective when they target specific age and gender groups. For example, Di Nardo *et al.* (2007) found that sterilizing only female dogs younger than 1 year was much more effective in reducing population size over a 20-year period than concentrating efforts in other age groups. In their model, sterilizing only 26% of females younger than 1 year resulted in population reduction, sterilizing females younger than 2 years resulted in population maintenance, and sterilizing females of 3 or more years could not halt population growth, unless 55% of the female population was sterilized (Di Nardo *et al.*, 2007). Given that half of the villagers in Oaxaca consider it important that village dogs breed at least once in a lifetime (Chapter 2), sterilization efforts could be effective if 2-year-old females are targeted.

Dog registration, dog shelters, and adoption are among the most common methods used for dog control in high income countries of the European Union (Dalla Villa *et al.*, 2010). These methods have in common that they try to promote 'responsible dog ownership'. **Dog registration and fees** have proved largely ineffective in The Bahamas, with very few people registering dogs that are allowed to roam freely (Fielding, 2008). This has not been tried in Mexico, but it would require infrastructure and enforcement, which might be difficult to have in rural areas. Furthermore, dog registration requires dog ownership by one person. In coastal villages of Mexico, both dog owners and non-dog owners take care of village dogs (Chapter 2), and, therefore, it is more realistic to acknowledge that a dog has more than one caregiver. The latter may be problematic for registering dogs and paying fees. This strategy, therefore, is considered as ineffective for managing village dog populations.

Adoption is a logical action in a system of dog-keeping where all dogs depend on humans (e.g. Global North), and some dogs from this population are lost or abandoned. In the village dog system, however, taking the village dogs off the street would mean having to transform the system. Adoption, therefore, can only have limited benefits for particular dogs but does not have the potential to reduce

village dog-related concerns. Another aspect to consider is that village dogs would be taken out of their normal environment (street) into a new environment of mainly enclosure, and this would limit the expression of their natural behavior. This is detrimental to dog welfare. Given the limited benefits, adoption is not an effective strategy for village dog management. In the Global North, adoption of dogs usually works together with dog shelters that can keep dogs until they are adopted. **Dog shelters** in developing countries lack resources and infrastructure. Depending on the dog, adoption from a shelter can be a long process, or may not occur. Furthermore, when a no-kill policy is adopted, this results in overcrowding of dogs and diseases inside the shelter (Dalla Villa *et al.*, 2008). Dog shelters are therefore considered as ineffective for reducing welfare problems in village dogs.

In the village dog welfare assessment, disease was found to be the greatest welfare concern. **Animal health control** programs aim to control common diseases, in particular zoonoses, such as rabies. These programs can be combined with sterilization and euthanasia of sick animals. One of the reasons why control of rabies through vaccination has been efficient is the fact that most dogs are associated with people and, therefore, are accessible for vaccination (Morters *et al.*, 2013). Rabies vaccination programs are in general widely accepted. However, rabies vaccination programs usually do not target other diseases that may affect dog welfare (e.g. mange, blood-borne diseases). As with other strategies to manage village dogs, rabies vaccination programs have in common their top-down approach, in which experts determine the problem and the requisite interventions. This approach creates a sense of powerlessness and dependence within local people (Constable *et al.*, 2012). When local people's concerns are considered, however, and they are trained to, for example, cure common diseases, health programs have great potential to increase village dog welfare (Constable *et al.*, 2012) In Mexican villages, the SSA (Ministry of Health) works through health clinics that attend to the most common human diseases. Perhaps a dog health program could take advantage of the existing infrastructure. Dog health programs are considered effective to improve village dog welfare, and to tackle public health concerns.

Strategies deriving from this thesis are night restriction and promotion of sufficient and adequate feeding. **Night restriction:** In tourist villages with current high criminality, villagers may not be willing to restrict dogs that have a guarding function (Chapter 2). Thus, this strategy needs to go hand in hand with other community measures to improve security. Furthermore, villagers need to provide

extra food and water when their dog is restricted to the household (which they naturally do when they occasionally tether dogs). Animal welfarists might have an interest in promoting and financing state-of-the-art equipment for restricting dogs (e.g. pet containment or trolley systems). Given the finding that village dogs mainly visit a sea-turtle nesting beach from night to dawn (Chapter 4), this strategy has great potential for reducing turtle-nest predation. **Promotion of sufficient and adequate feeding:** The adoption of this strategy would depend partly on having enough food for the household. In very poor households however, there might be a role for external stakeholders to help, for example by providing dog food. Given the finding that village dogs who scavenge sea-turtle nests do not receive their maintenance energy requirements (Chapter 4), this strategy has great potential for reducing turtle-nest predation.

The combination of one or more strategies, however, may have more impact than deploying only one – for example, a health management program with promotion of sufficient and adequate feeding, and selective sterilization of females under 2 years old. Strategies are effective when village dog concerns are prevented or adequately addressed before this leads to dog culling (Figure 2). On the occasion of relevant events that attract international visitors (e.g. football championships), it is important to consider that the presence of sick or aggressive dogs may be overestimated, just by the fact that dogs are seen on the street. Perhaps only a few dogs would need to receive treatment or be euthanized, without having to cull village dogs indiscriminately. Actual measurement of the incidence of diseased dogs in village dog populations in different areas, and levels of care, is a subject for further study. The vulnerability of dogs on the street to car accidents or poisoning has not been tackled in any of the strategies mentioned; nor the fact that the actual nuisance some dogs pose to neighbors can lead to dog poisoning (Chapter 2 and Chapter 5). These are points that need to be openly discussed with internal stakeholders to find adequate solutions in particular villages. If the majority of villagers consider that it is acceptable for dogs to be on the street, the street needs to be a safe place for them. Actual assessment of suggested strategies and recommendations for village dog management in Mexico and other countries of the Global South is a subject for further research.

6.5 Conclusion

This thesis has contributed to improving the understanding of human-(village) dog interactions. It has been shown that village dogs in coastal Mexico are not 'stray', but interact with familiar humans (i.e. caregivers, children) from one or

various households. Therefore, wildlife concerns, such as predation of sea-turtle nests, need to focus not only on village dogs, but also on caregivers' feeding practices. Interactions of dogs with humans surpass a purely ecological relationship, as village dogs also fill a social niche and have important functions. Furthermore, throughout this thesis, it has been shown how human-dog interactions are subject to clashing perceptions and discourses of internal and external stakeholders. External stakeholders' discourses shape current policies and management strategies for village dog populations, whereby dog culling is the main strategy but is largely ineffective. Other available strategies have been analyzed in regard to village dog-related concerns and respect for the village dog-keeping system. The Pacific Coast of Mexico was used as an example, but insights might be extrapolated to similar situations in other countries of the Global South. The main findings of this thesis are:

- Both dog owners and non-owners were involved in caretaking of free-roaming village dogs (Chapter 2).
- Villagers need dogs for guarding and as work companions, and consider dogs as children's playmates. Keeping dogs as companions was mostly mentioned in tourist villages (Chapter 2).
- Villagers in tourist villages and international tourists perceived dog welfare problems in tourist villages (Chapter 2).
- Village dogs are socialized towards familiar humans but are reluctant to approach an unfamiliar human (Chapter 3).
- By playing with dogs, children have a positive role in village dog socialization (Chapter 3).
- Dogs scavenging sea-turtle nests do not get sufficient maintenance energy requirements (Chapter 4).
- Villagers believe adult dogs are capable of self-care (Chapter 5).
- Current discourses about village dogs, portraying them as victims (e.g. abandoned) or vermin, shape current policies with regard to village dog management strategies (Chapter 6).

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Summary/Resumen/Samenvatting

Curriculum Vitae

Publications

Education certificate

Acknowledgements

Colophon



Summary

Dogs (*Canis familiaris*) are considered one of the most numerous carnivores worldwide with an estimated population of over 700 million. Although in the Global North dogs are popular companions that live inside homes, about 80% of the dogs in the world can be classified as village dogs. Village dogs are typically free-roaming animals that scavenge refuse around human dwellings, and associate with one or various households. At present, village dogs in the Global South are a concern for national and international organizations and individuals, such as tourists. Concerns arise about: overpopulation of village dogs, public health because of transmission of zoonoses and dog bites, welfare of village dogs, and issues relating to dog-wildlife interactions, such as predation on wildlife and disease transmission. Furthermore, there are concerns about bad image, because dogs on the street appear as a sign of underdevelopment to foreign visitors (e.g. tourists). Village dogs on the street are a common sight in any Mexican village, and are locally known as *callejeros*, and considered as stray.

Village dogs that live nearby nature protected areas are part of three main systems: the household, the village, and the nature protected area. At household level, dogs interact with familiar (i.e. caregivers) and unfamiliar humans (e.g. visitors, rabies campaign personnel). At village level, dogs interact with familiar humans from other households, or with unfamiliar humans, such as tourists and strangers. Dogs can enter a nature protected area (i.e. sea-turtle nesting beach) by themselves or with other dogs or humans. At all system levels, village dogs have experiences with humans that may range from positive to negative, and this may be reflected in their behavioral responses towards humans. Food is a central element in the above-described holistic system. Village dogs scavenge for food in proximity to humans, beg for food, or prey on sea-turtle eggs. The presence of sea-turtle nests, and/or tourists at beaches creates alternative sources of food for village dogs. The keeping of dogs in the above-described system, moreover, is subject to clashing perceptions and discourses of external (e.g. tourists, authorities) and internal (villagers) stakeholders. For internal stakeholders for example, dog predation of sea-turtle nests may be less relevant, whereas wildlife predation by village dogs is an important concern for wildlife agencies. If this complexity in human-dog interactions is not acknowledged, solutions regarding concerns around village dogs are likely to fail.

Dog culling has proved ineffective in managing dog populations, in controlling zoonoses, and preventing wildlife predation. Dog culling is, nevertheless, the dominant strategy deployed to manage village dogs in Mexico. The objective of this thesis was to improve the understanding of human-dog interactions in coastal areas of Mexico in order to identify strategies - embedded in the social

and cultural context - to manage village dogs. The Pacific Coast of Mexico is used as a case study area because of its high dog density (per human). Moreover, the Pacific Coast is home to important nature protected areas for sea-turtle nesting, where dogs from adjacent villages scavenge sea-turtle nests. In Mexico alone, there are over 30 important nesting beaches along the Pacific Coast and the Gulf of Mexico. Some of the villages in the vicinity of nature protected areas are important for tourism. The Pacific Coast of Mexico, therefore, enables in-depth study of human-dog interactions and related concerns, such as village dogs scavenging sea-turtle nests and the welfare of village dogs in tourist areas. Results presented are based on fieldwork conducted in villages from the eco-tourist corridors, known as Ventanilla-Puerto Angel in the state of Oaxaca and Costa Nahua in the state of Michoacán.

In **chapter 2**, a general overview of human-dog interactions, and dog-related problems in coastal villages is described. Dog-keeping systems and the opinions of 99 villagers and 151 tourists were investigated through interviews and questionnaires in three villages of coastal Oaxaca. The main economic activities of the three villages were tourism (Mazunte, Puerto Angel), fishing (Puerto Angel), and farming (Río Seco). Dogs were the most commonly kept animal in all villages. All dog owners allowed their dog(s) to roam freely in the farming village, but not in the tourist villages. All villagers perceived as a problem that there were too many dogs. Main reasons given for keeping dogs were: guarding, as work companions and as children's playmates. Significantly more dog owners in the tourist village mentioned companionship as a reason for keeping dogs than those in the farming village. Both dog owners and non-owners were involved in feeding of free-roaming village dogs. Villagers in tourist villages and international tourists perceived dog welfare problems, such as dogs being too thin or sick. Dog welfare problems were perceived more by international than by Mexican tourists. The difference in perceptions on dog welfare can be explained by economic reasons (dog welfare is not a priority for villagers whose own welfare is also low), disruptions in the dog-keeping system in tourist villages such as seasonal availability of tourist refuse, and different frames of reference of external and internal stakeholders.

The complexity of human-dog interaction with regard to familiar and unfamiliar humans is subject of **chapter 3**. Village dog socialization with humans, and body condition score of village dogs were investigated at the Coast of Michoacán. Villages differed in available seasonal food sources (sea-turtle nests or tourist refuse). Methods included interviews with caregivers and behavioral testing of 59 village dogs. This study showed that village dogs were socialized to familiar humans, but were not attracted to an unfamiliar human. Although not approaching the unfamiliar human could be related to negative experiences on the street, it is not likely to be due to a lack of interaction with

humans in general. It is possible that, through experiences on the streets, village dogs learn to ignore unfamiliar humans, and only some dogs take advantage of begging for food from tourists. Mainly children played with village dogs. Dogs that were reported to play with humans were more likely to respond with tail wagging to a caregiver's call. The fact that playing with humans was related to the response to familiar and unfamiliar humans, shows that play interactions occur regularly and are of a positive nature. Female dogs were less reported to engage in human-dog play, and did respond less with tail wagging to the caregiver's call. Dog gender differences in human-dog play could be explained by the overt preference of villagers for male dogs. Most dogs were in optimal body condition, which was not related to the behavioral response to the caregiver. Village dogs maintained their body condition also in the low season for sea-turtle nesting and tourism. In the sea-turtle nesting village dogs were probably maintaining their body condition by scavenging sea turtle nests on the beach.

To get a better insight in the nest scavenging behavior of dogs the ecological dimension of human-dog interactions is studied in **chapter 4**. Roaming characteristics and feeding practices of 19 beach-visiting dogs (some of which scavenged sea-turtle nests) at Colola Sanctuary (Michoacán) were studied through radiotracking and interviews with caregivers regarding feeding practices. Corn tortillas was the main food provided daily by caregivers. Nest scavengers had a lower metabolic energy intake of tortillas, and a larger mean distance from home compared to non-nest scavengers. The larger activity range of nest scavengers, however, was not only restricted to the beach, as their activity range in the village was also larger than that of non-nest scavengers. This could indicate that nest scavengers are not able to find enough food close to their household, and, therefore, need to scavenge further away from the household. Competition for food resources is possibly greater in the village than at the beach. The lower provision of tortillas at the household might be one of the drivers for village dogs to scavenge sea-turtle nests. This conclusion is supported by the interview results, which suggest that once dogs are old enough to scavenge, they are fed only limited amounts of tortillas. Dogs are expected, therefore, to scavenge additional food around their household or neighboring households. Furthermore, 39% of caregivers reported that they provided turtle eggs or egg shells to their dogs at least once. Dogs were generally found at the beach at night and dawn, whereas they generally were in the village during the day. These findings have implications for the management of dogs at sea-turtle nesting beaches. It is recommended that dogs' movements should be restricted between night (21.00 hours) and dawn (06.00 hours) and that sufficient and adequate feeding of dogs should be promoted among caregivers; in particular, sea-turtle eggs and shells should be excluded from the dogs' diet.

Village dog predation on wildlife is a major conservation concern, but the socio-cultural context of village dog-keeping is rarely considered. In **chapter 5**, discourse analysis and ethnographic methods were used to unveil the discourses that sustain current policy regarding village dogs and to compare these with the narratives voiced at village level. The main argument developed is that current policies and attempts to manage village dog populations in Mexico are derived from discourses and experiences largely disconnected from the village context. Moreover, the discourses that are identified evolve around structurally different interpretations of human–environment interrelationships. Expert and animal welfare discourses portray dogs as out of place either as vermin and a threat, or as abandoned victims in need of rescue. The ‘Pinocchio theory’ on dog domestication presumes that humans had a major role in dog domestication. Total dependence on humans is a logical ethical argument deriving from the idea that humans took dogs out of the wild. Based on the Pinocchio theory, the human-dog relationship is similar to a parent-child relationship. Villagers’ narratives, in contrast, perceive dogs as autonomous and as making their own judgments. Perceptions of villagers are more in line with the Village Dog theory of dog self-domestication. In this theory, dogs are recognized as agents and co-producers of their domestication. The logical ethical argument of total dependence on humans cannot be derived from this theory. If village dogs are viewed only from the perspective of the Pinocchio theory, dog culling is inadvertently reinforced, even by animal welfarists who are concerned with culling. From the Village Dog theory perspective, village dogs’ ability to take care of themselves is recognized, but the vulnerability of dogs on the streets is blurred. Furthermore, this way of keeping dogs is considered as irresponsible ownership by external stakeholders. The label of irresponsible owners prevents the inclusion of village dog caregivers as legitimate participants in policy processes.

In **chapter 6**, the general discussion, the welfare of village dogs (one of the main concerns of external stakeholders) was assessed by combining results of this thesis with the so-called five freedoms. This analysis of village dog welfare shows that, in respect of various aspects of animal welfare, village dogs are adapted to some of their life conditions on the street; this is reflected in a close to optimum body condition score and breeding up to twice per year. Village dogs, however, are exposed to a high incidence of diseases, like mange, and to injuries due to car accidents, which diminish dog life expectancy. Furthermore, because of the lack of veterinary services in coastal areas, health problems may easily become complicated and suffering may be prolonged. The fact that diseases are easily visible (because sick dogs are on the street) may give the impression of more welfare problems than are actually present at population level.

Discourses of external stakeholders shape current policies and management strategies for village dog populations. Dog culling is the dominant strategy but appears largely ineffective. In **chapter 6**, therefore, dog culling and other available strategies are analyzed. Each strategy is evaluated with regard to village dog-related concerns, its respect for dog-free roaming, and its consideration of internal stakeholders' perceptions. Dog sterilization could be effective in controlling village dog populations, only if internal stakeholders' perceptions and opinions are considered, such as perceiving motherhood as important, and expecting female dogs to breed at least once. Dog registration, dog adoptions, and dog shelters are likely to be ineffective because these strategies do not respect free-roaming of village dogs. A health program that tackles also dog diseases other than rabies (e.g. mange), is likely to improve village dog welfare. Strategies deriving from this thesis are partial restriction, and sufficient and adequate feeding. These strategies respect free roaming of village dogs and internal stakeholder perceptions. These strategies have the potential to prevent predation of sea-turtle nests.

In conclusion, the findings of this thesis show that village dogs in coastal Mexico are not stray, but interact with familiar humans (i.e. caregivers, children) from one or various households. Therefore, wildlife concerns, such as predation of sea-turtle nests, need to focus not only on village dogs, but also on caregivers' feeding practices. Interactions of dogs with humans surpass a purely ecological dimension, as village dogs also fill a social niche and have important functions. Furthermore, throughout this thesis, it is shown how human-dog interactions are subject to clashing perceptions and discourses of internal and external stakeholders. In order to find possible strategies to manage village dog populations, it is necessary to acknowledge the complexity of human-dog interactions, and include the views of both external and internal stakeholders. The Pacific Coast of Mexico was used as an example, but insights might be extrapolated to similar situations in other countries of the Global South.

Resumen

El perro (*Canis familiaris*) es considerado como uno de los carnívoros más numerosos en todo el mundo, con una población estimada de más de 700 millones de perros. Aunque en el Norte Global, los perros son populares compañeros que viven en el interior de las casas, cerca del 80% de los perros en el mundo se pueden clasificar como perros de pueblo. Los perros de pueblo, por lo general, son animales que deambulan libremente e ingieren los desperdicios alrededor de las casas, y se asocian con uno o varios hogares. En la actualidad, los perros de pueblo en el Sur Global son un tema de preocupación para organizaciones e individuos tanto nacionales e internacionales, como los turistas. Los temas de preocupación son: la sobrepoblación canina, la salud pública, debido a la transmisión de zoonosis y mordeduras de perro, el bienestar de los perros del pueblo, y las cuestiones relativas a la interacción perro-fauna silvestre, tales como la depredación de la fauna y la transmisión de enfermedades. Por otra parte, existen cuestiones sobre mala imagen, porque los perros en la calle dan apariencia de subdesarrollo a los visitantes extranjeros (por ejemplo, turistas). Prácticamente en todo México, es común encontrar perros en la calle, los cuales comúnmente se denominan callejeros, y dan la impresión de no tener dueño.

Los perros de pueblo que viven cerca de áreas naturales protegidas son parte de tres sistemas principales: el hogar, el pueblo y el área natural protegida. A nivel del hogar, los perros interactúan con humanos conocidos (es decir, sus cuidadores) y desconocidos (por ejemplo, visitas y personal de la campaña antirrábica). A nivel de pueblo, los perros interactúan con humanos conocidos de otros hogares o con humanos desconocidos, como los turistas. Los perros pueden entrar en un área natural protegida (es decir, las playas de anidación de tortuga marina) por sí solos o junto con otros perros o humanos. En todos los niveles del sistema, las experiencias de los perros con los seres humanos varían de positivas a negativas, y estas experiencias se pueden ver reflejadas en sus respuestas de comportamiento hacia los seres humanos. La comida es un elemento central en el sistema holístico antes descrito. Los perros de pueblo pueden buscar su comida en proximidad a las personas, pueden pedir comida a las personas, o bien, escavar huevos de tortugas marinas. La presencia de nidos de tortugas marinas, y/o turistas en las playas crea fuentes alternativas de alimento para los perros. El mantenimiento de los perros en el sistema antes descrito, está además sujeto a las percepciones y discursos de actores externos (por ejemplo, turistas, autoridades) e internos (gente del pueblo). Para los actores internos, por ejemplo, la depredación de los nidos de tortuga marina por perros puede ser poco relevante, mientras que la depredación de fauna silvestre es un tema importante para las agencias de fauna silvestre. Si no se

reconoce esta complejidad en las interacciones humano-perro, las soluciones a las diversas cuestiones en torno a los perros del pueblo son propensas a fallar.

La matanza de perros ha demostrado ser ineficaz en el control de poblaciones caninas, en el control de las zoonosis, y en evitar la depredación de fauna silvestre. La matanza de perros es, sin embargo, la estrategia dominante empleada para controlar a los perros de pueblo en México. El objetivo de esta tesis es mejorar la comprensión de las interacciones entre humanos y perros en las zonas costeras de México con el fin de identificar estrategias - integradas en el contexto social y cultural - para manejar a los perros de pueblo. La costa del Pacífico mexicano se utiliza como zona del estudio de caso debido a su alta densidad de perro (por cada ser humano). Por otra parte, la costa del Pacífico es sede de importantes áreas naturales protegidas de anidación de tortuga marina, donde los perros de pueblos cercanos escarban los nidos de tortuga. Tan sólo en México, hay más de 30 importantes playas de anidación a lo largo de la costa del Pacífico y el Golfo de México. Algunos de los pueblos en los alrededores de las áreas naturales protegidas son importantes para el turismo. La costa del Pacífico mexicano, por lo tanto, permite estudiar a fondo las interacciones humano-perro y cuestiones relacionadas, tales como la depredación de nidos de tortuga marina y el bienestar de los perros de pueblo en zonas turísticas. Los resultados presentados se basan en el trabajo de campo realizado en pueblos de los corredores eco-turísticos, conocidos como Ventanilla-Puerto Ángel, en el estado de Oaxaca y la Costa Nahua en el estado de Michoacán.

En el **capítulo 2**, se describe un panorama general de las interacciones humano-perro, y de los problemas con perros en pueblos de la costa. El sistema en que la gente cuida y mantiene a los perros de pueblo y las opiniones de 99 habitantes y 151 turistas fueron investigados a través de entrevistas y cuestionarios en tres pueblos de la costa oaxaqueña. Las principales actividades económicas de éstos pueblos son el turismo (Mazunte, Puerto Angel), la pesca (Puerto Angel), y la agricultura (Río Seco). Se encontró que los perros son los animales más comunes en todos los pueblos. Todos los dueños permitían a sus perros andar libres en el pueblo agrícola, pero no en los pueblos turísticos. En todos los pueblos, la gente percibió como un problema la presencia de demasiados perros. Las principales razones dadas para tener perros fueron: vigilancia, como compañeros de trabajo, y como compañeros de juego de los niños. Significativamente más dueños del pueblo turístico mencionaron compañía como una razón para tener perros en comparación con los dueños del pueblo agrícola. Tanto los dueños de perros así como gente que no tenía perros estuvieron involucrados en la alimentación de los perros. Los pobladores de los pueblos turísticos y los turistas internacionales percibieron problemas con el bienestar de los perros, por ejemplo, perros demasiado flacos o enfermos. Los problemas de bienestar fueron percibidos más por los turistas internacionales

más que por los turistas mexicanos. La diferencia entre las percepciones respecto al bienestar de los perros se pueden explicar en base a razones económicas (el bienestar de los perros no es una prioridad para los habitantes del pueblo agrícola, cuyo propio bienestar es también bajo), interrupciones en el sistema en que la gente cuida y mantiene perros en los pueblos turísticos, debidos a la disponibilidad temporal de basura turística y en base a los diferentes marcos de referencia de los actores externos e internos.

La complejidad de la interacción humano-perro con respecto a los seres humanos, conocidos y no conocidos es tema del **capítulo 3**. La socialización de los perros con los humanos, así como su condición corporal se investigaron en la costa de Michoacán. Los pueblos estudiados difieren en las fuentes de alimentos de temporada disponibles (nidos de tortugas marinas o residuos de turismo). Los métodos incluyeron entrevistas con los cuidadores de perros y pruebas de comportamiento a 59 perros de pueblo. Este estudio demostró que los perros del pueblo están socializados con humanos conocidos, pero no se sienten atraídos por humanos desconocidos. Aunque no acercarse a un humano desconocido podría estar relacionado con experiencias negativas en la calle, no es probable que sea debido a la falta de interacción con los seres humanos en general. Es posible que, a través de las experiencias en la calle, los perros del pueblo aprendan a ignorar los seres humanos que no conocen, y sólo algunos perros aprovechan de pedir comida a los turistas. Principalmente los niños juegan con los perros del pueblo. Los perros en los que se reportó juego con humanos, fueron más propensos a responder moviendo la cola al llamado de un cuidador. El hecho de que jugar con los seres humanos se relacionó con la respuesta a los seres humanos conocidos y no conocidos muestra que las interacciones de juego ocurren con regularidad y son de naturaleza positiva. En las perras se reportó menor juego con humanos, y respondieron menos con movimientos de cola al llamado del cuidador. Éstas diferencias entre perros machos y hembras podrían explicarse por la preferencia manifiesta de los pobladores por los machos. La mayoría de los perros estaban en condición corporal óptima, y ésta no estuvo relacionada con la respuesta de comportamiento al cuidador. Los perros mantuvieron su condición corporal también en la temporada baja de turismo y de anidación de tortugas marinas. Los perros del pueblo con anidación de tortugas marinas probablemente mantienen su condición corporal consumiendo los nidos de tortugas.

Para tener una mejor visión sobre el comportamiento de los perros que consumen nidos de tortuga, la dimensión ecológica de las interacciones humano-perro se estudia en el **capítulo 4**. Las características de deambuleo y las prácticas de alimentación de 19 perros que visitan la playa (algunos de los cuales escavan los nidos de tortugas marinas) en el Santuario Colola (Michoacán) fueron estudiadas a través de radio telemetría y de entrevistas con

los cuidadores sobre sus prácticas de alimentación. Las tortillas de maíz fueron el alimento principal proporcionado diariamente por los cuidadores. Los perros depredadores de nidos tuvieron una menor ingesta de energía metabólica de tortillas y un rango de actividad más grande que los perros no depredadores. El rango de actividad más grande de los depredadores de nido, sin embargo, no se limitó a la playa, ya que su rango de actividad en el pueblo también fué más grande que el de los no depredadores. Esto podría indicar que los depredadores de nidos no son capaces de encontrar suficiente comida cerca de su hogar, y, por lo tanto, necesitan buscarla más lejos del hogar. La competencia por los recursos alimenticios es posiblemente mayor en el pueblo que en la playa. La menor provisión de tortillas en el hogar podría ser uno de los factores para los perros del pueblo vayan a la playa a escavar nidos de tortugas. Esta conclusión se apoya en los resultados de la entrevista, que sugieren que una vez que los perros tienen la edad suficiente para buscar comida, son alimentados sólo con cantidades limitadas de tortillas. Por lo tanto, los perros necesitan buscar alimento adicional alrededor de su hogar u hogares vecinos. Por otra parte, el 39% de los cuidadores informaron que han proporcionado huevos de tortuga y cáscaras de huevo a sus perros al menos una vez. Los perros se encontraron en la playa generalmente por la noche y el amanecer, mientras que por lo general se encontraron en el pueblo durante el día. Estos resultados tienen implicaciones para el manejo de los perros en las playas de anidación de tortuga marina. Se recomienda que los movimientos de los perros deben restringirse entre la noche (21,00 horas) y la madrugada (06.00 horas) y que una alimentación suficiente y adecuada se debe promover entre los cuidadores, en particular, los huevos de tortugas marinas y conchas deben ser excluidos de la dieta de los perros.

La depredación de fauna silvestre por perros es una de las principales preocupaciones de conservación, pero el contexto socio-cultural de los perros de pueblo rara vez es considerado. En el **capítulo 5**, se utilizaron métodos de análisis discursivo y métodos etnográficos para conocer los discursos que sostienen la política vigente en materia de perros de pueblo y para compararlos con las narrativas expresadas por los pobladores. El principal argumento desarrollado es que las políticas y los acciones encaminadas a controlar las poblaciones caninas rurales en México se derivan de discursos y experiencias en gran medida desconectados del contexto de pueblo. Por otra parte, los discursos que se identifican giran en torno a interpretaciones estructuralmente diferentes de relaciones humano-ambiente. Los discursos de los expertos y los defensores de animales muestran a los perros como fuera de lugar, ya sea como peligros y una amenazas, o como víctimas abandonadas en necesidad de ser rescatadas. La “teoría de Pinocho” sobre la domesticación del perro presume que los seres humanos tuvieron un papel importante en la domesticación del perro. La dependencia total en los seres humanos es un argumento ético lógico derivado

de la idea de que los seres humanos sacaron a los perros de la naturaleza. Con base en la teoría de Pinocho, la relación hombre-perro es similar a una relación padre-hijo. La narrativa de los pobladores, en cambio, muestra que los perros se perciben como autónomos y capaces de hacer sus propios juicios. Las percepciones de los pobladores están más en línea con la teoría de auto-domesticación de perros de pueblo (Village dog theory). En esta teoría, los perros son reconocidos como agentes y coproductores de su domesticación. El argumento ético lógico de total dependencia en los seres humanos no se puede derivar de esta teoría. Si los perros de pueblo se ven sólo desde la perspectiva de la teoría de Pinocho, la matanza de perros se refuerza inadvertidamente, incluso por los defensores de animales que se oponen a ella. Desde la perspectiva de la teoría de auto domesticación, la capacidad de los perros de pueblo para cuidarse a sí mismos se reconoce, pero la vulnerabilidad de los perros en las calles se vuelve borrosa. Además, esta forma de tener perros es considerada como tenencia irresponsable por los actores externos. La etiqueta de dueños irresponsables impide la inclusión de los cuidadores de perros de pueblo como participantes legítimos en los procesos políticos.

En el **capítulo 6**, la discusión general, el bienestar de los perros de pueblo (una de las principales preocupaciones de los actores externos) se evaluó mediante la combinación de los resultados de esta tesis con las llamadas cinco libertades de los animales. Este análisis del bienestar de los perros muestra que, en relación con diversos aspectos del bienestar de los animales, los perros de pueblo se adaptan a algunas de sus condiciones de vida en la calle, lo que se refleja en una condición corporal cercana a la óptima y en camadas de hasta dos veces por año. Los perros de pueblo, sin embargo, están expuestos a una alta incidencia de enfermedades, como la sarna, y lesiones por accidentes de tráfico, que disminuyen su promedio de vida. Además, debido a la falta de servicios veterinarios en las zonas costeras, los problemas de salud pueden fácilmente complicarse y el sufrimiento puede ser prolongado. El hecho de que las enfermedades son fácilmente visibles (porque los perros enfermos están en la calle), puede dar la impresión de que hay más problemas de bienestar que los que realmente están presentes a nivel de la población.

Los discursos de los actores externos moldean las actuales políticas y estrategias para el manejo de las poblaciones de perros de pueblo. La matanza de perros es la estrategia dominante, pero parece en gran medida ineficaz. En el capítulo 6, por lo tanto, se analizan las estrategias disponibles para controlar poblaciones caninas. Cada estrategia se evalúa en relación con las preocupaciones relacionadas con perros de pueblo, el respeto a la libertad de movimiento del perro de pueblo, y la consideración de las percepciones de los actores internos. La esterilización de perros podría ser eficaz en el control de poblaciones de perros de pueblo, sólo si se consideran las percepciones y opiniones de los

actores internos, tales como que perciben la maternidad como importante y desean que las perras se reproduzcan al menos una vez. El registro de perros, las adopciones de perros, y los refugios de perros tienden a ser ineficaces debido a que estas estrategias no respetan la libertad de movimiento de los perros de pueblo. Un programa de salud que aborde también otras enfermedades además de la rabia (por ejemplo, sarna), podría mejorar el bienestar de los perros de pueblo. Las estrategias que se derivan de esta tesis son la restricción parcial, y la alimentación suficiente y adecuada. Estas estrategias respetan la libertad de movimiento de los perros de pueblo y las percepciones de los actores internos. Estas estrategias tienen el potencial de prevenir la depredación de los nidos de tortuga marina.

En conclusión, los resultados de esta tesis muestran que los perros de pueblo en la costa de México no son callejeros, sino que interactúan con humanos conocidos (es decir, los cuidadores, los niños) de una o varias familias. Por lo tanto, la solución a la depredación de los nidos de tortuga marina por parte de perros, debe centrarse no sólo en los perros de pueblo, sino también en las prácticas de alimentación de sus cuidadores. La interacción de los perros con los humanos superan la dimensión puramente ecológica, ya que los perros de pueblo también ocupan un nicho social y tienen funciones importantes. Además, en esta tesis, se muestra cómo las interacciones humano-perro están sujetas a percepciones y discursos discordantes entre los actores internos y externos. A fin de encontrar las posibles estrategias para el manejo de las poblaciones de perros de pueblo, es necesario reconocer la complejidad de las interacciones humano-perro, e incluir los puntos de vista de los actores externos e internos. La costa del Pacífico mexicano se utilizó como un estudio de caso, pero los resultados pueden extrapolarse a situaciones similares en otros países del Sur Global.

Samenvatting

Honden (*Canis familiaris*) worden beschouwd als een van de wereldwijd meest voorkomende carnivoren met een geschatte populatie van meer dan 700 miljoen. Hoewel op het Noordelijk Halfrond honden populaire huisdieren zijn die binnenshuis leven, kan 80% van de honden in de wereld worden geclassificeerd als dorps honden. Dorps honden zijn vrij rondlopende dieren die etensresten bijeen scharrelen in en rondom bewoonde gebieden, en zij hebben een relatie met een of meerdere huishoudens. Op dit moment zijn dorps honden op het Zuidelijk Halfrond een zorg voor nationale en internationale organisaties en individuen, zoals toeristen. Bezorgdheid ontstaat over: overbevolking van de dorps honden populaties, volksgezondheid als gevolg van de transmissie van zoönosen en hondenbeten, welzijn van de dorps honden, en de interacties tussen honden en wilde dieren, zoals predatie en de overdracht van ziekten. Verder zijn er zorgen over een slecht imago, omdat honden die op straat leven als een teken van onderontwikkeling worden beschouwd door buitenlandse bezoekers (bijv. toeristen). Dorps honden op straat zijn een normaal verschijnsel in een Mexicaans dorp, en zijn lokaal bekend als 'callejeros', en worden beschouwd als straathonden zonder baas.

Dorps honden, die vlakbij beschermde natuurgebieden wonen, zijn onderdeel van drie belangrijke systemen: het huishouden, het dorp en het beschermde natuurgebied. Op huishoudniveau hebben honden interacties met bekende (d.w.z. verzorgers) en onbekende mensen (bijvoorbeeld bezoekers, hondsdolheid campagne personeel). Op dorpsniveau hebben honden interacties met bekende mensen uit andere huishoudens (bijv. familie), of met onbekende mensen, zoals toeristen en vreemdelingen. Honden kunnen een beschermd natuurgebied (bijv. een strand waar zeeschildpadden landen) betreden alleen of met andere honden of mensen. Op alle systeemniveaus hebben dorps honden ervaringen met mensen die kunnen variëren van positief naar negatief, en dit kan worden weerspiegeld in hun gedrag ten opzichte van mensen. Eten is een centraal element in het boven beschreven holistische systeem. Dorps honden scharrelen naar voedsel in de nabijheid van de mens, bedelen om voedsel, of graven en zoeken naar zeeschildpad eieren. De aanwezigheid van zeeschildpadnesten, en/of toeristen op de stranden creëert alternatieve bronnen van voedsel voor de dorps honden. Het houden van honden in het hierboven beschreven systeem is bovendien onderworpen aan botsende opvattingen en botsende manieren van beschrijven tussen externe (bijv. toeristen, overheden) en interne (dorpelingen) belanghebbenden. Voor dorpelingen kan bijv. de predatie van zeeschildpadnesten door honden minder relevant zijn, terwijl deze predatie door dorps honden een belangrijke zorg is voor natuurbeschermingsorganisaties. Als deze complexiteit in mens- hond

interacties niet wordt erkend, is het waarschijnlijk dat de aangedragen oplossingen voor problemen met dorpshonden mislukken.

Het ruimen (ofwel doden) van honden is ineffectief gebleken in het beheer van de honden populaties, in het beheersen van zoönosen, en in het voorkomen van predatie. Het ruimen van honden is niettemin de dominante strategie die wordt ingezet om de dorpshonden populatie onder controle te houden in Mexico. Het doel van dit proefschrift was om het begrip van de mens - hond interacties in de kustgebieden van Mexico te verbeteren, om strategieën te bepalen - ingebed in de sociaal-culturele context - om dorpshonden te beheren. De Pacifische kust van Mexico wordt gebruikt als case study gebied vanwege de hoge hondendichtheid (per mens). Bovendien heeft de Pacifische Kust een aantal belangrijke beschermde natuurgebieden vanwege de zeeschildpadnesten, waar de honden uit aangrenzende dorpen deze schildpadnesten uitgraven. In Mexico alleen al zijn er meer dan 30 belangrijke landingsstranden langs de Pacifische kust en de Golf van Mexico. Sommige van de dorpen in de nabijheid van de beschermde natuurgebieden zijn belangrijk voor het toerisme. Daarom maakt de Pacifische kust van Mexico een diepgaande studie van de mens - hond interacties en gerelateerde problemen, zoals dorpshonden die zeeschildpadnesten uitgraven en het welzijn van de dorpshonden in toeristische gebieden. Gepresenteerde resultaten zijn gebaseerd op veldwerk in de dorpen van de eco - toeristische gebieden, bekend als 'Ventanilla - Puerto Angel' in de staat Oaxaca en 'Costa Nahua' in de staat Michoacán.

In **hoofdstuk 2** wordt een algemeen overzicht gegeven van de mens - hond interacties, en de hond - gerelateerde problemen in kustdorpen. Het systemen van het houden van honden en de meningen van 99 dorpelingen en 151 toeristen werden onderzocht door middel van interviews en vragenlijsten in drie dorpen van de kust Oaxaca. De belangrijkste economische activiteiten van de drie dorpen waren toerisme (Mazunte, Puerto Angel), visserij (Puerto Angel) en landbouw (Río Seco). Honden waren de meest gehouden dieren in alle dorpen. Alle hondenbezitters lieten hun hond (en) in het boerendorp vrij rondlopen, maar niet in de toeristische dorpen. Alle dorpelingen zien als probleem dat er te veel honden zijn. Voornaamste redenen voor het houden van honden waren: bewaking, het vergezellen van de dorpelingen tijdens het werk en als speelkameraadjes voor kinderen. Significant meer hondenbezitters in het toeristische dorp noemden gezelschap als reden voor het houden van honden dan die in het boerendorp. Zowel hondenbezitters als niet- hondenbezitters gaven voer aan loslopende dorpshonden. Dorpelingen in toeristische dorpen en internationale toeristen namen welzijnsproblemen waar bij de honden, zoals honden die te dun of ziek zijn. Welzijnsproblemen bij honden werden meer waargenomen door internationale dan door de Mexicaanse toeristen. Het verschil in perceptie van het hondenwelzijn kan verklaard worden door

economische redenen (hondenwelzijn is geen prioriteit voor dorpingen wiens eigen welzijn ook laag is), door storingen in het systeem waarin honden gehouden worden in de toeristische dorpen, zoals seizoensgebonden beschikbaarheid van afval van toeristen, en door de verschillende referentiekaders van externe en interne betrokkenen.

De complexiteit van de mens - hond interactie met betrekking tot bekende en onbekende mensen is het onderwerp van **hoofdstuk 3**. Dorpshonden socialisatie met de mens, en conditiescore van de dorps honden werden onderzocht aan de kust van Michoacán. Dorpen verschilden in beschikbare seizoensgebonden voedsel bronnen (zeeschildpadnesten of afval van toeristen). De methoden bestonden uit interviews met verzorgers en gedragstesten van 59 dorps honden. Deze studie toonde aan dat dorps honden waren gesocialiseerd met bekende mensen, maar niet werden aangetrokken tot onbekende mensen. Hoewel het niet benaderen van onbekende mensen zou kunnen samenhangen met negatieve ervaringen op straat, is het waarschijnlijk niet te wijten aan een gebrek aan interactie met de mens in het algemeen. Het is mogelijk dat door ervaringen op straat dorps honden leren om onbekende mensen te negeren, en slechts enkele honden profiteren van bedelen om voedsel bij toeristen. Vooral kinderen speelden met dorps honden. Honden van wie werd gezegd dat ze spelen met mensen reageerden vaker met kwispelen van de staart als de verzorger ze riep. Het feit dat het spelen met mensen was gerelateerd aan de respons op bekende en onbekende mensen, laat zien dat spelinteracties regelmatig voorkomen en van positieve aard zijn. Vrouwelijke honden werden minder genoemd deel te nemen in mens- hond spel, en reageerden minder vaak met kwispelende staart op de oproep van de verzorger. Hond sekseverschillen in mens- hond spelen kon worden verklaard door de duidelijke voorkeur van de dorpingen voor reuen. De meeste honden waren in optimale conditie, en deze conditie was niet gerelateerd aan de gedragsrespons op de verzorger. Dorps honden behouden hun conditie ook in het laagseizoen als er weinig zeeschildpadnesten en toeristen zijn. In het dorp met zeeschildpadnesten onderhielden de dorps honden waarschijnlijk hun lichamelijke conditie door het uitgraven van zeeschildpadnesten en het eten van de eieren op het strand.

Om een beter inzicht in het nest uitgraafgedrag van honden te krijgen wordt de ecologische dimensie van de mens- hond interactie bestudeerd in **hoofdstuk 4**. Kenmerken van het loslopen en de voerpraktijken van 19 strandbezoekende honden (waarvan sommigen zeeschildpadnesten uitgroeven) in Colola Sanctuary (Michoacán) werden bestudeerd door radio-tracking en gesprekken met verzorgers over het voeren van de honden. Maïstortilla's waren het belangrijkste voer dat dagelijks door de verzorgers aan de honden werd gevoerd. Nest uitgravers hadden een lagere metabolische energieopname van tortilla's, en een grotere gemiddelde afstand van huis in vergelijking met niet -

nest uitgravers. Het grotere gebied waarin de nest uitgravers zich bewogen, was echter niet alleen beperkt tot het strand, ook hun afstanden in het dorp waren groter dan die van niet - nest uitgravers. Dit zou erop kunnen wijzen dat nest uitgravers niet in staat zijn om genoeg voedsel dicht bij huis te vinden, en zij moeten daarom verder van huis hun voedsel bij elkaar scharrelen. Concurrentie om voedsel is mogelijk groter in het dorp dan op het strand. De lagere gift van tortilla's door de verzorgers zou een van de redenen kunnen zijn voor dorpshonden om zeeschildpadnesten uit te graven. Deze conclusie wordt ondersteund door de interviewresultaten, die suggereren dat zodra honden zijn oud genoeg om voer bij elkaar te scharrelen, ze slechts worden gevoerd met beperkte hoeveelheden tortillas. Van de honden wordt verwacht dat ze extra voedsel vinden rond hun huis of in de buurt. Bovendien meldde 39% van de verzorgers dat zij minstens een keer schildpadeieren of eierschalen hebben verstrekt aan hun honden. Honden werden meestal 's nachts en in de vroege ochtend op het strand gevonden, terwijl ze over het algemeen gedurende de dag in het dorp waren. Deze bevindingen hebben implicaties voor het beheer van de honden in zeeschildpad neststranden. Het wordt aanbevolen dat de honden moeten worden vastgehouden tussen 21.00 uur ('s nachts) en 6.00 uur (zonsopgang) en dat moet worden gepromoot dat de verzorgers voldoende en adequate voeding aan de honden geven, in het bijzonder moeten zeeschildpadeieren en eierschalen worden uitgesloten van het hondendieet.

Dorpshonden predatie van wilde dieren is een belangrijke zorg in natuurbeheer, maar de sociaal - culturele context van het houden van dorpshonden wordt zelden overwogen. In **hoofdstuk 5** werden discourseanalyse en etnografische methoden gebruikt om de achterliggende redeneringen van het huidige beleid ten aanzien van dorpshonden te identificeren en deze te vergelijken met de verhalen geuit op dorpsniveau. Het belangrijkste argument is dat het huidige beleid en de pogingen om dorpshondenpopulaties te beheren in Mexico zijn afgeleid van redeneringen en ervaringen die grotendeels losgekoppeld zijn van de dorpscontext. Bovendien evolueren de geïdentificeerde redeneringen rond structureel verschillende interpretaties van de mens - milieu relatie. Redeneringen van experts en dierenwelzijnspecialisten portretteren dorpshonden als misplaatst hetzij als ongedierte en een bedreiging, hetzij als achtergelaten slachtoffers die moeten worden gered. De 'Pinokkio theorie' over hond domesticatie veronderstelt dat de mens een belangrijke rol heeft gespeeld in de domesticatie van de hond. Totale afhankelijkheid van de mens is een logisch ethisch argument dat is ontleend aan de gedachte dat de mens honden uit het wild heeft genomen. Op basis van de Pinokkio theorie is de mens - hond relatie vergelijkbaar met een ouder - kind relatie. Daarentegen worden honden, in de verhalen van de dorpelingen, beschreven als autonoom en in staat om te oordelen. Percepties van de dorpelingen zijn meer in lijn met de dorpshonden theorie, waarin de

hond zichzelf domesticeerde. In deze theorie worden honden erkend als agenten en co - producenten van hun domesticatie. Het ethische argument van de totale afhankelijkheid van de mens kan niet worden afgeleid uit deze theorie. Als dorpshonden alleen worden gezien vanuit het perspectief van de Pinokkio theorie, wordt het ruimen van honden onbedoeld versterkt, zelfs door dierenwelzijnactivisten die zich zorgen maken over het ruimen. Vanuit het perspectief van de dorpshonden theorie wordt erkend dat dorpshonden voor zichzelf kunnen zorgen, maar er wordt geen rekening gehouden met de kwetsbaarheid van honden op straat. Bovendien wordt deze manier van het houden van honden beschouwd als 'onverantwoordelijk eigenaarschap' door externe betrokkenen. Het label van 'onverantwoordelijke eigenaren' verhindert dat dorpshondverzorgers legitiem deelnemen aan beleidsprocessen.

In **hoofdstuk 6**, de algemene discussie, werd het welzijn van dorpshonden (één van de belangrijkste zorgen van de externe betrokkenen) bepaald door de resultaten van dit proefschrift te combineren met de "vijf vrijheden" (vrij van honger en dorst; van ongemak; van pijn, verwondingen en ziekten; vrij om zich natuurlijk te gedragen; en vrij van angst en stress). Deze analyse van het welzijn van de dorpshonden laat zien dat met betrekking tot de verschillende aspecten van dierenwelzijn, dorpshonden zijn aangepast aan een deel van hun levensomstandigheden op straat; dit wordt weerspiegeld in een dicht bij optimale conditiescore en het tot twee keer per jaar krijgen van pups. Dorpshonden worden echter blootgesteld aan een hoge incidentie van ziekten, zoals schurft, en verwondingen vanwege auto-ongelukken, welke de levensduur van de dorpshonden verminderen. Bovendien, vanwege het ontbreken van veterinaire diensten in de kustgebieden, kunnen gezondheidsproblemen gemakkelijk ingewikkelder worden, waardoor het leed wordt verlengd. Het feit dat ziekten gemakkelijk worden waargenomen (omdat zieke honden op straat leven) kan de indruk wekken van meer welzijnsproblemen dan daadwerkelijk aanwezig zijn op populatieniveau.

Redeneringen van externe belanghebbenden geven vorm aan het huidige beleid en de management strategieën voor dorpshonden populaties. Het ruimen van honden is de dominante strategie, maar lijkt grotendeels ineffectief. Daarom worden in hoofdstuk 6 het ruimen van honden en andere beschikbare strategieën geanalyseerd. Elke strategie wordt geëvalueerd met betrekking tot dorpshond gerelateerde problemen, in hoeverre de strategie het loslopen van de dorpshonden respecteert, en of de percepties van interne belanghebbenden worden meegenomen. Sterilisatie van honden kan effectief zijn in het beheersen van dorpshonden populaties, alleen als de meningen van interne belanghebbenden worden meegenomen, zoals dat het moederschap belangrijk wordt gevonden, en dorpelingen verwachten dat vrouwelijke honden ten minste een keer reproduceren. Hondenregistratie, adopties van honden, en

asielen zijn waarschijnlijk niet effectief, omdat deze strategieën het loslopen van de dorpshonden niet respecteren. Een gezondheidsprogramma dat ook andere hondenziektes aanpakt naast hondsdolheid (bijv. schurft) verbetert waarschijnlijk het dorpshonden welzijn. Strategieën die voortvloeien uit dit proefschrift zijn gedeeltelijke beperking van de bewegingsvrijheid van de dorpshonden, en voldoende en adequate voeding. Deze strategieën houden rekening met het loslopen van de dorpshonden en de percepties van de interne belanghebbenden. Deze strategieën hebben het potentieel om predatie van zeeschildpadnesten te voorkomen.

Kortom, de bevindingen van dit proefschrift laten zien dat dorpshonden in kustgebieden Mexico geen zwerfhonden zijn, maar een relatie hebben met bekende mensen (d.w.z. verzorgers, kinderen) van een of verschillende huishoudens. Daarom moet het beheer van wilde dieren, zoals het voorkomen van predatie van zeeschildpadnesten, zich niet alleen richten op dorpshonden, maar ook op de voerpraktijken van de verzorgers. Interacties van honden met mensen gaan verder dan een puur ecologische dimensie, aangezien dorpshonden een sociale niche vervullen en belangrijke functies hebben. Bovendien is in dit proefschrift aangetoond dat de mens - hond interacties onderhevig zijn aan botsende opvattingen en redeneringen van de interne en externe belanghebbenden. Om mogelijke strategieën te vinden om dorpshonden populaties te beheren, is het noodzakelijk om de complexiteit van de mens- hond interacties te erkennen, en onder meer de standpunten van zowel externe als interne belanghebbenden mee te nemen. De Pacifische kust van Mexico werd als voorbeeld gebruikt, maar inzichten kunnen geëxtrapoleerd worden naar vergelijkbare situaties in andere landen van het Zuidelijk Halfrond.

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Curriculum vitae

Eliza Ruiz Izaguirre was born on October 31st, 1975 in Guadalajara, Mexico, where she grew up. She studied veterinary medicine in Mexico City at the Universidad Nacional Autónoma de México (UNAM). She has been active in research since veterinary school, when she obtained the Frontiers for Veterinary Medicine research grant (Geraldine Dodge Foundation). She graduated as a veterinarian in 2003 under the scheme of Professional Supervised Practice Abroad, granted to the top ten veterinary students at UNAM. After a conducting a year of internal medicine rotations at



veterinary hospitals, Eliza was awarded a Wageningen University scholarship to study an MSc in Animal Sciences at Wageningen University. She followed the specialization of Companion Animals and conducted two master thesis, one at the former Ethology Department, and one at the Animal Production Systems Group. After her MSc studies, she obtained a doctoral scholarship from the Council of Science and Technology of Mexico pursue her PhD degree. She has presented results of her research at the International Society for Applied Ethology (2007), and the Canine Science Forum (2010). In 2012, she was one of seven fellows awarded the Human-Animal Studies summer fellowship at Wesleyan University, U.S.A., to write a paper about socio-cultural aspects of village dog-keeping, and to engage in intellectual discussion with other researchers in human-animal studies. In 2012, she was also awarded a summer retreat to work on one of her articles, at Shin Pond, Maine, U.S.A. (Humane Society of the United States). Eliza has published in international peer reviewed journals, and has several articles submitted and in preparation. Eliza has supervised MSc students in Mexico and in The Netherlands.

She is married and mother of two sons.

List of Publications

Refereed scientific journals

Ruiz-Izaguirre, E., Eilers, C.H.A.M. (2012) Perceptions of village dogs by villagers and tourists in the coastal region of rural Oaxaca, Mexico. *Anthrozoös*, 25:1.

Ruiz Izaguirre, E., Eilers, C.H.A.M., Bokkers, E., Ortolani, A., Ortega-Pacheco, A. (2010) Village dogs at the Pacific Coast of Mexico: Socialization towards humans and human-dog interactions. *Journal of Veterinary Behaviour*, 6:1, p.66.

Ruiz-Izaguirre, E., Eilers, C.H.A.M., Hebinck, P. Dog free-roaming revisited: Village dogs in the rural coast of Michoacan, Mexico, in the midst of a globalized world. (submitted)

Ruiz-Izaguirre E., Eilers, C.H.A.M., Bokkers, E., Ortolani, A., Ortega-Pacheco, A. Human-dog interactions and behavioral responses of village dogs in sea-turtle nesting and tourist villages of Michoacán, Mexico. (submitted)

Ruiz-Izaguirre E., C.H.A.M. Eilers, van Wieren, S.E., van Woersem, A., Bosch, G., van der Zijpp, A.J., de Boer I.J.M. Roaming characteristics and feeding practices of village dogs scavenging sea-turtle nests. (submitted)

Abstracts in conference proceedings

Ruiz-Izaguirre, E., Eilers, C.H.A.M. (2012) The village dogs of Mexico in the midst of modernity. *Minding Animals Conference*. July 2012. Utrecht, The Netherlands.

Ruiz Izaguirre, E., Eilers, C.H.A.M., Bokkers, E., Ortolani, A., Ortega-Pacheco, A. (2010) Village dogs at the Pacific Coast of Mexico: Socialization towards humans and human-dog interactions. In: *Proceedings of the 2nd Canine Science Forum on dogs and related canids- from genes through behaviour to society*. July 25-28, Vienna, Austria.

Ruiz Izaguirre E., Groot, J., van der Borg, J., Graat, L. (2007) Developing a model diagnosis for separation related problems in dogs based on a behavioural test. *Proceedings of the 41st International Congress of the International Society for Applied Ethology (ISAE)*. July 30 – August 3rd, Mérida, Mexico.

Other publications

Ruiz Izaguirre, E., Aluja S., A. Educational Program for Children on Animal Welfare. (1999) *Frontiers for Veterinary Medicine* (report).

Education Certificate			
Completed Training and Supervision Plan			
The Basic Package		year	credits *
WIAS Introduction Course		2007	1.5
Biology underpinning animal sciences, Wageningen		2007	1.5
International Conferences		year	credits
ISAE, Mérida, Mexico		2007	1.5
CSF, Vienna, Austria		2010	1.2
Seminars and workshops			
Poultry and People Workshop, Wageningen		2007	0.2
18th Symposium Tropical Animal Health and Production, Utrecht		2007	0.3
Personalities in Animals: Implications for Welfare, Wageningen		2007	0.2
WIAS Science Day, Wageningen		2010	0.2
Interpreting the human-animal relation, WASS Seminar Series, Wageningen		2012	0.2
Presentations			
ISAE, Mérida, Mexico (oral)		2007	1.0
Programa 'Pescando Ideas', Colegio de Michoacán, Mexico (oral)		2008	1.0
WIAS Science Day (oral)		2010	1.0
Canine Science Forum, Vienna, Austria (poster)		2010	1.0
Jornadas de Bioética y Bienestar Animal, Univ. Mich., Morelia, Mexico (oral)		2012	1.0
ASI HAS opening workshop (oral), Middletown, USA		2012	1.0
Minding Animals Conference, (oral) Utrecht		2012	1.0
Disciplinary and interdisciplinary courses			
Biomass use: food, feed or fuel, Wageningen		2007	1.5
Advanced statistics courses			
WIAS Advanced Statistics course: Design of Experiments		2009	1
Statistics for the Life Sciences, WIAS		2010	2.0
Statistics course Mixed Linear Models, PE&PR		2010	0.6
MSc level courses			
Introduction to (social sciences) Fieldwork I, Colegio de Michoacán, Mexico		2009	6.0
Professional Skills Support Courses			
Course Techniques for Scientific Writing, Wageningen, 16-19 october		2007	1.2
PhD competence assesment, Wageningen, 26 september		2007	0.3
Writing Grant Proposals, Wageningen University, November 2, 9 and 23		2010	2
Research Skills Training			
Preparing own PhD research proposal		2007	6.0
Canine natural history exploration: Mexico City, Mexico		2009	1.4
Animals and Society Summer Fellowship, Wesleyan University		2012	2.0
Didactic skills training			
Canine natural history exploration: Mexico City, Mexico (practical)		2009	0.2
Supervision of MSc students		2011	3
Organisation of seminars and courses			
WIAS Science Day organising committee		2010	0.6
Education and Training Total			41.5

* one ECTS credit equals a study load of approximately 28 hours

Colophon

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