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Dog population management in Malawi and Peru

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SUMMARY

The aim of the study was to look into the implementation of guidelines of dog population management (DPM), published by WHO & WSPA, ICAM-coalition and OIE, in Malawi and Peru. Fieldstudies with interviews with representatives of authorities, international organizations and local NGOs were conducted in these two countries. The conclusions from the interviews were that guidelines are only partially implemented in both countries, but the problems differ in between. No comprehensive national plan for DPM exist in either country and there are no executive group taking full responsibility. In Malawi a NGO have taken the responsibility to try to pilot a program and involve authorities to coordinate and harmonize there work. However, lack of information about the dog population and the rabies situation as well as lack of resources, makes it very difficult to succeed with DPM. Insufficient information also makes it difficult to evaluate any rabies vaccination program. In Peru on the other hand, they have good knowledge about the number of dogs and have also succeeded very well in rabies control. Even if they lack an executive working group, they have a legislaion supporting DPM and a direction working with eg. education programs for children. They have a comprehensive rabies program which shows that rabies control is indeed possible but instead they have other problems with diseases as echinococcosis. In both countries reproduction control is totally dependent on the work done by NGOs. The need is overwhelming and cost-benefit analysis very important when resources are limited.

INTRODUCTION

There are about 500 million dogs in the world (Stafford, 2007, WSPA, Stray animals, n.d.). It's been estimated that approximately 75 %, or about 375 million, of these are free roaming dogs, also called stray dogs, which are more common in developing countries than in developed countries (Matter & Daniels, 2007, WSPA, Stray animals, n.d.).

Dogs living without human supervision may suffer from diseases, starvation, trauma and painful death. Dogs are also reservoirs, carriers and transmitters of several important zoonotic diseases such as rabies, hydatidosis/echinococcosis, leishmaniasis, schistosomiasis, toxocara canis and leptospirosis (Macpherson, Meslin & Wandeler (Eds), 2000). Free roaming dogs can also be a threat to livestock as well as wildlife in some areas, both as a predator and as a transmitter of different diseases (Stafford, 2007).

With all these aspects in mind, dog population control is of great concern and is also a part in public health programmes in many countries (Stafford, 2007). Control programmes for free roaming dogs have been established in cities in Europe and North America and rabies vaccination programs are running in many parts of the world. Guidelines in dog population management (DPM) have also been published by both World Health Organisation (WHO), World Organisation for Animal Health (OIE) and The International Companion Animal Management Coalition (ICAM Coalition) (ICAM Coalition, 2007, OIE, 2009, WHO & WSPA 1990). Local government may be involved in DPM mainly when it concerns public health while local Non Governmental Organisations (NGOs) often are involved in improving animal welfare and protecting them against cruelty (Stafford, 2007).

Even though many people and organizations are engaged in DPM, stray dogs are still a problem of great concern. For this reason you can suspect lack of resources as well as lack of implementation of published guidelines.

The purpose of this study is first to shortly review problems associated with straying dog and major guidelines for dog population management, and secondly to study how these guidelines are implemented in the management of dog populations in Malawi and Peru. The study focus on aspects of reducing the number of dogs, improving their welfare and preventing transmission of zoonotic diseases with special reference to rabies and echinococcosis.

METHOD

The study is based on a literature review about dog populations and guidelines of DPM published by WHO, OIE and ICAM Coalition. The literature review is combined with fieldstudies and interviews in Malawi and Peru.

The interviews were all but two arranged through meetings. Two of the interviews (see below) was not able to take place during the fieldstudy and questionnaires were therefore sent by e-mail.

All questions were asked in an open way. Questions were prepared in advance (see appendix) but unprepared follow up questions were sometimes also asked to clarify the answers. The questions were designed to relate to the published guidelines in DPM. Different questions were asked to different persons depending on their position. All answers were written down.

In Malawi, all interviews were carried out in English. In Peru, four out of eight interviews were carried out with a translator between English and Spanish. The translator was D.V.M. Alfonso Enrique Victor Chavera Castillo at the San Marco University.

Malawi

The field study in Malawi took place between the 10th and the 27th of Aug. It was partly co-arranged with Worldwide Veterinary Service¹ (WVS) which came to Malawi in cooperation with Lilongwe Society for the Protection and Care of Animals² (LSPCA). The aim with the trip was to help out with vaccination and castration of dogs and also provide with help for farm animals. The team from WVS consisted of two veterinarians, two nurses, the International Projects Manager of WVS and a veterinary student from Sweden. Another British veterinarian already in Malawi also joined the team for two days. WVS stayed in Malawi for ten days of which three whole days and two half days were devoted for working with dogs.

Five people involved in DPM and/or disease control in Malawi were interviewed:

Dr. Kelias Msyamboza

Disease prevention and control officer at WHO, Lilongwe, Malawi

Mr. Humphreys Dzanjo Masuku

Chief Environmental Health Officer, Ministry of Health, Lilongwe, Malawi

¹ Worldwide Veterinary Service is a UK based charity that supplies animal charities and non-profit organisations around the world with drugs, equipment and volunteer teams. The teams are comprised with both veterinarians and nurses but also non-veterinary volunteers and students. (WVS).

² Lilongwe Society for the Protection and Care of Animals is a charity based in Lilongwe which primary mission is to improve the health and welfare of animals in Lilongwe and surrounding villages. This is done by providing free veterinary care and vaccinations to domestic animals combined with educational activities for children (LSPCA, About the LSPCA, n.d.)

D.V.M. Richard Ssuna
Project manager at LSPCA, Lilongwe, Malawi

Donnamarie O'Connell,
Senior Training & Projects Manager at RSPCA International.
The interview was carried out as a written questionnaire.

D.V.M. Patrick Chikungwa
Deputy Director responsible for Research and Investigations, Department of
Animal Health and Livestock Development, Lilongwe, Malawi.
The interview was carried out as a written questionnaire.

Peru

The field study in Peru took place between the 14th of Sep and the 1st of Oct.
Interviews were combined with visits at the Anti Rabid center, a dog shelter and a
clinic working with both pets and straying animals.

Eight people involved in DPM and/or disease control were interviewed:

Mr. Fernando Moreno
Founder of Grupo Caridad, an animal charity and NGO working in Lima.

D.V.M. Guillermo Leguia
Decano Facultad de Veterinaria Y Zootecnia, Universidad Peruana Cayetano
Heredia.

D.V.M., Ph.D., Cesar Gavidia
Assoc. Prof. Facultad De Medicina Veterinaria, Universidad Nacional Mayor De
San Marco.

MV. M.BA. Fíorella Cochella and MV. Fransisco Cavera Alprecht
Founders of Humanitarian Association of Animal Welfare, a NGO situated in
Lima. The interview was both in English and with translation between English
and Spanish.

D.V.M. Rosa Victoria Gutierrez Castilla
Coordinadora Programa de Tenencia Responsable de Animales de Compañía,
DIGESA. The interview was carried out with translation between English and
Spanish.

D.V.M. Monica Villanueva Herencia
Medical chief and chief of the diagnostic laboratory at the Anti Rabid Center
belonging to the Ministry of Health. Coordinator of strategies for zoonotic
diseases at the Direction of Health in Lima. The interview was carried out with
translation between English and Spanish.

D.V.M Jaime Villavicencio.
Chief of disease control program at SENASA, Ministerio de Agricultura. The
interview was carried out with translation between English and Spanish.

REVIEW

Dog populations

It has been estimated that approximately 375 million dogs or 75 % of the global dog population are free roaming, also called stray dogs, living mostly in Latin America, Africa and Asia (Matter & Daniels, 2007, WSPA, Stray animals, n.d.). How many dogs living in a certain country is usually an estimation since many countries lack reliable systems for registration (Stafford, 2007).

The increased human population is found to be directly linked to an increase in the dog population (WHO, 1988). Studies have shown that free roaming dog populations are higher in developing countries than in developed countries and they are also more common in urban areas compared to rural (Matter & Daniels, 2000) However surveys in Sri Lanka and Tunisia shows that over 70 % of the dogs in rural areas also are free roaming (WHO, 1988).

In Africa the dog population has a high turn-over rate, meaning high birth and death rates leading to a high proportion of juvenile dogs and young adults (Matter & Daniels, 2000).

Subpopulations of dogs

The dog population can be divided into different subpopulations (Beck, 2000, ICAM Coalition, 2007, OIE, 2009, WHO and WSPA, 1990):

Dogs that never roam

1. Owned dogs, fully dependant, fully restricted/supervised.

Free roaming dogs/stray dogs

2. Owned dogs
 - i) fully or semi-dependant, sporadically or continuously roaming.
 - ii) that are lost and therefor free roaming.
3. Neighbourhood/community dogs that are semi- or fully dependant and semi- or unrestricted.
4. Unowned dogs independant, unrestricted, born as a strays or abandoned.
5. Feral dogs – independant, unrestricted.

The term free roaming dog or stray dog has the meaning of a dog not currently restricted or under direct human control, not prevented from roaming (ICAM Coalition 2007, OIE, 2009). It is not telling if the dog is owned or unowned (ICAM Coalition, 2007, Matter & Daniels 2000). It can also be used for a dog that is not in compliance with the local regulatory requirements (WHO & WSPA, 1990).

Neighbourhood dogs/community dogs are dogs which more than one person claims responsibility for, a dog that are given food and shelter by a number of families in the neighbourhood (ICAM Coalition 2007, Leney & Remfry, 2000). The feral dogs are dogs that have become de-socialized from humans or never have become socialized (Matter & Daniels, 2000). These dogs are untamed and wild, like for example the dingo.

Of these different subpopulations the owned free roaming dogs and the free roaming neighbourhood dogs constitute the majority (Matter & Daniels, 2000). A study in Tanzania by Cleaveland et al concluded that the proportion of ownerless strays are relatively insignificant compared to the owned ones (Cleaveland et al, 2002a). Other studies have made the same conclusions that most free roaming dogs actually are dependent on either one family or a number of families in the neighbourhood giving food and shelter, and that only a small proportion were totally abandoned scavenging for food (Leney & Remfry, 2000).

All of these subpopulations of dogs are interacting and fluid and dogs can move from one categorie to another (Beck, 2000, ICAM Coalition 2007).

When managing problems caused by strays it's important to be able to distinguish and categorize the dogs, to know their degree of supervision and to know where the dogs come from (Beck, 2000, ICAM Coalition 2007, WHO & WSPA 1990). The different groups tell us about different problems and thereby different strategies of management.

Problems met by stray dogs

In order to find something to eat dogs scavage for food among human garbage and this is one reason to why the number of free roamning dogs are higher in urban areas with relatively high garbage production per capita (Matter & Daniels, 2000)

In rural areas, unowned dogs can cause problems, chasing and injure livestock and it is therefore important for livestock owners to control dog populations (Leney & Remfry, 2000). Dog-owners may therefor kill unwanted puppies or leaving them to die of starvation, temperature or by predators. In urban areas these sometimes crule traditions seems to subside, leading to larger population of dogs left in the street.

With no human supervision and with unrestricted roaming, dogs may suffer from starvation, illness, roadaccidents or people beeing cruel to them (WSPA, Stray animals, n.d.). In some countries in the South East Asia like China, South Korea and Vietnam dogs are also killed for meat and straying dogs can suffer from terrible cruelty when they are trapped, transported and killed (WSPA, Dog meat trade, n.d.).

Problems caused by stray dogs

In the cities or villages free roaming dogs may cause nuisance by scavenging, barking, and contamination and people may also feel intimidated by packs of dogs (Leney & Remfry, 2000).

Dogs also causes dogbites and in countries where rabies is endemic a dog bite can be fatal (Beck, 2000). Studies in USA show that most of the bites are caused by pet dogs and not by strays. However this result may not be applicable in developing countries where the free roaming population is higher.

Apart from rabies, dogs are carriers and transmitters of many other zoonotic diseases, both bacterial, protozoan and helminthic infections such as echinococcosis, leishmaniasis, and toxocara canis (Macpherson, Meslin & Wandeler (Eds), 2000).

In the interviews rabies and echinococcosis was found most important in Malawi and Peru.

Why dogs are free roaming

Canine abundance, number of dogs, degree of supervision and the proportion of free roaming dogs varies considerably among and within countries (Matter & Daniels, 2000). Human culture, behaviour and attitudes towards dogs is probably what effects the dog population dynamics the most (ICAM Coalition, 2007, WHO & WSPA 1990) Other factors contributing is laws and regulations. Ideas about ownership and responsibilities varies in different countries and cultures and also religion has an impact (ICAM Coalition 2007, Matter & Daniels, 2000, WHO & WSPA, 1990).

Mr Masuku at the Ministry of Health in Malawi is concerned that dog owners in Malawi do not take care of their dogs (Masusku, 2009, pers. comm). People often have several dogs of which most are free roaming. The indiscriminate breeding of dogs also results in surplus animals which encourages the practice of illegal selling on the side of the road (O'Connell, 2009, pers. comm.).

Mr Moreno at Grupo Caridad in Lima, Peru, believes that the biggest problem in Peru is that owners abandon their dogs when they have too many or get tired of them (Moreno, 2009, pers. comm.). In the street, dogs are exposed to violence and people beeing cruel, they get diseases and get hit by cars. Ownerless dogs have problems to survive in the street, and it's even harder to reproduce and have a litter survive. Hence reproduction of unowned dogs isn't the major source to the increased number of dogs.

Also Gutierrez agree with this and says that irresponsible ownership is her biggest concern (Gutierrez, 2009, pers. comm.). She says it's been a study in Lince in Lima where it was concluded that most of the free roaming dogs were owned with irresponsible owners letting the dogs out in the street.

Diseases in focus

Rabies

Rabies is caused by the rabies virus in the family of rhabdoviridae (Quinn et al, 2002). It causes fatal encephalitis in most mammals including humans. Animals like dogs, bats, racoons, skunks and foxes act as reservoirs and the virus is transmitted through bites and licking. The incubation period can vary between 2 weeks and several years, with an average of 2-3 months (WHO, 2005).

The epidemiology of dog and human rabies depends on the human-dog relationship and the structure and density of the dog population (WHO, 1987).

Straying dogs are known to be important in transmitting rabies (WHO, 1987). A rapid growth of the dog population in combination with high birth and death rates which is typical for eg. African dog populations, generates new susceptible animals for the infection to maintain within the population (Cleaveland, 1998). In developed countries rabies is mainly preserved in wild animals (WHO, Rabies, 2008).

Even though rabies is fully vaccine-preventable, more than 55000 people die each year from rabies, which is the same as one person every ten minutes (WHO, Rabies, 2008). Most of them are in Africa and Asia and 30-60 % are children under 15 years of age. More than 95 % of the human cases are caused by dog bites or scratches from rabid dogs (WHO, Human and animal rabies, 2009). The annual cost of rabies in Asia and Africa is estimated to 540-626 million US\$ of which Africa stands for only about 20 million US\$, due to less post exposure treatment (PET) (WHO, 2005). In Latin America, Brazil excluded, the costs were about 11 million US\$ in the year of 2000.

According to the WHO there is a lack of surveillance data and underreporting of rabies (WHO, Human and animal rabies, 2009, WHO, Rabies in humans, 2009). In 1998, 204 cases of rabies was reported from Africa to RabNet, the WHO rabies data bank, while 33075 was reported from Asia (WHO, 2000). Searching in the RabNet databank for later years shows quite an empty result (WHO, RabNet, 2009). This must be compared to that 44 % of all human rabies are estimated to occur in Africa (WHO, 2005). The underreporting was also shown in a study in Tanzania from 2002, where the incidence of human rabies was up to 100 times greater than the official records using the number of human dog bites to estimate human rabies mortality (Cleaveland S. et al., 2002b).

Hydatidosis/Echinococcosis

Echinococcosis granulosa is a zoonotic cestode/tapeworm causing echinococcosis in its hosts, primary dogs but also other wild canids (Budke, Deplazes & Torgerson, 2006, Urquhart et al. 2003). In its intermediate hosts, ruminants, pigs, horses, donkeys and man it causes hydatid disease/cystic echinococcosis.

The adult tapeworm, living in the small intestine of canids, does not usually cause any clinical signs. In its intermediate host the larvae develop chronic hydatid cysts in mainly liver and lungs, but sometimes also in other organs. It rarely causes any clinical signs in domestic animals but can cause severe disease in man depending on localisation, size and number of cysts.

Dogs and other canids are infected by ingestion of hydatid cysts and the intermediate hosts by ingestion of oncospheres shed in faeces from hosts and spread in the environment.

People are often infected as children (Gavidia 2009, pers. comm.). The oncosphere has a long survival time outside the host and can be viable and infectious on the ground for about two years (Urquhart et al., 2003).

The disease is endemic in most parts of the world, except from USA, northern Europe and South-East Asia, and some countries are even free of the disease in these areas (Budke, Deplazes & Torgerson, 2006). It occurs mainly in poor, rural areas, with people rearing sheep, having dogs for herding and guarding (McManus et al 2003, Craig et al, 2007, Gavidia 2009, pers. comm.).

The prevalence varies, in Tibet, at the Tibetan Plateau, 6,6 % of the people investigated had cysts (WHO, Cystic echinococcosis and multilocular echinococcosis, 2009). A prevalence study among humans and dogs in a farming area in the Peruvian Andes held the prevalence of hydatid disease to be 9,1 %, and the echinococcosis in dogs to 32 % (Moro et al, 1997). According to Gavidia as much as 80-90 % of the sheep in some areas of the Peruvian highlands is infected (Gavidia, 2009 pers. comm.).

Guidelines for dog population management

Many initiative to DPM are taken by animal protection groups, local charities, layman and charities with veterinary services (WHO & WSPA, 1990). Different methods are used, and even if the engagement is profound, they often suffer from inadequate support and founding, are disharmonized with official policies and have to less impact on legislation. It's very important to coordinate activities and policies and to form a united plan for DPM. To make authorities, organisations and charities work in phase with one another and make them use efficient and humane methods for DPM, guidelines have evolved both for control of populations and diseases such as rabies.

Guidelines for dog population management have been published by four different organisations. WHO in cooperation with World Society for the Protection of Animals (WSPA) published in 1990 "Guidelines for dog population management". This document arised after protests from WSPA to older guidelines published by WHO in which inhumane methods of killing dogs were recommended (Leney & Remfry, 2000). The new document was intended to provide those responsible for DPM with practical, effective and humane solutions (WHO & WSPA, 1990).

In 2007 the ICAM Coalition³ published "Humane dog population management guidance". This publication is aimed for governments and NGOs to provide guidance on how to assess DPM (ICAM Coalition, 2007). Finally in 2009, OIE came out with "Guidelines on stray dog population control" as a chapter in OIE – Terrestrial Animal Health Code (OIE, 2009).

Apart from these guidelines there are also guidelines for rabies control and for control of echinoccosis (WHO & WSPA, 1990).

Responsibility and planning for DPM

All the guidelines agree upon that the overall responsibility for DPM should reside within the central or local authorities (WHO & WSPA, 1990, ICAM Coalition 2007, OIE, 2009). The government are responsible for animal welfare legislation, and authorities like the veterinary authorities or health ministeries have also responsibilty for control of zoonotic diseases. Since DPM offer requires high level of resources for a long period of time it's ideal if the government are involved to work for sustainability through funding and engagement (ICAM Coalition, 2007). It's recommended that the government take responsibility to establish an advisory group/working group with veterinarians, experts in dog

³ The International Companion Animal Management Coalition (ICAM Coalition) is made up of representatives from the World Society for the Protection of Animals (WSPA), the Humane Society International (HSI), the International Fund for Animal Welfare (IFAW), RSPCA International (the international wing of the Royal Society for the Prevention of Cruelty to Animals), the Universities Federation for Animal Welfare (UFAW), the World Small Animal Veterinary Association (WSAVA) and the Alliance for Rabies Control (ARC).

ecology and behaviour, experts in zoonotic diseases, local authorities, health services and NGOs working with dogs (ICAM Coalition, 2007, OIE, 2009). International bodies like WHO and OIE should also be involved in relevant matters. However if the governmental authorities is unable or unwilling to take responsibility, NGOs can do this for them, create a working group and feed back information to the relevant authority.

The established advisory group/working group would have responsibility for initial surveys, analyse and quantify the problem, identify causes of straying dogs and propose the most effective line of action (ICAM Coalition, 2007, OIE, 2009).

Initial data collection and assessment of the dog population and problems involved

Information about the dog population as well as available resources for DPM need to be collected for an accurate assessment of the dog population and possible solutions (ICAM Coalition, 2007, OIE, 2009, WHO & WSPA, 1990).

Important issues that need to be considered for successful DPM are as follows:

- number of dogs, distribution and ecology, sex rate, turn-over rate
- identification of subpopulations/degree of supervision, sources of strays, dog reproductive capacity, habitats
- dogs access to resources and environmental control
- problems met by stray dogs
- problems caused by stray dogs
- zoonoses, prevalence and available methods for preventing transmission
- human attitudes and behaviour, religion and culture affecting the dog population
- governmental resources and engagement at national and local level
- legislation and regulations
- human resources – veterinary and public health, NGOs, charities, industries etc. that can influence the presence and survival of dogs and that also can contribute to the DPM
- financial resources
- infrastructure
- facilities for detaining and/or rehoming dogs
- what is currently being done and is it efficient?
- available methods for DPM

Collected information must be analysed to determine which factors having the biggest impact on dog population and problems involved. It's also necessary in order to assess which measures would be the most effective in resolving it.

Control measures for dog populations

There are many different control measures in DPM, some more efficient than others.

The following objectives will be discussed:

- Legislation
- Registration and identification
- Reproductive control
- Removal and euthanasia
- Dog shelters and rehoming
- Habitat control

Legislation

It's ideal to have a legislation that supports DPM (ICAM Coalition, 2007, Leney & Remfry 2000). It's important for the sustainability of DPM, to protect the animals from cruelty and make sure that DPM are carried out humanely. The necessary objectives for legislation are 1. laws for animal protection 2. legislation for registration and identification 3. regulations on breeding and sale of dogs 4. legislation for protection of humans and livestock against dangerous dogs (Leney & Remfry, 2000).

Where rabies is present it is essential to have a legislation giving power to the authorities to take necessary actions to prevent disease (WHO & WSPA, 1990). This can be legislation for identification and registration of dogs, as well as giving authority to seize and detain dogs suspected of having rabies.

To have any effect of laws and regulations education about legislation is required on all levels, from dog owners, to veterinarians, animal welfare organisations and law enforcement bodies (ICAM Coalition, 2007).

Registration and identification

Through registration and identification, an animal is connected to its owner and it's an essential measure in DPM (ICAM Coalition, 2007, WHO & WSPA 1990). It can encourage a sense of responsibility in the owner and facilitates reuniting of lost animals with owners (ICAM Coalition, 2007, OIE, 2009). It's also most important in rabies campaigns to know which animals are vaccinated or not (WHO & WSPA, 1990, OIE, 2009, ICAM Coalition, 2007). Registration can also be used for collecting data and for restricting number of dogs owned by one person.

Fees or taxes may counteract people's willingness to register their dogs (WHO, 1987). On the other hand it has also shown to have a positive influence on responsible ownership and the money can be used for DPM-programmes in the country. To promote reproduction control, fees can be higher for unsterilized dogs/females.

Reproductive control

Reproductive control in dogs can limit the number of unwanted puppies and help to balance between supply and demand for dogs (ICAM Coalition, 2007, OIE, 2009)

Different methods can be used but before applying a method several aspects need to be considered (WHO & WSPA, 1990). There must be a cultural and religious acceptability for the chosen measure. In some cultures people can be negative to castration of male dogs since they are afraid it has negative impact on their behaviour (ICAM Coalition, 2007) Owners often need education to understand the importance of control of reproduction (Leney & Remfry, 2000). Other information needed is information about the population – sex ratio, reproduction rate among owned and unowned dogs and the proportion of dogs available for a chosen measure.

In aspect of cost-benefit it's important to focus efforts where it makes the most difference and give priority to the most reproductive individuals which also can support their puppies to adulthood (ICAM, 2007, OIE, 2009). Often this means dogs under human supervision with relatively good welfare compared to unsupervised female dogs, which often suffer from poor welfare and where the mortality among puppies are likely to be high. On the other hand these unsupervised puppies will probably suffer more, they may die from starvation, trauma etc, and are therefor to consider an animal welfare issue (ICAM Coalition, 2007). These poor females may also become healthy in the future and may then be able to reproduce succceccfully, why these animals must not be forgotten.

Priority may also be given dogs whose offspring are most likely to become free roaming. Studies done on specific populations have shown that most strays are recruited from the owned population rather than from ownerless strays reproducing (OIE, 2009). This inidicates that focus should remain to the owned dogs.

If possible, it's also advisable to give priority to female dogs (ICAM Coalition, 2007). Since a male dog has the capacity to fertilize several bitches, it requires only a few intact males to still have a lot of puppies. The number of female dogs is usually the limiting factor in reproductive capacity in a population, and a reduction in intact females will thus decrease the number of puppies.

Mating restrictions

Owners can be educated to recognize signs of oestrus and separate their bitches from male dogs during oestrus (OIE, 2009, ICAM Coalition, 2007). This could be problematic and it's also important to ensure the dogs welfare during "isolation". However it's a cheap solution.

Surgical sterilisation/castration

This method requires availability for veterinarians, aseptic conditions, equipment, drugs and supervision during recovery (OIE, 2009, ICAM Coalition, 2007). It may be more costly initially, but may be more cost efficient over time.

Chemical sterilisation and contraception

These methods are relative expensive and the need to repeat the treatment is a disadvantage (OIE, 2009, ICAM Coalition, 2007). It's only suitable with responsible owners.

Dog shelter and rehoming

Building a dog shelter does not solve the problem of unowned free roaming dogs, it only ease the symptoms temporarily (ICAM Coalition, 2007). It can actually even worsen the problems since a dog shelter makes an easy way out for dog owners wanting to dispose their dogs. A dog shelter does not either guarantee good welfare for the dogs. They can easily become over crowded with lack of resources and too less staff resulting in inadequate care for the animals, animal suffering and distress for both staff and dogs. They are also expensive and time consuming. If having a rehoming center, animals which cannot be rehomed because of disease, old age, aggressiveness or other behavioral problems are recommended to be euthanised humanely (WHO & WSPA, 1990). Advices for running a dog shelter is available from several animal protection organisations (Leney & Remfry, 2000).

A fostering system could be a good alternative to a rehoming center (ICAM Coalition, 2007). It can be more cost efficient, more effective and can also be better in aspect of animal welfare.

Removal, mass killing and euthanasia

Removal, masskilling of straying dogs or euthanasia is a way to ease the symptoms of the problems with big dog populations (ICAM Coalition, 2007). Dog removal programmes are ineffective, it has no evidence for having a significant or sustainable impact on dog density or being effective in rabies control, why it's not a sustainable solution (ICAM Coalition 2007, WHO 1988, WHO, 2005). Dog populations return to their previous levels after only a few years unless the campaign are repeated continuously (Leney & Remfry, 2000). Mass killing of dogs in the street may also lead to increased availability of resources for surviving dogs or lead to an immigration of new dogs to the area with less population density (ICAM Coalition, 2007). Culled dogs will in this way be replaced by new ones.

Masskilling are directed towards unsupervised dogs in the street (Edelsten, 1995). Since these dogs are in minority and also less likely to reproduce successfully, killing of these dogs do not adress the problem and the real reason to free roaming dogs, and therefore has to be repeated continuously.

Methods used for masskilling can also be very inhumane like poisoning or shooting into a flock of dogs (ICAM Coalition, 2007). It's also a risk of killing dogs that have been vaccinated against rabies which may discourage owners to vaccinate their dogs as well as it's a waste of money (ICAM Coalition, 2007, WHO, 1988).

If euthanasia is practised the most practical, rapid and humane methods should be used to minimise pain and distress (OIE, 2009). The operators handling the dogs and euthanasing them must also be properly trained for the mission. The recommendations for euthanasia is primarily chemical injections. Shooting with free or captive bullet can be considered if there is a skilled operator and the shooting is accurate, killing the dog directly and not only wounding it. Also inhalant of for example anaesthetic gas may be used. For either method death must be confirmed and the carcasses must be disposed in a correct manner that complies with current legislation.

If the dog is suspected of rabies it must not be shoot in the head since rabies diagnosis require undamage brain tissue.

Culling of dogs are also very cost-intensive (WHO, 1988) and can be up to 4 times more expensive than vaccination when calculated per dog (Edelsten, 1995). It is even less cost effective than reproduction control and should never be considered an efficient way to reduce the number of dogs since it isn't dealing with the cause of the problem which is the overproduction of dogs (WHO & WSPA, 1990). If dog removal and killing are considered necessary it must be in combination with other measures.

Environmental control

Reducing access to resources in public areas may lead to decreased number of free roaming dogs in that area (ICAM Coalition, 2007). Measures to be taken are for example animal-proof rubbish containers, improved rubbish collection and prevention of access to slaughter and dumping areas.

Dogs dependent on these resources for survival may suffer from starvation when the sources of food are reduced. Therefore it's important to combine environmental control with other measures of DPM to reduce the number of straying dogs or by giving alternative solutions for these dogs.

Education

Since human culture, behaviour and attitudes towards dogs probably compose the greatest influence over the dog population, education of people to change behaviour of the masses is very important (ICAM Coalition, 2007). The general aim with education is to promote responsible ownership among dog owners (ICAM Coalition, 2007, OIE, 2009). This includes socialisation, training, care and kindness towards the dog, food and water, basic knowledge about canine behaviour, how to prevent biting, reproduction control, environmental control,

healthcare and disease prevention, especially prevention of zoonotic diseases (OIE, 2009, WHO & WSPA, 1990).

Information about responsible ownership can be communicated in many ways, like lessons in school or seminars, by public media, through brochures and leaflets (ICAM Coalition, 2007).

It's important to engage all possible sources of information, like national and local authorities, animal welfare/protection groups, media, schools and veterinarians, so that everyone is communicating the same message (ICAM Coalition, 2007, OIE, 2009).

The cost for education are moderate and the result is primarily seen in a long term though it takes time to educate and change the mind of a hole society.

Control of rabies

During the last two decades there has been a reduction in human rabies in South America due to public health sectors at national and community level taking a central leading position for rabies control (WHO, 2005). Contrary, an increase of rabies has been seen in parts of Asia an African countries south of Sahara. Contributing factors are growing dog populations in combination with increased urbanization, mobility and density of people.

Rabies control programmes should always be based on cost-benefit analysis (WHO, 1987). To do this and to ensure a sufficient vaccination coverage, information is needed about the dog population ecology, size of population, growth rates, turn-over rates, degree of supervision and number of unowned dogs etc (WHO, 2005, WHO, 1987).

According to the WHO, dog rabies control programmes should contain three basic elements; a) epidemiological surveillance b) mass vaccination and c) dog population control (WHO, 2005). Governements or communities must bear the costs and the communities must be actively involved in dog vaccination, DPM and surveillance (Meslin, Fishbein and Matter, 1994).

Mass vaccination of dogs is the most important measure in a rabies control programme and it has shown to be the most cost-effective strategy (Meslin, Fishbein and Matter, 1994, WHO, 2005, WHO, 1987). It reduces the number of dog bites from suspected rabid dogs and reduces the costs for post-exposure treatment (PET). For a vaccination strategy to be effective its important to reach a certain vaccination coverage (Cleaveland et al, 2002a). WHO recommend a coverage of at least 70 % in areas where rabies is endemic (WHO, 2005). A study by Cleaveland in Tanzania showed that a coverage of 60-70 % of the owned dog population was sufficient do reduce the incidence of dog rabies with over 90 % (Cleaveland et al, 2002a). In a study by Chomel et al they showed that a coverage of 78 % were enough to stop an epidemic of rabies (Chomel et al, 1988). They also proved that mass vaccination campaigns are efficient in controlling urban rabies and that they should be carried out regularly to reduce outbreaks of rabies.

This is especially important when other DPM programs are undeveloped and/or insufficient. To know the coverage, information about the size and growth of the population is necessary (Cleaveland et al, 2002a). Guidance to estimate the number of dogs are available from WHO (WHO, 2005).

In order to succeed you also need to take the dogs turn-over rate and the density of dogs into consideration (Cleaveland et al, 2002a). A high density and a population with high birth and death rates requires a higher vaccination coverage and more frequent vaccination campaigns. Campaigns may be runned as often as every 6-10 months to maintain the immunity in the population.

Also removal/killing of dogs can be considered but it is as told expensive and has no evidence for beeing effective in reducing the spread of rabies (WHO, 2005). There is also a risk of killing already vaccinated animals.

Surveillance and diagnostic possibilities is also very important instrument in defeating rabies as well as public education. PET of animals is prohibited in all effective rabies control programmes, and is only available for humans (WHO, 1987).

Effective and economical measures for rabies control are available, but the implementation of rabies programmes in developing countries are impeded by social, political and economical factors (WHO, 2005). One reason for low political interest is the underreporting and lack of data, which gives a view of a disease less important.

Control of echinococcosis

Controlling echinococcosis is about breaking the worms life cycle and routs of transmission (Gavidia 2009 pers. comm.). Different measures include deworming of dogs, reducing the number of dogs, improving routines of sanitation, preventing dogs to attend slaughter, confiscating viscera containing hydatid cysts, vaccination of dogs or sheep, deworming of sheep and health education of people (McManus et al 2003, Gavidia 2009 pers. comm.).

Countries beeing successfull in controlling echinococcosis and hydatid disease are mainly islands which have based their control programmes on health education and control or elimination of home slaughter of sheep (Craig et al, 2007). The conclusion from a survey in the Pacaraos distict in Peru was also that education is a very important measure in a control programme for hydatid disease to increase the knowledge of *Echinococcosis*, its route of transmission and health impact on dogs and humans (Moro et al, 2005).

Vaccination of sheep is an effective method (Gavidia, 2009, pers. comm.). Field trials in Australia, New Zealand among others have shown a 95% protection for 12 months in sheep (Craig et al, 2007).

Also dogs can be vaccinated. In a study by Zhang et al from 2006, dogs vaccinated with proteins from protoscoleces from hydatid cysts had reduced

number of gravid worms. This reduces the transmission of parasites to intermediate hosts.

Dogs can also be treated with praziquantel orally every sixth week (Gavidia, 2009, pers. comm.) Also sheep can be dewormed with praziquantel as well as albendazol and oxfendazol (Gavidia, 2009, pers. comm.).

RESULT - DOG POPULATION MANAGEMENT IN MALAWI AND PERU

Responsibility and planning for DPM

Malawi

Malawi is a decentralized country with local authorities, the city assemblies (CA), which act as administrative decision making organs (Ssuna, 2009, pers. comm.). The country is also divided into 28 agricultural development districts (ADD) (Ssuna, 2009, pers. comm., Chinkungwa, 2010, pers. comm.).

WHO is active in Malawi and works with the human problems (Msyamboza, 2009, pers. comm.). But since diseases like rabies affect both humans and animals, they can get involved in DPM in aspect of preventing zoonotic diseases.

The Ministry of Health in Malawi is as well as WHO involved in human health aspects (Masuku, 2009, pers. comm.). They are not involved in DPM but are involved in national rabies programs.

Dr Msyamboza at WHO and Mr Masuku at the Ministry of Health was not informed about the guidelines for DPM from WHO, ICAM or OIE (Msyamboza, 2009, pers. comm., Masuku, 2009, pers. comm.).

The Department of Animal Health and Livestock development (DAHLD) have offices within the ADDs (Chikungwa, 2009, pers. comm.). They are involved in DPM and would ideally be the one to coordinate the work. DAHLD have access to the guidelines and try to employ the OIE guidelines on stray dog population control. However there is no formal national plan for DPM resembling the recommendations published in the guidelines, but programs for rabies have been established in which DAHLD is involved. Instead of having authorities taking responsibility for DPM, Lilongwe Society for Protection and Care of Animals (LSPCA) has worked out a plan and tries to pilot a program in Lilongwe which than can be used as a model for the rest of Malawi (Ssuna, 2009, pers. comm.). LSPCA try to engage and encourage the CA in Lilongwe in DPM and advise them in dog control measures (Ssuna, 2009, pers. comm., O'Connell, 2009, pers. comm.). They also assist the government in for example rabies campaigns and will together run a vaccination campaign and rabies education program in 2010.

The Government through The Ministry of Agriculture and Food Security in DAHLD has formalised a working collaborative arrangement through signed memorandum of understanding with Lilongwe Society for Protection and Care of Animals (LSPCA) (Chikungwa, 2009, pers. comm.). The ultimate aim is to improve basic care/health and welfare of animals, particularly companion pets as dogs, cats and other frequently abused companion pets.

DAHLD in Malawi is also a member in the Board of Trustees of LSPCA, hence attend in scheduled meetings, share reports and also have electronic communication when necessary (Chikungwa, 2009, pers. comm.).

DVM Richard Ssuna at LSPCA is well aware of the guidelines, and they have been discussed with RSPCA and with the City Assembly (CA) in Lilongwe (Ssuna, 2009, pers. comm.). LSPCA try to implement the guidelines and use them for times of planning, but the problem is lack of resources and infrastructure and that even if the CA is positive, DPM isn't their main priority and their capacity is limited.

O'Connell from RSPCA International, who works together with LSPCA says that the OIE standards for stray control form the basis of their work with central and local government and they work to encourage authorities to adopt and enforce these recommendations (O'Connell 2009, pers. comm.). The ICAM Coalition guidelines than form the basis of their policies and recommendations on humane stray dog control.

There is no vet school in Malawi and the availability for veterinarians in Malawi is therefore quite limited (O'Connell, 2009, pers. comm., Chikungwa, 2009, pers. comm.). There is only 22 veterinarians of which six in public and sixteen in private sector (Chikungwa, 2009, pers. comm.). D.V.M. Richard Ssuna, veterinarian and project manager at LSPCA is Uganadan, but they work closely with a Malawian veterinarian and a long term goal for LSPCA is to have a local veterinarian to run LSPCA (O'Connell, 2009, pers. comm.).

Peru

MINSAs is the Health Ministry of Peru. MINSAs is divided into different departments, one of them is DIGESA – Dirección General de Salud Ambiental, corresponding to the general direction for health and environment (Gutierrez, 2009, pers. comm.) DIGESA is also divided into several directions of which one is the direction of hygien, food and zoonoses. This direction govern different programs, one of them is a program for rabies and another is a program for responsible ownership for companion animals, so called TRAC. DVM Gutierrez at DIGESA is aware of and has read the document from the ICAM-coalition. No national plan for DPM has been established and it's not a field of high priority. But DIGESA puts good efforts in educating people in responsible ownership and transmission of zoonoses, primary in Lima, and they also by word promote castration.

Peru is divided into several municipalities. In the city of Lima there is 34 municipalities. Each municipality is responsible for the population of free roaming dogs in their district. They have the authority to make decisions about regulations concerning their own district in order to achieve objects from DIGESA. This result in different regulations and methods for DPM in different municipalities and the engagement in DPM varies in between.

DVM Gutierrez at DIGESA experience difficulties in the cooperation between DIGESA and the municipalities caused by lack of veterinary expertise in the municipalities.

SENASA is the Servicio Nacional de Sanidad within the Ministry of Agriculture (SENASA, n.d.) SENASA is involved in wild rabies and rabies in livestock, but not in dog rabies or DPM (Villavicencio, 2009, pers. comm.). Their involvement in dogs concerns immigration into Peru, and the control of vaccination status before crossing the border.

There are several NGOs and charities working with dogs in Peru (WSPA, Animal welfare groups, n.d.). Grupo Caridad is a charity founded by Fernando Moreno in 2005 (Moreno, 2009, pers. comm.). It's a NGO supported by Humane Society International (HSI), which is one of the organisations in the ICAM-coalition. Mr Moreno has the guidance from the ICAM Coalition which he received from HSI, but didn't have any information about the other documents. He tries to implement some of the guidelines in his work and try to use their resources in the most efficient way.

There is no cooperation in between Grupo Caridad and the local or national authorities, and no financial support (Moreno, 2009, pers. comm.). DIGESA works with rabies and information campaigns (Gutierrez, 2009, pers. comm.) while Grupo Caridad mainly works with reproduction control in combination with education of dog owners (Moreno, 2009, pers. comm.).

Animazul is another charity working outside Lima with a dog shelter with the idea of rehoming stray dogs (Guiliana Farina Merino, 2009, pers. Comm.) Mrs Farina Merino who runs the Animazul also use to euthanise straying dogs from the street. As for Grupo Caridad there are no cooperation with national or local authorities.

Humanitarian Association for Animal Welfare (HUAW) is an association in Lima that include all animals (Cavero Alprecht, 2009, pers. comm.). It was founded in 2004 by MV. Francisco Cavero Alprecht and his wife MV. Fiorella Cochella. The association is a member society to WSPA but their cooperation is rather limited and they get only minimal support. Despite being linked to WSPA, they have not been informed about the guidelines in DPM. They have also been occasionally supported by WVS with veterinary supplies and books.

HUAW have at some occasions worked together with Animazul and UPA (another animal charity in Lima). They have helped voluntarily with castrations of dogs, but they have no cooperation on a regular basis and no common plans. HUAW has also contacts with the Municipality of Baranko. HUAW share documents with the municipality and inform about their way of work so other districts/municipalities can learn from them.

According to Moreno, Cochella and Cavero Alprecht the cooperation in between different charities is very limited in Lima, if at all existing. This depends on difficulties in cooperation, conflicts in between and different aims. They also feel that the authorities interest in their work are quite absent.

Initial data collection and assessment of the dog population and problems involved

Malawi

There is little information available on dog population density estimates in Malawi (Chikungwa, 2009, pers. comm.). According to Edelsten (1995) the official recorded mean dog population in Malawi between 1986 and 1992 was 250.000 dogs. Another estimation says its 500.000 dogs (Chikungwa, 2009, pers. comm.). A survey carried out in rural and urban households around Lilongwe in 1998 based on human-dog ratio revealed that there is one dog per 6.7 human beings in rural areas and one dog per 2.5 human beings in the city. With the estimated population in 1998 of 8.5 million rural people and 1.4 million urban people this would give a dog population of about 1.3 million dogs in rural areas and close to 0.6 million dogs in the urban areas. This survey was confined to Lilongwe district, meaning that the human-dog ratios cannot strictly be extrapolated to other areas of Malawi, given the socio-cultural and religious differences that exist in the country. At present time, when the population has grown, these numbers would be even higher. However, the same year of 1998, WHO in The World Survey of Rabies, estimated a population of 98300 dogs to count for 10 % of the population, giving a total population of about 1 million dogs.

A personal comment in the article of Edelsten (Van Noppen, pers. comm.) says that another survey in 1993 also estimated the dog population to 2 million dogs of which the free-roaming owned dogs constituted 99 % in rural areas and 93 % in urban areas. The same source says that the mortality rate in puppies under 6 month of age was over 70 % and that the life expectancy of dogs was 4 years. Since the reference is inadequate this study has not been found and the reliability is unknown. However this shows that there is only little knowledge about the dog population in Malawi, but it also indicates high birth and death rates, which is common for African dog populations (Cleaveland, 1998). It also indicates that most dogs are owned with some but limited human supervision. This is also supported in a study by Cleaveland in rural areas of Tanzania where it was concluded that the number of ownerless dogs was relatively insignificant (Cleaveland, 2002a).

According to Msyamboza at WHO and Masuku at the Ministry of Health no surveys of the dog population have been done in recent years and the data collection of zoonotic diseases are also insufficient with underreporting of diseases (Msyamboza, 2009, pers. comm., Masuku, 2009, pers. comm.) There is no co-ordinated data collection as recommended in the guidelines, and DVM Ssuna says that they do not know more about the population than what they see in the street and experience by themselves. However O'Connell at the RSPCA International says that they are planning a survey of the dog population in Lilongwe in the near future which will cover both owned and unowned dogs (O'Connell, 2009, pers. comm.). The study will involve both household surveys and counts of animals on the street. She also says that ideally the survey would have been conducted before the spay/neuter programme began, but this was not feasible due to lack of staff in the LSPCA. It was therefore decided to go ahead and

begin the spay/neuter programme to benefit the animals concerned as well as contributing to a reduction in the dog population.

Peru

In Peru studies have been carried through at universities about both rabies and echinococcosis. There has also been an estimation of number o dogs based on the human population and dog/human quote where the total number of dogs are estimated to about 4,2 million (Ministerio de Salud, DIGESA, 2009). 1,2 million dogs live in Lima (Ministerio de Salud, DIGESA, 2009, Moreno, 2009, pers. comm.) of which 400.000 are estimated to be free roaming (Moreno, 2009, pers. comm.). Mr Moreno and Grupo Caridad did some research before starting their program, to know where to put their efforts. He learned that the shelters in Lima runned by different layman were very inefficient, rehoming only a few dogs per year. He also experienced that the biggest problem is people abandoning their dogs so the recruitment of new unowned strays occurs much more from the owned population than from unowned stray dogs reproducing.

In the study of mass vaccinations campaigns in Lima-Callao by Chomel et al in 1988 they estimated the number of dogs in this area to 400.000 (Chomel et al, 1988). In the same survey they found out that 75 % were regularly roaming the streets.

In another study based on interviews with dog owners in Lince, Lima, 80 % replied that they let their dogs out in street to roam freely (Gutierrez, 2009, pers. comm).

Legislation

Malawi

Malawi has a legislation for animal protection and welfare called “Protection of Animals Act” in which dogs should be included (Chikungwa, 2009, pers. comm.).

Peru

Peru has a law from 2001 concerning animal protection (Gutierrez, 2009, pers. comm.). This was Perus first law to protect animals. The law was not sufficcient to cover problems related to dogs and public health, so additional regulations were accepted in 2002. This legislation regulates which breeds are imposed to wear muzzle and leash in public areas and how to educate the population about zoonotic diseases.

To implement the new regulations, programs have evolved. One of them is the program for responsible ownership of companion animals (TRAC) developed by DIGESA (read more in section Education).

Registration and identification

Malawi

According to Masuku there is a regulation about people are not allowed to have more than two dogs (Masuku, 2009, pers. comm.). But Chikungwa from the DAHLD says there is no official registration of dogs and owners in Malawi (Chikungwa, 2009, pers. comm.) Ssuna from LSPCA says that in Lilongwe you need to register your animal to the CA. If this is not done the owner can be penalised and the CA can seize and detain the animal (Ssuna, 2009, pers. comm.). In reality this never happens since the CA doesn't have any resources to detain dogs.

During rabies vaccination campaigns dogs and their owners are registered and owners are also given a certificate for vaccination. The aim is to register and give identification to every dog.

Peru

In Peru the municipalities are in charge of registration and identification (Gutierrez, 2009, pers. comm.). This is far from implemented in all districts and in Lima only the wealthier districts register dogs and dog owners. Owners do not have to pay taxes but they may pay a minor registration fee (Moreno, 2009, pers. comm., Gutierrez, 2009, pers. comm.). Some municipalities with a veterinary employed, use chip for marking the dogs, others use lockets with an inscription of registration number and municipality (Gutierrez, 2009, pers. comm.). Some municipalities also give the owners an identification card for their dogs.

Registration and identification will in the future be applied in the whole country, but this will take time to establish.

Reproductive control

Malawi

LSPCA has started a program for control of reproduction, and performs castrations of owned dogs once a week (Ssuna, 2009, pers. comm.). The plan is to expand the castration program to twice a week from sep. 2009. LSPCA has also established a cooperation with Worldwide Veterinary Service (WVS) who will send teams of veterinarians and nurses to Malawi to help out with castration and vaccination, but also with farm animals. The teams are planned to arrive to Malawi twice a year.

LSPCA work with isolated communities around Lilongwe. They work with one community at a time and from March to June they had accomplished in total 93 castrations in the Chinsapo district of which 61 were male dogs and 32 were female dogs (LSPCA, Spay clinic, n.d.). Since June, DVM Ssuna have performed additional castrations, so at the time for the interview in August he says he has

accomplished about 115. There is no priority between the sexes, but all dogs shown up at the clinic are castrated, even puppies.

WVSs trip to Malawi in August 2009 was the first arranged. During those 10 days two days were spent in the Chinsapo district, a poor community in Lilongwe. Three veterinarians were doing surgery assisted by two nurses, one veterinarian was doing anesthesia and a veterinary student were assisting and medicated the dogs. Another person cleaned the instruments and there was also another two or three persons from Malawi helping out with registration of dogs and owners as well as with the translation. During these two days 67 dogs, both females and males, were castrated.

Another 1,5 day were spent with castrating dogs in a village called Mua Mission, south of Lilongwe. In this trip from Lilongwe there were three veterinarians doing surgery and anesthesia, two nurses and one veterinary student assisting. There were also people from Malawi to translate and register animals and owners. In total, 18 male dogs were castrated. No females were accepted due to the short period of time spent by the team in Mua Mission, which unabled eventual post-operative care and supervision.

Animals that arrived with problems like wounds or flees or other dermatological diseases were also treated.

In total, 85 dogs were castrated in 3,5 days, of which about 50 % were females. Castrated dogs were cut in one ear as marking.

There is no data for the overall cost of this project, but there is a lot of costs to include; flighttickets, transportation, accomodation for all the WVS members, added to this are all materials, medications and anesthetics and cost for other persons involved. Only the flighttickets are about 6-7000 Euro or 70-82 Euro per dog.

LSPCA together with RSPCA have a vision of having a permanent mobile clinic like an equipped bus, instead of provisional tents, to facilitate transportation, surgery and treatment of animals (Ssuna, 2009, pers. comm.).

Peru

In Lima, Grupo Caridad is running a project for reproduction control (Moreno, 2009, pers. comm.). They offer free castrations at weekends in poor areas of Lima and have started out in one district called San Juan de Lurigancho. They employ veterinarians from Lima and pay them 5 USD per castrated dog. They focus on one area at a time and try to castrate as many as possible in that district. They offer castration for both male and female dogs but Moreno says that 98 % are females. The clinic is advertised in forehand by flyers and posters in local human clinics and at markets. About 2000 dogs have been castrated so far in two years.

During clinics they try not to treat other problems, but sometimes offer low cost deworming. Instead they direct them to local veterinarians.

There is no marking of the dogs. Since they only castrate owned animals, and do not apply trap-neuter-release (TNR) of strays, marking is not considered necessary.

The project is financed and totally dependent on donations from private persons, HSI and Dogtrust. At the time for the interview they have just run out of funds and need more financial contributions to preserve the free spay program and they plan to extend their program to other districts in December 2009.

Grupo Caridad are also supported by Worldvets, a NGO providing veterinary aid around the world (Worldvets, 2009), which will send seven teams of veterinary service a year (Moreno, 2009, pers. comm.).

According to Moreno the response to their project has been very positive in the community. People are interested and want them to come and have clinics in their district. Moreno also experience a change in attitudes among dog owners, and feel that they started to care more about their animals, taking a better responsibility.

Grupo Caridad have no intention of having a permanent low cost spay clinic. Instead they have an idea of establish a permanent high cost clinic in a wealthy district to pay for free spay programs in poor areas.

Another organisation offering free castrations in Lima is HUAW. They run a program at the veterinary clinic owned by the founders of HUAW (Cavero Alprecht, 2009, pers. comm.). The program is called “humanitarian vets” and is based on the principle that everyone pay with respect to their own assets. Wealthy people pay more and poor people pay less or nothing at all. People in the district also bring animals from the street to the clinic for castration. HUAW perform the surgery and the person that brought the dog is obliged to take responsibility for it afterwards (Cochella, 2009, pers. comm.). Unfortunately many dogs are released in the street again.

Unowned stray dogs represent 80 % of the castrations at the clinic, and Cavero experience that “ordinary” dog owners do not want their dogs castrated.

All the surgery are performed at the clinic. Therefor HUAW mainly reach out to dogs and people in their own district, and not to the real poor areas.

There is no priority of dogs, instead all dogs brought to the clinic for castration will go through surgery if not in a really bad condition.

They have done about 3000 castrations in the surrounding area, the Baranko and Surko districts, and they do about 1500 castrations per year. They also try to promote other veterinarians to take responsibility and work in the same way, combining their practice with charity.

Dog shelter and rehoming

Malawi

There is no information about any dog shelter in Malawi.

LSPCA has neither no intention of having a dog shelter (Ssuna, 2009, pers. comm.). Ssuna says that shelters in Africa are generally not very well managed and often fails.

Instead of a rehoming center, LSPCA works with fostering and adoption of dogs and cats (LSPCA, To foster, n.d.). Fostering means temporary accomodation of animals until they find someone to adopt the animal and give it a permanent home.

Peru

With the new legislation every municipality should have a shelter for free roaming, dogs runned by a veterinarian, where dogs can be held for 30 days for their owner to reclaim them by paying a fee (Villanueva Herrencia, 2009, pers. comm). Up to date, this is not working. There are no shelters and there are so many dogs that it would be very expensive for the townhalls to build well functioning shelters and have the dogs taken care of.

In Lima there are sveral other persons taking care of stray dogs for rehoming (Moreno, 2009, pers. comm.). But since only a few number of dogs are successfully rehomed every year, the shelters get overcrowded, why new dogs can't be accommodated.

Animazul is one of the shelters where 60 dogs are accommodated (Farina Merino, 2009, pers. comm.). Guiliana Farina Merino who runs the center also has 14 dogs at home. Very few dogs are rehomed and many dogs have been there for years says Fernando Moreno who started off helping at Animazul and other shelters before he founded Grupo Caridad (Moreno, 2009, pers. comm.). This result in new strays beeing euthanised instead of accommodated and rehomed. Farina Merino finds it better to kill the dogs than letting them out in the street where they may suffer (Farina Merino, 2009, pers. comm.).

Grupo Caridad has no rehoming center at the moment, but is planning for one since people have inquired for it (Moreno, 2009, pers. comm.). Moreno at Grupo Caridad knows that a rehoming center is not a solution, but it can help individual animals already in the street. If starting a rehoming center they will only take on young and healthy dogs with a potential of beeing adopted.

Moreno has also noted a difference in the district of San Juan de Luriganchu since they began with there spaying campaign. People have now started adopting dogs from the street and he experiences that the number of strays has declined.

Also Cavero Alprecht and Cochella at HUAW have thought about having a dog shelter, in the Baranko District (Cavero Alprecht & Cochella, 2009, pers. comm.).

They say it can be a part of the solution if a culture of adoption evolves, which might get promoted through television .

Removal, masskilling and euthanasia

Malawi

Shooting of dogs has been an applied method in Malawi (Masuku, 2009, pers. comm.). The CA makes decisions about shooting campaigns and also inform the public (Ssuna, 2009, pers. comm.). They instruct dog owners to put leash on their dogs and every dog not in a lead or held in a restricted area is than shot by the ADD.

Mr Chikungwa at DAHLD says that all dogs are killed humanely with all required professional ethics employed (Chikungwa, 2009, pers. comm). The carcasses are than disposed mostly through burying.

Peru

Masskilling with strychnin has previously been used in Peru (Gutierrez, 2009, pers. comm.). For over 30 years ago free roaming dogs were captured in the street by special teams and than killed with carbomonoxide (Villanueva Herrencia, 2009, pers. comm.). After protest by people and dog owners and after increased aversion against rabies vaccination this method was terminated. Now it's forbidden for the municipalities to kill dogs (Gutierrez, 2009, pers. comm). But Gutierrez also says that it is difficult to get information about this from the municipalities, and sometimes they collect dogs from the street and drive away with them. Moreno suspects they still kill dogs, and often with inhumane methods (Moreno, 2009, pers. comm.).

Farina Merino at Animazul also euthanises dogs (Farina Merino, 2009, pers. comm.). People often bring dogs to her from the street and if she isn't able to take care of them she euthanises them instead of letting them out in the street again. She uses pentobarbital sodium that she injects intravenously and kill them humanely.

Environmental control

Malawi

No environmental control is implemented in Malawi.

Peru

No environmental control is implemented in Peru.

Education

Malawi

O'Connell from RSPCA always recommend a comprehensive programme of education (O'Connell, 2009, pers. comm.). This is important so the public understand the benefits of for example vaccination and neutering.

LSPCA has an education program in Lilongwe for children between ten and twelve years (Ssuna, 2009, pers. comm.). They visit children in school and talk about animal welfare issues and responsible ownership, how to care for and treat the animals, how to give them food and water, etc. They also talk about animals as sensing and emotional beings and inform about health issues, rabies and worms. At the time for the interview 5 schools had been visited in two months. How many school there is to visit is not really known but it's estimated to 250, only in Lilongwe. The headmasters allow LSPCA to deliver a class for 1-2 hrs which involves a presentation and then games outside to reinforce the messages (O'Connell, 2009, pers. comm.). The authorities are not involved in this education program, it's administered solely by LSPCA in collaboration with staff from the Lilongwe Wildlife Centre who helps out with the classes. However, there will also be a public education programme around the rabies campaign in association with the CA in the year of 2010. For this reason LSPCA, with funding from RSPCA, develops education materials including a dog care poster which includes information on vaccinations.

There is also a programme addressing issues like zoonotic diseases, vaccination against rabies and responsible ownership through the veterinary public health section within the DAHLD (Chikungwa, 2009, pers. comm.). Also the Department of Public Health within the Ministry of Health are involved. Through this programme they try to reach both rural and urban communities. Local authorities are involved in the dissemination of the technical messages to the rural masses through local leaders and other influential persons in the society. Schools are involved only partially as the subject has not been fully integrated in the curriculum, particularly not in the primary schools. Chikungwa thinks there is a need for a more holistic approach with involvement of other stakeholders to enhance the success of such programmes, and this has already been initiated.

Since the sixties there has been a radioprogram in Malawi to inform the public about rabies and how to prevent dog bites (Masuku, 2009, pers. comm.). There is also information spread mostly through community meetings, leaflets/posters, radio and occasionally TV programmes (Chikungwa, 2009, pers. comm.). Chikungwa says there is need to improve and increase the capacity for different channels and media to reach the public.

Peru

In the regulations from 2002 it was established that the human population of Peru shall have education about zoonotic diseases transmitted from dogs (Gutierrez, 2009, pers. comm.). For this reason the program for responsible ownership of

companion animals (TRAC) was prepared at DIGESA. They have designed educational materials, posters and a rotafolio directed to children in primary school, age between five and eleven years old. The material is basically pictures and less text. In the material following objectives are brought up for discussion: animals cost time and money, animals need proper food and protection, hygiene, what to do with faeces, when to go to the veterinarian, reproductive control, the zoonoses – toxocara canis and rabies, and the importance of washing hands after contact with animals. The final message is that with responsible ownership follows healthy animals and a healthy family.

The municipalities have to implement this material, but often DIGESA help with arranging meetings with teachers to teach them how to work with the material. The municipalities help coordinate the schools so all of them will have information.

Apart from the education material directed to children in school, there are also flyers with information available for municipalities to spread in public.

Gutierrez emphasize that it is very important to educate people in responsible ownership. It's the key to successful DPM since dogs with irresponsible owners are the ones causing problems. Education is the main measure. Without education everything else will be a waste of efforts. But she also stress that changing people's mind or the society as a whole are not easy. One way to reach further out is to educate the veterinary students, as they will be a future information source in their work as veterinarians.

Grupo Caridad talks to people about responsible ownership when they arrive to their free spay clinics (Moreno, 2009, pers. comm.). Moreno says they would like to put more efforts in education, but the time and budget is limited. However, he has already experience that Grupo Caridad's appearance in the districts and their communication with people has given a positive response, with the result of people caring more for their animals.

HUAW also strongly believes in education of people, both dog owners and others (Cavero Alprecht, 2009, pers. comm.). They try to inform and educate owners, visiting the clinic, in responsible ownership. They also have a program for education about animal welfare (Cochella, 2009, pers. comm.). This program is in cooperation with WSPA who sent lecture material to HUAW. In the program, HUAW is teaching teachers at universities how to teach veterinary students. HUAW also runs a postgraduate education program for veterinarians and students. They arrange workshops and lectures about humanitarian veterinarians, to promote them to follow in the footsteps of HUAW.

Both Grupo Caridad and HUAW also have TV-programs where they try to bring up the importance of responsible ownership (Cavero Alprecht, 2009, pers. comm., Moreno, 2009, pers. comm.).

WSPA has an international Animal Welfare Education Programme (IN AWE-programme) for children in the age between 5 and 16 years (WSPA News, 2010).

In Chulucanas in northern Peru teachers have involved in this. They promote animal welfare education through presentations and public events.

Rabies control

Malawi

Not many studies of dog population and rabies has been done i Malawi. Searching at PubMed for “Malawi” and “dog” gives the result of two articles of which only one is really discussing this topic. Searching for “Malawi” and “rabies” results in another 2 articles of which one is from 1973 and the other from 1995.

In Malawi the last report to RABNET and WHO is from 2005, when eight cases of rabies was reported (WHO, RabNet, 2009). Mr Humphreys Dzanjo Masuku, Chief Environmental Health Officer at the Ministry of Health in Malawi says that they get reports of about ten human rabies cases each year, but he suspects there is an underreporting and estimates the total number of cases to about 25 per year (Masuku, 2009, pers. comm.). Also Dr Msyamboza at WHO in Malawi says that the number of human cases of rabies in Malawi is unclear and suspects a big proportion of underreported cases (Msyamboza, 2009, pers. comm.).

According do Chikungwa three cases of human rabies have been reported so far in 2009 (Chikungwa, 2009, pers. comm). Two cases were reported in 2008, and three cases in 2007. These cases of rabies were all confirmed at laboratory.

Chikungwa also says that almost all cases are caused by dogbites, both by owned and unowned dogs and stress that the number of rabies cases are grossly underreported. This obvious lack of accurate data on human rabies is compounded by the local medical laboratories lack of capacity to confirm rabies in humans. The clinical picture of rabies has also several other differential diagnoses presenting with nervous signs, why rabies is not always confirmed. Reporting also depends on people seeking medical help and Masuku suspects that people die from rabies because of lack of knowledge of the disease (Masuku, 2009, pers. comm.). One other reason to the low number of confirmed human rabies is that no statistices about human rabies are held at national level but only at district level (Msyamboza, 2009, pers. comm.). When the districts report diseases to the Ministry of Health by a system called Health Management Information System, rabes is put together with other diseases in a group called “others”. To get detailed information, districts need to be contacted directly. It’s the same for dog bites where the statistics also are held only at district level.

If bigger outbreaks of rabies occur, WHO gets involved (Msyamboza, 2009, pers. comm). They give technical support and instructions on how to vaccinate people, while the government covers the costs.

10 cases of lab confirmed dog rabies have been reported so far in 2009 (Chikungwa, 2009, pers. comm). 17 cases were reported in 2008, and 23 cases in 2007. When a dog has bitten a human it is quarantined for at least 10 days for observation at a known and well managed veterinary station/clinic. In cases of

strays/ownerless dogs who normally cannot be traced this can however be difficult. If rabies is suspected, people exposed to the dog are traced and details and history of the incident are recorded. If the dog is available it is thoroughly examined by a Veterinary Officer who decides whether people bitten or in contact with the dog should be recommended post exposure treatment or not. If clinical signs of rabies, the dog is normally destroyed and a brain sample or the whole head is sent to the Central Veterinary Laboratory for confirmatory diagnosis.

If the laboratory confirms the dog as rabies positive, the PET of exposed people continues. If it turns out negative, further treatment is regarded as unnecessary.

There is a vaccination campaign running in Malawi (Chikungwa, 2009, pers. comm, Ssuna, 2009, pers. comm.). The current policy is to achieve vaccination coverage of at least 70-80%, as recommended by WHO. In the World Survey of Rabies No 34 for the year of 1998, which is the latest survey available at WHO's webpage, the summarized number of immunized dogs was counted to 98.300 which is estimated to a vaccination coverage of 10 % (WHO, 2000). A survey from the same year estimated the population to nearly 2 million dogs (Chikungwa, 2009, pers. comm). If this estimation was accurate the coverage was only about 5 %. Between 1986 and 1992, 41.000 to 85.000 dogs were vaccinated annually (Edelsten, 1995). After a vaccination campaign "tie-up" orders were announced and straying dogs were shot. In the same study Edelsten concluded that shooting of small number of unsupervised dogs was not only expensive but also unlikely to have any impact on the incidence of rabies in Malawi.

In 2001 and 2002, 30 and 33 dogs respectively were reported vaccinated in Malawi according to WHO RabNets webpage (WHO, RabNet, 2009). The accuracy for this data must however be questioned and is probably inaccurate. According to Chikungwa vaccinations are done annually in all the districts of the country and the currently vaccinated population could be estimated to approximately 50% (Chikungwa, pers. comm.). However according to Dr. Ssuna, 11500 dogs were vaccinated in Lilongwe in 2009 (Ssuna, 2009, pers. comm.). In 1998 about 440.000 people were living in Lilongwe (National Statistical Office of Malawi, n.d.). If the human-dog ratio of one dog per 2,5 people from the same year is accurate, the estimated number of dogs in Lilongwe was 176.000 at that time. The population has probably not decreased why a vaccination of 11500 gives a coverage of only 6,5% in Lilongwe.

If tools and dog collars are available this is used to mark vaccinated dogs, but the majority just issue authenticated vaccination certificates (Chikungwa, 2009, pers. comm.).

Peru

Since 2003 more people in South America have died from rabies transmitted from wild animals than from dogs (WHO, Rabies, 2008). In Peru there was an epidemic of dog rabies in Lima-Callao in the beginning of 1980s, with a peak in 1982 (Chomel et al, 1988, Merial, 2007). A successful mass vaccination were reintroduced in that area and during one month in the beginning of 1985, 270000

dogs, or estimated 65 % of the dog population, were vaccinated in the campaign. Another 54-55000 dogs were vaccinated by private practitioners and at the Anti Rabid Center in Lima, so the total coverage were estimated to 78 %. This coverage was enough to break the epidemic. Since the beginning of 1990 the number of both dog cases and human deaths has steadily declined with the exception of 2007 (WHO, RabNet 2009).

In 2007, 24 people was reported dead from rabies in Peru to the WHO. 23 of these cases were caused by bats in the area of Puno and Madre de Dios, no cases of dog rabies was reported (Salmón-Mulanovich, 2009). This year two cases of dog rabies have been reported from Puno (Gutierrez, 2009, pers. comm.). Gutierrez stress that there is no possibility to underreporting due to the system, but it is always a risk of people not seeking medical help.

Even though rabies are almost only present in bats in Peru, Peru was still in 2008 considered as a high risk area according to WHO (WHO, Essential rabies maps, Rabies - countries or areas at risk, 2008). Because of rabies among wild animals in the djungle area, it's more or less impossible for Peru to be absolutely free from the disease, but the country will might be declared as free from urban rabies (Villanueva Herrencia, 2009, pers. comm.). The reason to the success according to Villanueva Herrencia is the education of people and the continued mass vaccination of dogs.

There is still an ongoing mass vaccination program of dogs in Peru which has been runned for over twenty years (Gutierrez, 2009, pers. comm). About 2,6 million dogs of a total population of about 4,2 million dogs was suppose to be vaccinated in 2009, which represent about 62 % of the total dog population (Ministerio de Salud, DIGESA, 2009). This coverage is considered enough to prevent dog rabies and epidemics (Gutierrez, 2009, pers. comm). The vaccination is free, but owners are responsible of having their dogs vaccinated (Villanueva Herrencia, 2009, pers. comm.).

When a dog has bitten a human it is seized and detained for observation during ten days (Gutierrez, 2009, pers. comm.). The Anti Rabid Center (ARC) in Lima is the center for rabies control and prevention in Lima (Villanueva Herrencia, 2009, pers. comm). They recieve and observe about 700 dogs anually. As an alternative the dog can also be kept at home for observation. An ambulatory clinic visits the dog day 1, 5 and 10 to see if the dog shows any sytoms of rabies and if it's still alive. If the dog shows any sytoms of rabies, the person who got bitten goes through a PET. This is also the procedure when it's impossible to capture the dog (Gutierrez, 2009, pers. comm.). At the ARC, doctors and nurses are employed to take care of people who has been bitten and the center also helps out with preventive vaccination of dogs against rabies (Villanueva Herrencia, 2009, pers. comm.).

Dogs showing signs of rabies is not killed but has to die from the disease and then an autopsy is done.

Villanueva Herrencia at the ARC is concerned about the incidence of dog bites has increased in Lima, especially among children (Villanueva Herrencia, 2009,

pers. comm.). People having more dogs can be one reason she says, but the problem also depends on the culture why it's important to educate people. To educate children in school is a long way but she also consider it to be the best way to go in order to make a change that last.

Control of echinococcosis

Malawi

There is no control programme for Echinococcosis/Hydatid disease in Malawi and neither no records of cases (Masuku, 2009, pers. comm.). Masuku at the Ministry of Health suspects there are cases, but says that no data are reported. Msyamboza at the WHO on the other hand does not believe they have Echinococcosis in the country since there are no reports about it (Msyamboza, 2009, pers. comm.). In a review of prevalence studies of *Echinococcus granulosus* in dogs in Africa they reported that 60 % of the dogs in Maasailand, Tanzania, in 1989 were infected while the prevalence in Maputo in Mozambique in 1980 was only 0,5 % among dogs (Macpherson & Craig, 2000). Both of these countries are neighbourhood countries to Malawi.

Peru

Hydatid disease and echinococcosis is highly endemic in the highlands of Peru. According to Gavidia 80-90 % of sheep in some areas of the Peruvian highlands can be infected (Gavidia 2009 pers. comm.). The prevalence study by Moro et al from 1997 among humans and dogs in a farming area in the Peruvian Andes held the prevalence of hydatid disease to be 9,1 % in the human population, and the prevalence of echinococcosis in dogs to 32 %. Interviews of people showed that 65 % had complete or partial knowledge of the cause of the disease. Another study by Moro et al in 2005 in the district of Pacaraos, northeast of Lima, in the Peruvian Andes held the prevalence of canine echinococcosis to 51 %. In this study interviews were also conducted with the owners to the sampled dogs, which showed a complete lack of knowledge of how the parasite was transmitted and how to prevent it. It was also showed that sheepdogs, dogs with owners that slaughtered livestock in the field and dogs fed with hydatid infected viscera was more likely of being infected.

Echinococcus granulosus is not only present in the highlands but has also been found in Lima and in Chinchipe, another coastal city in Peru (Moro et al, 2004).

A reason to the high prevalence in the highlands is that dogs resides in and around slaughterhouse at slaughter, feeding of viscera containing hydatid cysts (Moro et al, 1997). There is also a lot of home slaughter which also allows dogs to feed of hydatid cysts (Gavidia 2009, pers. comm.).

Problems involved in managing the disease in Peru are the localisation of people in the highlands, dogs that are difficult to capture and handle, illiterate and uneducated people, insufficient evidence for dog vaccine and no access to vaccine

for sheep which otherwise is a well functioning alternative (Gavidia 2009 pers. comm.).

During this project a study was running in the region of Tunin in Peru with the aim of comparing the result after treatment with praziquantel every sixth week or every sixth month (Gavidia, 2009, pers. comm.). If treatment every sixth month could be enough to reduce echinococcosis among dogs this would clearly facilitate a control program.

At time for this study in 2009, there is no control programme for echinococcosis/hydatid disease in Peru (Gavidia, 2009, pers. comm.). However a legal framework for a control programme has been prepared and hopefully a control programme will begin during 2010.

The educational program in TRAC does not involve Echinococcosis, but it does stress the importance of washing hands before eating, if being in contact with dogs (Gutierrez, 2009, pers. comm). The educational material also involves information about picking up feaces from the dogs and some of the municipalities have signs with this information in parks and also give out sanitary bags for free (Gutierrez, 2009, pers. comm).

DISCUSSION

The purpose of this study was first to shortly review problems associated with straying dog and major guidelines for dog population management, and secondly to study how these guidelines are implemented in the management of dog populations in Malawi and Peru.

Even though many people and organizations are engage in DPM, stray dogs are still a problem of great concern, why you can suspect lack of resources as well as lack of implementation of published guidelines. This also seems to be the case in both Malawi and Peru even though their problems differ in some aspects.

In Malawi the initiative to DPM has been taken by a NGO instead of authorities. This is also what is recommended in the guidelines if the government is unable or unwilling to take responsibility. It's therefor to consider LSPCA's work as a good initiative and they also try to involve local authorities and coordinate their work to be more efficient. The consequence of not having the authorities as the main executive is the lack of a comprehensive national plan for DPM. It also leaves DPM to be totally dependent on funding and the engagement of volunteers with the risk of unsustainability. However the support from RSPCA International makes the project more reliable.

One of the biggest concerns with DPM in Malawi is the lack of knowledge about the dog population. Information and assessment of the dog population is fundamental for both DPM as well as disease control. Unreliable information about the dog population complicates the assessment of what control measures to use, which measures are the most cost-efficient, as well as measurement of result and efficacy of choosen methods. In case of rabies control lack of information makes it difficult to calculate an accureate vaccination coverage. This may lead to insufficient vaccinations with risk of aggravating the rabies situation with devastating outcome for affected poeple and their families. Hopefully the intended survey by RSPCA and LSPCA will be a reality and give more information for both DPM and disease control.

I found it very difficult to make any conclusions about the rabies situation in Malawi. What is clear is that no one really know what the situation is like. Many sources belive in an underreporting and there are no reliable statistics due to both underreporting as well as the system of reporting. Information about vaccination coverage, the requirements for how many should be vaccinated and how often is also inadequate. Other aspects that complicates the rabies situation is lack of resources and infrastructure. Underreporting of rabies may also be misleading making the disease seem less important and may therefore be given less priority. On the oher hand, in a poor country with a HIV-prevalence of 12 % and an infant mortality of 13 %, it's understandable that DPM and rabies prevention isn't the main priority.

Peru also lacks a comprehensive national plan for DPM but awareness about the problem with free roaming dogs seems high among authorities, particularly in DIGESA. A successfull rabies programme has evolved and been well established in Peru for many years. The vaccination programme is extensive with about 2,6

million dogs vaccinated annually with the result of rabies being almost eradicated among dogs in Peru. This shows that it's possible to get dog rabies under control with big efforts and thoroughly assessment of the dog population, leading to a protective vaccination coverage. Rabies from wildlife will however always be a threat to dogs and humans in Peru.

The situation with echinococcosis and hydatid disease in Peru are more difficult and complicated involving both livestock, dogs and people in areas difficult to access. A lot of surveys have been done by universities in Peru but so far there is no national control programme. The good thing is that a legal framework for a control programme has been prepared and hopefully a control programme will begin during 2010. How this will be enunciated is for me unknown.

There is no information of echinococcosis in Malawi, but since it's endemic in most part of the world with the highest prevalence in poor rural areas you can suspect that *Echinococcus granulosus* is also present in Malawi. To get any information of this more research need to be done.

Apart from being responsible for the rabies program, DIGESA in Peru is also involved in law enforcement, promoting DPM and disease control, as well as education. Both of these are essential steps for sustainable DPM. Education of the public to change attitudes towards dogs, increase knowledge and awareness of dogs and diseases are considered fundamental in both Malawi and Peru. The education is primarily directed towards children, the future generation. Educating children already in school makes the campaign more efficient. But where people and infrastructure is poor, education could fail. The good thing in Malawi is that LSPCA and government works together to educate people, while there is no such cooperation in Peru. Both DIGESA, WSPA, Grupo Caridad and HUAW in Peru works with education. Coordinating work, sharing material and harmonizing messages could definitely improve and save both time and resources.

Population control which basically should rely on control of reproduction is one of the most important control measures in DPM. Unfortunately maskilling of dogs has been used in both Malawi and Peru even though it's proven both inefficient and more expensive than reproduction control and also seems to have no impact on the prevalence of rabies.

In Malawi, LSPCA in cooperation with WVS has began a program for reproduction control. One day per week (with the aim of two days per week) are set aside as spay days, which indeed is a good start. Added to this, WVS will come twice a year to help out with more castrations. When looking at the result in comparison to the estimated number of dogs in Malawi (even if this differ between different sources/surveys) it's easy to be pessimistic. If the aim of coming twice a year, doing only a few days of castration in each campaign, with the result of less than 50 female dogs castrated to a cost of over 6000 Euros, I find myself very critical. The result will only have an absolutely minimal impact on the population to a huge amount of money. This way of working gives a very high cost compared to a very low benefit and it's more or less a total waste of money that could be used in another way. In a low developed country where resources are limited it's even more important to use the resources in the most efficient way

looking at the cost-benefit before employing any measure. What could be much more cost-efficient and give a better result is to employ a veterinarian for a long term project with reproduction control, and combine work at a permanent clinic with an ambulatory clinic. The problem in Malawi is the lack of veterinarians and veterinary schools, why it may be necessary to employ veterinarians from abroad.

Also in Peru the reproduction control is runned by NGOs. DIGESA promotes castration of dogs by words, the municipalities have the responsibility for the dogs roaming in their area, but the NGO's are the ones doing all the work. The campaigns/programmes by Grupo Caridad and HUAW are however much more efficient than the programme in Malawi and about 2500 dogs are castrated annually in Lima. 2500 dogs are still a low number when compared to the estimated population of 1,2 million dogs only in Lima, but the work is done continuously to a much lower cost per dog which together suggest sustainability. With support and enforcement from both government and local authorities the result would be even better.

The same support is given Grupo Caridad by World Vets as given LSPCA by WVS and this must indeed also be questionized. The difference in between is that World Vets plan to go to Peru seven times a year which probably will make a better result, but also to a higher expence. The cost efficacy of these projects should definitely be considered. I think that these resources could be spent in a much more efficient way by continue to employ local vets to do the castrations, which is also normally done by Grupo Caridad.

HUAW works for sustainability and profound change by informing other veterinarians about the problems with straying dog population. They also informe about their programme and try to influence them to work in the same manner, helping out castrating dogs. If more veterinarians would do the same work as HUAW does, the result would be evident.

This study was based on literature reviews combined with open interviews. All interviews were in English or with translation between English and Spanish. Since English isn't the mother tongue for anyone but Donnamarie O'Connell, confusion of languages is a source of error. There is also a risk of lost of information during translation. To minimize these sources of error, follow up questions were asked whenever answers were unclear or not really understood. Another way would have been to send the given answers to the persons interviewed for them to proofread. This would however been a problem in Peru were many important interviews were done with translation.

Many contacts were made during the fieldstudies and I think the study gave room for both authorities, international organisations and local NGOs. What also would have been interesting is to have made interviews with representatives of the city assembly in Lilongwe as well with the Pan American Health Organisation in Lima as these two parties also are involved in different aspects of DPM.

To sum up, free roaming dogs are still a problem in both Malawi and Peru. DPM are relatively new in Malawi but will hopefully get more resources for a sustainable and efficient program to evolve. Very important is proper assessment

of the dog population as well as coordinating resources and use cost-efficient methods for both DPM and disease control. Peru on the other hand has come a long way in research and disease control but has still much to do in DPM to reduce the population. More resources and involvement of authorities would be a contribution. The rabies campaign in Peru shows that it is possible to get rabies under control and hopefully they will also be able to reduce echinococcosis and hydatid disease. The new education program is a good start for DPM and to reduce disease transmission, but would probably benefit from coordination between authorities and NGOs. To succeed with DPM and disease control in these two countries as well as other countries I think a national coordinator and working group as proposed in the guidelines would definitely be a great idea. The purpose of this would be to gather all necessary information, coordinating NGOs and authorities, looking at available resources and methods to form a national plan for DPM and disease control, and also do follow ups and evaluations. Free roaming dogs will probably always be present but the situation with 375 million dogs could definitely improve with the right measures.

APPENDIX 1

Malawi – facts and figures

Malawi is one of the poorest countries in the world. (Regeringskansliet, n.d.) A low educated population, limited natural resources and widespread corruption aggravates the situation and work against development.

In the United Nations Development Programme (UNDP) Human development report 2009 – HDI Rankings, Malawi is number 160 of 182 countries and belong to the group of low human development (UNDP, Human development reports – HDI Rankings, n.d.). This could be compared to Norway which is number one or Sweden which is number seven.

Location: South-east part of Africa, in between Tanzania, Zambia and Moçambique. See map.

Capital: Lilongwe

Climate: Malawi has two distinct seasons, a wet, warm season and a dryer, cooler season (National Statistical Office of Malawi, n.d.). The wet, rainy season runs from October to April, while the dry season runs from May to September.

Constitution: Republic

Population: Estimated to 13,1 million people in 2008, of which 6,4 million men and 6,7 million women. (The National Statistical Office of Malawi) Approximately 50 % are under 15 years of age and 83 % live in rural areas. (WHO Country cooperation strategy)

Illiteracy: 28,2 % of adults age over 15 years. (UNDP-Human Development Report 2009 – Country Fact Sheets – Malawi)

Water supply and undernourishment: 19 % of children under 5 years are underweight for their age. 24 % of the population are not using an improved water source.

Life expectancy at birth: 49 years for men and 51 years for women (WHO – Malawi)

Infant mortality rate age under 5 years: 13,3 % (WHO Country cooperation strategy)

HIV/AIDS: The prevalence among adults is 12,5 % (2005) (WHO – core health indicators)

Number of vet. schools: 0

APPENDIX 2

Peru – facts and figures

Peru has suffered from political instability and corruption for many years, with both non-democratical and democratical governments. (Regeringskansliet - Utrikesdepartementet – Peru) The country has social, regional and economical contrasts of great concern and poverty is spread both in urban and rural areas.

In the United Nations Development Programme (UNDP) Human development report 2009 – HDI Rankings Peru is number 78 of 182 countries and belong to last six countries of the group of high human development.

Location: North-west of South America with a coastline to the Pacific Ocean.

Capital: Lima

Constitution: Republic

Population: 27,589,000 in 2006 (WHO – Peru)

Illiteracy: 10,4 % of adults age over 15 years. (UNDP-Human Development Report 2009 – Country Fact Sheets – Peru)

Life expectancy at birth: 71 years for men and 75 years for women.

Infant mortality rate age under 5 years: 2,5 %

Water supply and undernourishment: In 2000 5,2 % of children under 5 years are underweight for their age. 11,8 % are of the children are overweight according to WHO. (WHO – Core health indicators) 16 % of the population are not using an improved water source. (UNDP-Human Development Report 2009 – Country Fact Sheets – Peru) And according to the same source 8 % of children under five years are underweight.

Number of vet. shools in Lima: 7

APPENDIX 3

Maps over Malawi and Peru



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APPENDIX 4

Interview questions

- 1a) Name?
- b) Position?
- c) Education?

- 2a) Do you have any estimation about the number of dogs in Malawi(M)/Peru(P)?
- b) Do you know how many of these are ownerless?

- 3a) Has there been any study/survey over the dog population in M/P?
 If yes:
- b) What kind of study and when?
- c) What where the conclusions?
- d) Which methods have been used?

- 4a) Is there any registration of dogs and owners in M/P?
 If yes:
- b) Do people pay taxes or other fees for their dogs?

- 5a) What welfare problems do dogs face in M/P?
- b) Has there been any surveys about the health status among dogs in M/P?
 If yes:
- c) What was the result?

- 6) What are your biggest concern about the dog population in M/P?

- 7) How many cases of human rabies have you had in M/P
- a) so far in 2009?
- b) 2008?
- c) 2007?
- d) How many of these are transmitted from dogs?

- 8) How many cases of dog rabies have you in M/P
- a) so far in 2009?
- b) 2008?
- c) 2007?

- 9) Which areas/districts are affected?

- 10) Which dogs (which part of the dog population) are most often infected?

- 11a) What other zoonotic diseases do you have in the dog population in M/P?
- b) What is the prevalence?

- 12) What is the routine of reporting rabies?

- 13) Do you have an estimation of how many cases of rabies that are not being reported?
- 14) Is there any reporting of dogbites in M/P?
- 15) What is the routine for a dog that has bitten a human – quarantine, euthanasia?
- 16a) What is the practice when a dog is suspected of having rabies – what happens to the dog, and to other dogs and people being in contact with the suspected rabid dog?
- b) Do local authorities have the possibility to seize and detain dogs?
- 17) What other problems apart from zoonotic diseases are caused by free roaming dogs in M/P?
- 18a) How many veterinarians is there in M/P?
- b) How many of these are employed by government?
- 19) How many veterinary schools is there in M/P?
- 20) Can people afford veterinary services?
- 21) Guidelines for DPM have been published by WHO & WSPA, ICAM-coalition and OIE.
- a) Do you have any knowledge about these documents/have you been given any information about these documents?
- b) Are you using them?
- 22a) Is there a national for DPM in M/P?
- If yes:**
- b) Which departments/authorities/organizations are responsible?
- c) How is the plan or program enunciated?
- d) Which is the executive organ?
- e) Which departments/authorities/organizations are involved in DPM?
- f) Are local animal welfare and protection groups involved?
- g) Is there any local community committee for DPM?
- 23a) What methods are primarily used for DPM?
- b) Do you know the proportion of animals accessible to the campaign?
- c) Do you know many dogs you need to reach do achieve a desired effect?
- d) Is there any monitoring of the effect of chosen measure?
- If yes:**
- e) What indicators are measured?
- 24a) Do you know about the work and involvement in DPM done by NGO/government/local authorities?
- b) What contact and cooperation do you have?
- c) Have you harmonized your work? Are your plans and programme coordinated?

- d) As a NGO – do you get any financial contributions from the authorities?
- 25a) If mass killing is used, how are the dogs killed?
 - b) What is the routine with the carcasses?
- 26a) If dogs are being neutred, are some dogs given more priority than others?
 - b) Are spayed animals marked?
- 27a) Do you have any rabies campaigns in M/P?
 - b) How many dogs are vaccinated?
 - c) What is the vaccination coverage?
 - d) How often?
 - e) Do you know how many dogs you need to vaccinate to establish a sufficient immunity within the population?
- 28) What is done to improve the health of the dogs?
- 29) Do you have a programme for educating the public about:
 - a) zoonotic diseases?
 - b) the importance of vaccinating dogs against rabies?
 - c) the importance of neutering?
 - d) the importance of giving healthcare to your dog if it gets sick?
 - e) other topics concerning dogs?
 - f) Which people are given education?
 - g) Are schools and local authorities involved?
 - h) Is anyone coordinating the education?
- 30a) Do you have other information campaigns?
 - b) How are these designed and which media is used?
- 31) Are veterinary students given any education about DPM?

Questions for NGOs only:

- 32) What is the aim with your organization?
- 33) What education do you have in your organization?
- 34) Do you get any financial contribution from the government/local authorities?
- 35) Do you have any thoughts of having a permanent low cost veterinary clinic?
- 36) Do you involve local veterinarians?
- 37) Do you have any thoughts of starting an animal shelter?
- 38) What attitudes do you meet from the public?

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