Investigations regarding tail injuries in working gundogs and terriers in pest control in Scotland

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Abstract

Non-therapeutic tail docking was until recently performed on 29% of dog breeds in the Scotland but was banned by the Animal Health and Welfare (Scotland) Act 2006. This work was commissioned by the Scottish Government to ascertain what effect the total tail docking ban had on working gundogs and terriers and whether legal exemptions to the ban should be made to improve the welfare of working dogs. Three studies were conducted to examine the risk of tail injury, especially in undocked working dogs, as well as details regarding tail injuries: A retrospective internet survey for working dog owners, an analysis of clinical veterinary data, and a prospective study of tail injuries. The main findings of study one on 2860 dogs were a clear predisposition for tail injury in spaniels (17.8%) and hunt point retrievers (HPR; 15.6%), especially if undocked. Terriers and pointers/setters were at least risk in this population. Being docked by more than one third did not appear to infer increased protection from tail injury compared to a one-third dock. Between 10 and 30 spaniel or HPR puppies would need to be docked to one-third to avoid one tail injury examined at a veterinary practice. Tail injuries were mainly tail tip injuries and lacerations elsewhere on the tail, they were mainly sustained during work related activities and were mainly caused by brambles and gorse. While 13.5% of all dogs in the survey sustained a tail injury, 9.8% of dogs also sustained injuries to other parts of the body. A substantial reduction in the number of spaniels originating from Scotland after the tail docking ban was obvious. Veterinary practice data showed that 0.59% of dogs had sustained a tail injury, with a significantly higher prevalence (0.90%) in working dog breeds than in non-working dog breeds (0.53%). Amongst the working breed groups 1.7% of pointer/setters, 1.3% of HPR and 1.2% of spaniels had sustained a tail injury. Spaniels were 2.3 times more likely to have sustained a tail injury if born after compared to before the introduction of the legislation on tail docking. The third, prospective, study could not be conducted as planned due to poor compliance. Therefore only minimal analyses were performed and only few deductions can be made, including that the majority of tail injuries were caused by brambles, gorse and fern, were sustained during work and training, and were almost exclusively tail tip injuries. A minority of tail injuries (between 10% and 12%) were reported as having been examined by a veterinarian. We conclude that based on these data there may be grounds to review the existing complete tail docking ban. However, ethical considerations surrounding tail docking should constitute an important part of this review.

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Author's declaration

I declare that, except where explicit reference is made to the contribution of others, this dissertation is the result of my own work and has not been submitted for any other degree at the University of Glasgow or any other institution.

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Chapter 1
Introduction

The dog was the first species to be domesticated (Mills, 2010) and exists today in the form of more than 400 breeds worldwide (Fogle & Morgan, 2000). Its success is inextricably linked to its close relationship with humans and the two species appear to have co-evolved (Mills, 2010). The selection by humans for diverse functions led to the existence of specific breeds of dogs, which were further defined by Kennel Clubs' breed standards, which in turn were increasingly based on a dog's physical appearance (Mills, 2010). Historically, tail docking was performed in many breeds for a variety of reasons (Morton, 1992): to avoid tax, to prevent a dog from being bitten when ratting or fighting, in the belief that it would prevent rabies, that docked dogs would produce docked offspring (Lamarck's theory), that it would strengthen a dog's back, increase a dog's speed, and more recently in the belief that it would prevent injuries when shooting, hunting and guarding or to improve a dog's appearance. Until recently 61 (29%) of the 210 breeds currently eligible for registration in the UK were either sometimes docked or "customarily docked", spanning across most breed groups (The Kennel Club, 2013; Bennett & Perini, 2003).

Tail docking of dogs for non-therapeutic (that is prophylactic or cosmetic) reasons has been banned in the United Kingdom since 2007 when the Animal Welfare Act 2006 came into force. However, amendments made to the Act (The Docking of Working Dogs' Tails (England) Regulations 2007; The Docking of Working Dogs' Tails (Wales) Regulations 2007) allow the docking of certain working dogs or working dog breeds in Wales and England. Only recently the Welfare of Animals Act (Northern Ireland) 2011 came into force with similar exemptions (The Welfare of Animals (Docking of Working Dogs' Tails and Miscellaneous Amendments) Regulations (Northern Ireland) 2012). However, the Animal Health and Welfare (Scotland) Act 2006 includes a total ban on non-therapeutic docking of dogs with no exemptions.

Mutilation in any species poses an ethical dilemma, in relation to the pain and potential risk of complications at removal, as well as implications for the animal's long-term welfare, and seems justifiable only if it protects the animal from greater suffering if not performed (Morton, 1992; Bennett & Perini, 2003). The ethical problems and health issues involved with tail docking have been discussed in depth elsewhere (Morton, 1992; Holt and Thrusfield, 1993; Wansborough 1996; Bennett & Perini, 2003). Earlier studies by Darke et al. (1985) and Diesel et al. (2010) found a rather low incidence of canine tail injuries in practice data, but a high incidence of tail injury and a protective effect of preventative tail docking in working dogs have been claimed by country sports organisations who would welcome amendments to the legislation, which would bring Scotland into line with the legislation in England, Wales and Northern Ireland.

When introducing the tail docking ban in Scotland the Scottish Government agreed to review the legislation and assess the potential impact of the ban in terms of the risk for tail injury in undocked working gundogs and terriers used in pest control.

The following work describes the research undertaken to support this review by Scottish Government. The mandate of the research project was the investigation of tail injuries in dogs of specific working breeds within spaniels, hunt point retrievers (HPR) and terriers in Scotland to provide robust evidence on the incidence, causes and types of tail injuries in docked and undocked dogs of these breeds in Scotland, both in working dogs and dogs not used for work.

The main questions to be answered were:

1. What is the risk of tail injury in undocked working dogs in Scotland?
2. Do undocked working dogs of particular breeds experience a higher incidence of tail injuries than docked dogs?
3. What are the incidence, causes and types of tail injuries in docked and undocked working and non-working spaniels, HPR and terriers?

To address these aims three separate but related studies were conducted:

Study 1:
An online survey for working dog owners regarding the occurrence of tail injury in their dogs was conducted. The survey was advertised and distributed to members of the British Association of Shooting and Conservation, Scotland (BASC) and other interested parties. The primary aim of this study was to estimate the incidence of minor and major tail

injuries sustained by working dogs during the previous shooting season and to describe the different types of tail injury sustained by working dogs as well to identify risk factors for tail injury, such as tail length, in working dogs.

Study 2:

An analysis of veterinary clinical data regarding tail injuries examined by a veterinary surgeon in dogs of working breeds and other breeds, in Scotland was undertaken. The primary aim of this study was to estimate the prevalence of major tail injuries in spaniels, HPR and terriers visiting veterinary practices.

Study 3:

A prospective case-control study of tail injuries sustained by active working dogs throughout a shooting season was attempted. This study was designed to describe the different types of tail injury sustained by working dogs, analyse risk factors, and to provide an estimate of the strength of any association between tail length and other risk factors and tail injury in working dogs of different breeds.

Chapter 2
Literature Review

2.1 Dogs throughout history

2.1.1 Canine evolution and domestication

Genetic and archaeological evidence suggests that dogs have diverged from a subspecies of the ancestral grey wolf (*Canis lupus*) (Vila et al., 1997; Leonard et al., 2002; vonHoldt et al., 2010). The exact details regarding the evolution and domestication of the domestic dog (*Canis lupus familiaris*) such as the location, number, and timing of founding events still remain uncertain however and are extensively debated. Archaeological evidence implicates the Near East as the location of domestication although this may have already taken place in Central Europe as far back as the Upper Late Paleolithic (Germonpré et al., 2009). This makes the dog the first species to have become domesticated (Mills et al. 2010). It is also the only large carnivore to ever have been domesticated (Wayne & vonHoldt, 2012).

Most of the archaeological finds of dogs support the occurrence of domestication between 15,000 and 20,000 years ago (Spady et al., 2008), an example for this being the remains of a dog buried among human remains in Germany (Bonn-Oberkassel) dating back to 14,000 years ago (Clutton-Brock, 1999). The actual divergence of dogs from wolves is believed to have taken place between 15,000 – 40,000 years ago (Savolainen et al., 2002) and possibly even as much as 135,000 years ago (Vila et al., 1997) and dog-like fossils indicate that dogs were already present during the late Pleistocene in Belgium (36 000 years ago) (Germonpré et al., 2009), the Czech Republic (Germonpré et al., 2011) and South-western Siberia 33,000 years ago (Ovodov et al., 2011), indicating at the same time that dog domestication was most likely multiregional rather than stemming from a single place of origin, and that not all domestications succeeded to continue into modern dog lineages. There is evidence of multiple and genetically diverse founder populations (Vila et al., 1997).

A common origin from a single gene pool in East Asia (Pang et al., 2009; Savolainen et al., 2002; Ardalan et al., 2011) has been suggested, but has been challenged as being too simplistic (Boyko et al., 2009; vonHoldt et al., 2010). More recent genetic research has traced dogs back to a primarily Middle Eastern or European wolf ancestry, which would be more consistent regarding the location of archaeological finds (Wayne & vonHoldt, 2012); This means there is genetic evidence consistent with European as well as Middle Eastern wolf populations contributing to the dog genome, whereas mtDNA suggests an East Asian origin (Wayne & vonHoldt, 2012)

It appears likely that dogs would have had a long prehistory of domestication when they were still morphologically wolf-like and hence cannot be recognised as domestic dogs at archaeological sites (Ostrander & Wayne, 2005; Larson et al., 2012). It is possible that this morphological change would only have occurred later with a transition from the hunter-gatherer to a more sedentary lifestyle of humans (Ostrander & Wayne, 2005). However, the first unambiguous domestic dogs appear to already precede settled agriculture archaeologically by several thousand years (Larson et al., 2012; Sablin & Khlobachev, 2002; Germonpre et al., 2009; Ovodov et al. 2011). A large study and review of genetic, archaeological and bio-geographical data (Larson et al., 2012) concluded that archaeological data were suggestive of independent domestications of local wolf populations, and the migration of humans with dogs, or secondary acquisition of dogs by other humans. This would explain the heritage of Scandinavian dogs (Malmstrom et al., 2008) and Northern American dogs (Leonard et al., 2002) for example.

Wolf domestication in itself is most likely the result of inter-woven processes originating more than 14,000 years ago during the hunter-gatherer period in which less fearful wolves started to use (permanent or temporary) human settlements as a new niche (Ovodov et al., 2011; Mills et al., 2010), which led to natural selection and genetic drift and resulting in changes in their phenotype. Following this cultural selection processes would have taken place which selected for decreased flight distance and increased sociality, both hallmarks of tameness. Eventually artificial selection for desired traits by humans began. (Driscoll et al., 2009; Mills et al., 2010). It has been generally accepted that the "success" of dogs worldwide is closely linked to the success of humans and the close relationship and probable co-evolution between the two species (Mills et al., 2010).

2.1.2 The creation of dog breeds and breed diversification

The dog has been under a strong artificial selection throughout its history, which resulted in extensive morphological and behavioural differentiation from its wild ancestor, the wolf.

Domestication was followed by several phenotypic changes such as a smaller cranium and mandible, compacted teeth, and smaller auditory bulla, widened snouts, decreased tooth size, decreased body size, altered coat colour and pattern and altered tail and ear carriage (Spady et al., 2008). These characteristics are commonly used to distinguish the remains of domesticated early dogs from wolves (Sablin & Khlopachev, 2002). As shown in the "farm fox experiment" on silver foxes *(vulpes vulpes)* by Belyaev and colleagues, selection for tameness alone led to substantial changes in behaviour as well as their appearance (Trut, 1999). With the development of agrarian societies there was likely more selection for dogs of smaller size and with behaviours that allowed for closer contact (Davis & Valla, 1978).

Dogs today show more morphological variability than any of the 35 wild canid species, the entire carnivore order or any other mammal species (Wayne & vanHoldt, 2012; Shearin & Ostrander, 2010a). Although they have been domesticated for 15-20,000 years, the wide phenotypic variation within dogs only began to appear around 3-4000 years ago, with a rapid acceleration in divergence from about 200 years ago with the creation of breed clubs and systematic breeding practices, which led to the approximately 400 distinct breeds recognised worldwide today (Fogle & Morgan, 2000). It appears that many dog breeds were formed rapidly, taking advantage of novel mutations relating to body size, skeletal mutations such as chondrodysplasia, brachycephaly, and coat colour and texture mutations (Shearin & Ostrander, 2010a). Mutations in a small number of genes of large effect are responsible for many breed characteristics (Shearin & Ostrander, 2010b). In fact much of the distinct morphological diversity of dogs reflects variations in a relatively small number of genes, such as the IGF1 small dog haplotype as a cause for miniaturisation (Boyko et al., 2010), which is derived from a Middle Eastern grey wolf (Gray et al., 2010). These phenotypes were then preserved within breeds through crossing and selecting for desirable traits in the F2 generation or through multigenerational selection for desirable traits in part through intense inbreeding (Wayne & vonHoldt, 2012). This was accelerated by the systematic creation of novelty breeds, especially in the early 19th century (Shearin & Ostrander, 2010b). Interestingly, the dog genome project found two population bottleneck signatures, one of which is likely associated with this most recent formation of dog breeds while the other is likely associated with first domestication (Lindblad-Toh et al., 2005). Most modern dog breeds have therefore only been developed within the last 200 years primarily in Europe (Parker et al., 2004). However, there are some truly ancient "dog breeds" such as the Australian Dingo, the Basenji, the Shar Pei that were isolated from early dogs thousands of years ago and which remained distinct breeding populations (vonHoldt et al., 2010).

It is likely that our ancestors found dogs useful as guards and sentries and as hunting companions - scent hounds for example developed in Asia and the Middle East more than 5000 years ago – or even as draught dogs (Fogle & Morgan, 2000). Dog breeds have also been created for their use in sport such as hunting, fighting or baiting and racing. Pack hunting in Asia was described by Marco Polo in the 13^{th} century, and was enjoyed by European aristocracy. With the arrival of guns, it led to the development of retriever and setter types. The use of dogs in gladiatorial combat, bear and bull baiting also has an unfortunately long history, as did hare coursing which evolved at least 1800 years ago (Fogle & Morgan, 2000). Dogs that were used for these purposes would have been selected according to their working ability rather than a uniform phenotype however and are not truly breeds but rather types. This has been described (Sablin & Khlopachev, 2002) for Plains Amerindian dogs, which were selected for large size. In contrast to this form of selection, the first true breeds were only created with the first breed clubs and the development of breed standards, which ensured a relatively closed genetic pool within each breed (Parker et al., 2004). The British Kennel Club was the first kennel club worldwide and was established in 1873. It currently recognises 210 breeds today, which are grouped into 7 categories (Hound, Working, Terrier, Gundog, Pastoral, Utility and Toy) (The Kennel Club, 2013).

2.2 Tail docking in dogs

2.2.1 Canine tail docking in general

Tail docking is or has been performed on a variety of species: pigs, sheep, horses, dogs and cattle (Mills et al., 2010). Historically, canine tail docking was performed in many breeds for a variety of reasons: to avoid tax, to prevent a dog from being bitten when ratting or fighting, in the belief that it would prevent rabies, or that docked dogs would produce docked offspring (Lamarck's theory), that it would strengthen a dog's back, increase a dog's speed, and more recently in the belief that it would prevent injuries when shooting, hunting and guarding or to improve a dog's appearance (Morton, 1992; Wansborough, 1996).

2.2.2 Breeds of dogs that were historically docked

Until recently 61 (29%; Table 2.1) of the 210 breeds currently eligible for registration in the UK were either sometimes docked or "customarily docked", according to their breed standard, spanning across most breed groups (The Kennel Club, 2013; Bennett & Perini, 2003).

Table 2.1 British Kennel Club recognised breeds that were until recently docked in Great Britain.

Breed category	Breeds traditionally docked	Docked breeds/all breeds in the category
Gundog	Bracco Italiano, German Shorthaired Pointer, Hungarian Wirehaired Vizsla, Small Muensterlaender, Brittany, German Longhaired Pointer, German Wirehaired Pointer, Hungarian Vizsla, Italian Spinone, (Korthals Griffon), Large Muensterlaender, Slovakian Rough Haired Pointer, American Cocker Spaniel, Cocker Spaniel, Field Spaniel, Sussex Spaniel, Spanish Water dog, Clumber Spaniel, English Springer Spaniel, Welsh Springer Spaniel, Weimaraner	21 of 36 breeds
Hound		0 of 36
Pastoral	Australian Shepherd, Old English Sheepdog, Polish Lowland Sheepdog, Longhaired Pyrenean Sheepdog, Swedish Vallhund, Pembroke Welsh Corgi	6 of 33
Terrier	Airedale Terrier, Wirehaired Fox terrier, Irish Terrier, Lakeland Terrier, Norfolk Terrier, Parson Russell Terrier, Sealyham Terrier, Soft-Coated Wheaten Terrier, Welsh Terrier, Australian Terrier, Smooth Coated Fox Terrier, Glen of Imaal Terrier, Kerry Blue Terrier, Norwich Terrier	14 of 26
Toy	Cavalier King Charles Spaniel, Griffon Bruxellois, King Charles Spaniel, Yorkshire Terrier, Australian Silky Terrier, Miniature Pinscher,	6 of 23
Utility	Miniature Poodle, Toy Poodle, Standard Poodle, Miniature Schnauzer, Schnauzer, Schipperke,	6 of 29
Working	Boxer, German Pinscher, Neapolitan Mastiff, Rottweiler, Bouvier de Flandres, Doberman, Gian Schnauzer, Russian Black Terrier,	8 of 27

2.2.3 Canine tail docking legislation (in the UK and elsewhere)

It has been illegal for lay people to perform tail docking since July 1993 after the UK government amended the Veterinary Surgeons Act (1966) through the "Veterinary Surgeons Act 1966 (Schedule 3 Amendment) Order 1991. The "removal of the whole or part of any part of a dog's tail" for non-therapeutic (prophylactic or cosmetic) reasons was banned in Great Britain in 2007 when the Animal Welfare Act 2006 and the Animal Health and Welfare (Scotland) Act 2006 came into force. However, amendments made to the Act (The Docking of Working Dogs' Tails (England) Regulations 2007; the Docking of Working Dogs' Tails (Wales) Regulations 2007) allow the docking of certain working dogs or working dog breeds in Wales and England. Recently the Welfare of Animals Act (Northern Ireland) 2011 came into force with similar exemptions applied in 2013 (The Welfare of Animals (Docking of Working Dogs' Tails and Miscellaneous Amendments) Regulations (Northern Ireland) 2012). However, the Animal Health and Welfare (Scotland) Act 2006 includes a total ban on non-therapeutic docking of dogs with no exemptions.

In the Republic of Ireland the Animal Health and Welfare Bill 2012 has recently been passed in which tail docking in dogs is legal but is not permitted to be carried out by veterinary surgeons, because this is considered unethical by the Veterinary Council of Ireland (personal communication with Allan Rossiter, spokesman for Veterinary Ireland). However, docking would be permitted to be carried out by dog owners themselves. It allows docking as a procedure under "subsection 1 if done "in accordance with animal health and welfare regulations" and states that it may be carried out where a veterinary practitioner is satisfied that the operation is for therapeutic purposes and necessary for the health of the animal". It is also stated that "A person shall not - do, or fail to do, anything or cause or permit anything to be done to an animal that causes injury (including disfigurement) or unnecessary suffering to, or endanger the health or welfare of, the animal". Therefore docking is permitted but reasonably regulated.

The Anti-docking Alliance (2013) lists many countries' current stance on tail docking in dogs: While many countries have a national law prohibiting tail docking completely, others may allow docking for all dogs or restrict tail docking for certain breeds or types or uses, while again in others the law may vary even within a country (for example Canada and USA). Some countries that banned prophylactic (non-therapeutic) tail docking completely are: Australia (nationwide ban since 2004 based on 8 different state-wide pieces of legislation (RSPCA, 2009)), Belgium, Netherlands, Finland, Sweden, Norway (since 1987), Latvia, Lithuania, Luxembourg, Poland, Slovakia, Slovenia, Switzerland, Turkey. Other countries banned tail docking but allow tail docking for working dogs: Germany allows docking if dogs are used as hunting dogs (Jagdliche Verwendung), and similarly Denmark allows the docking of five gundog breeds.

2.2.4 Anatomy of the canine tail

The anatomy of the tail has been described in detail by Nickel et al. (2000) in several volumes and chapters.

Bone and muscles: The tail of members of the *Carnivora* consists usually of 20-23 vertebrae, which progressively (from cranial to caudal) lose the *arcus vertebrae* and with it the *foramen vertebrale,, the processus spinosus* and *articularis* and become cylindrical with a convex *extremitas cranialis* and *caudalis*. The vertebral canal and chord only extend to the first few vertebrae. Muscles on the tail are the *M. sacrococcygeus dorsalis medialis* which extends from the 7th lumbar vertebra to the last coccygeal vertebra, the *M. sacrococcygeus dorsalis lateralis* which extends from the 2nd to 7th lumbar vertebrae to at least the 8th coccygeal vertebra. Ventrally there are *M. sacrococcygeus ventralis medialis* which extends along the whole tail, and the *M. sacrococcygealis ventralis lateralis*, which extends to the 11th coccygeal vertebra. *Mm. intertransversarii caudae (dorsalis* and *ventralis)* extend to the 5th *(dorsalis)* and along the whole tail to the tail tip *(ventrali - under the M. sacrococcygealis ventr. lat* (Nickel et al., 2000, Volume 1).

Arteries: The *arteria sacralis mediana* continues from the aorta and becomes *arteria caudalis mediana* often called *arteria caudalis ventralis* in carnivores. Additionally: The *arteria glutaea caudalis* continues as *arteria caudalis lateralis (superficiallis)* along the tail (Nickel et al., 2000, Volume 3)

Veins: The *vena iliaca interna* continues as (on each side of the body) *vena caudalis lateralis superficialis* in dogs, which is larger than the *A. caudalis lateralis superficialis* and runs lateral and superficial in relation to it. The *vena sacralis mediana* continues along the tail as *vena caudalis mediana* and divides itself into a *vena caudalis ventrolateralis* and *vena caudalis dorsolateralis* (Nickel et al., 2000, Volume 3).

Tail nerves or *nervi coccygei* or *nervi caudales* exist as 5 pairs in the dog, each nerve exiting between coccygeal vertebrae and dividing into a dorsal and a ventral branch. These are in contact with each other as well as with the branches of the last *nervi coccygei* and the *truncus sympathicus*. This creates a nerve network, the so-called *plexus caudalis dorsalis* and *ventralis*, which accompanies the *arteriae caudales* dorsolaterally and ventrolaterally. The *plexus caudalis dorsalis* continues to the tail tip and serves *Mm.*

sacrococcygei dors. and *intertransversarii* as well as the dorsal skin of the tail. The comparatively larger *plexus caudalis ventralis* is close to the vertebrae and serves *Mm. sacrococcygei ventr*. as well as the ventral skin of the tail. A second innervation system exists through *nervi sacrales (rami mediales)* which additionally innervate the dorsal tail muscles (Nickel et al., 2000, Volume 2).

2.2.5 The tail docking procedure

The methods of tail docking differ from species to species and from country to country (Mills et al., 2010). In general puppy tails are cut off (Mills et al., 2010) but bands that restrict blood flow to the tail (tail banding) have been used as well. It appears that in general across species the initial pain is greater with cutting but that the ischaemic pain of bands lasts longer (Mills et al., 2010). Not a lot has been written in surgical literature on the details of tail docking. Morton (1992) states: "The precise technique will vary according to the knowledge, competence and experience of the operator". One surgical method of tail docking in pups has been described by Hosgood & Hoskins (1998) as follows: The tail is cleansed with antiseptic, a tourniquet is applied at the base of the tail, the amputation site is selected, the skin pushed cranially, (the cut through the remaining tail tissue made either between or through a vertebra), a dorsal and ventral flap is created with scissors or scalpel blade, these flaps are then closed with a single cruciate suture of absorbable suture material, the tourniquet is released and pressure is applied over the tail until bleeding ceases. The authors state that this procedure should be undertaken in pups less than 5 days old as surgery on individuals older than 5 days would require anaesthesia which may lead to some morbidity, including postoperative pain, bleeding and dehiscence. The authors also state that complications with this technique are uncommon in "appropriately aged animals". However interference with the surgery site by the pup's mother may result in exposure of the caudal vertebrae and lead to infection and scar formation. An unsightly or painful scar may need further surgical correction.

Another more recent description by Schoen & Sweet (2009) describes caudectomy in puppies (tail docking) as traditionally done at 3-5 days of age without anaesthesia. The authors however recommend the use a sedative as well as local anaesthesia for restraint and postoperative analgesia. The authors also recommend that the procedure be best delayed until the pup is 8-12 weeks of age and under general anaesthesia and analgesia, if it cannot be arranged for day 3-5. The surgical procedure begins after clipping and aseptic preparation of the area by retracting the skin cranially. Mayo scissors are placed at an obliqued angle with the ventral blade placed over an intervertebral space and the dorsal blade slightly distal to it in order to then retract more skin cranially, the tail is then transected with the scissors, and haemostasis achieved by electrocautery, pressure or ligation of vessels. The skin is then closed with non-absorbable suture material. Transection can also be made by means of scalpel blade or nail trimmers. Informal comment to the author from veterinary practitioners in the UK and Australia suggests that there is wide divergence from these published protocols in practice.

2.2.6 Adverse effects of tail docking on dogs

Reports on this topic are sparse but negative effects that are likely associated with being docked (short) have been described for dogs, such as faecal/urinary incontinence (Holt & Thrusfield, 1993), perineal hernia (Canfield, 1986), loss of counterbalance as the tail is important in maintaining body balance during locomotion (Wada et al., 1993; Morton, 1992) and decreased ability to express normal body language, as well as the potential of pathological pain due to peripheral and central sensitisation (Wansborough, 1996). The potential impact of partial tail docking (such as docking to one third) is however unknown.

A neuroma is a tumour or new growth largely made up of nerve cells and nerve fibres and a traumatic neuroma has been defined as an unorganised bulbous or nodular mass of nerve fibres and Schwann cells produced by hyperplasia of nerve fibres and their supporting tissues after accidental or purposeful sectioning of the nerve (Blood & Studdert, 1990). Neuroma formation has been described from six dogs (five Cocker Spaniels and one Miniature Poodle) which had undergone tail amputation at 1-4 years old (Gross & Carr, 1990). Amputation neuromas following tail docking had not been described previously. As 5 of the 6 dogs with this pathology were Cocker Spaniels it is unknown whether spaniels are predisposed for the development of neuromas. The authors conclude that amputation neuroma should be considered in the differential diagnosis for caudal pain in docked dogs.

There is a general lack of scientific data regarding complications arising from routine tail docking such as local infection and septicaemia or a potential negative impact on these docked dogs later on in life, such as hyperalgesia, nor is there work on complications arising from tail amputation in adult dogs or the possibility of subsequent phantom sensation.

Phantom sensation is present in virtually all human patients after amputation (Giummarra et al., 2007; Niraj & Niraj, 2014) and in about 50% of limb amputated children under 6 years old (Melzack et al., 1997). Up to 80% of amputees (Koijman et al., 2000) experience phantom pain of the affected body part, usually but not exclusively a limb (Flor, 2002). The exact mechanism for this "phantom limb pain" (PLP) is not clear but psychogenic, peripheral and central neural mechanisms have been proposed (Niraj & Niraj, 2014). It has been suggested that neuroma formation plays a role (Flor et al., 2006), however this does not explain the experience of phantom sensation (including pain) in about 20% of children with a congenital absence of limbs (Melzack et al., 1997; Flor et al., 2006; Weeks et al., 2010). It appears therefore that an innate "body schema" exists, refuting the prevailing view that normal, prolonged sensory input from a limb is essential for the establishment of the neural representation of a limb (Melzack et al., 1997). It also indicates that a number of mechanisms are involved in generating PLP, including changes in the peripheral nervous system, the spinal cord and in the brain such as cortical reorganisation and in case of peripheral nerve injury also spinal cord and central sensitisation (Baron et al., 2010). PLP can occur long after the loss of limb or worsen over time due to plastic alterations in the cortical regions of the brain (Elbert, 2012; Koijman et al., 2000).

Opposition to tail docking mainly centres around the issue of pain at docking. There is still little scientific data regarding the absence, presence or level of pain perception of puppies during canine tail docking. The only study on this topic in dogs, however, did indicate pain responses during and after tail docking. The study included 50 puppies of traditionally docked breeds, and found that all pups vocalised intensely ("shrieked"), on average 24 times, and whimpered on average 18 times, when their tails were amputated. On average they ceased vocalising 138 seconds (ranging from 5 seconds to 840 seconds/14 minutes) after docking (Noonan et al., 1996). The results show clearly that tail docking causes pain, and it contradicts the assumption that neonates could not experience pain because of a lack of myelinisation of nerves (Katz, 1977). It has been argued that the fact that neonates' nerves are not completely myelinated only means that a puppy will perceive pain a quarter of a second later than a mature animal, and that it might even mean that a pup with an immature nervous system would feel more pain than an adult due to a lack of inhibitory pathways, which means that we might even have an extra responsibility to protect (Morton, 1992).

There has been an increasing awareness of human neonatal pain perception (Fitzgerald & Walker, 2009), its assessment (Herr et al., 2006) and the necessity to limit and ameliorate potentially painful procedures in human neonates pharmacologically and non-pharmacologically (Lönnqvist, 2010; Johnston et al., 2011). Most importantly it has been reported that certain procedures performed on human neonates can trigger hyperalgesia later on in life (Taddio et al., 1997). Whether or not tail amputation in canine neonates would trigger hyperalgesia remains so far unknown. Measuring pain has been attempted (e.g. Glasgow University's Composite Pain Scale, an acute pain scale) and certainly has its value in measuring pain due to procedures but is not aimed at measuring pain in neonates. The topic of pain is complex. Pain is defined by the International Association for the study of Pain (2013) as: "An unpleasant sensory and emotional experience associated with actual or potential tissue damage, or described in terms of such damage." An annotation explains that pain is always subjective as it is a psychological state.

2.2.7 Ethical views on canine tail docking

Mutilation in any species poses an ethical dilemma, in relation to the pain and potential risk of complications at removal, as well as implications for the animal's long-term welfare, and seems justifiable only if it protects the animal from greater suffering if not performed (Morton, 1992; Bennett & Perini, 2003). Morton (1992) proposed that several questions should be asked to test the necessity to remove or modify any part of a dog, such as: Is there evidence that leaving the dog intact predisposes the dog to harmful consequences? Is there evidence that the interference is in the best interest of the dog and will be beneficial to the dog? Are there alternatives that would achieve the same? The assessment of benefit and animal suffering should therefore be carefully evaluated.

Earlier studies by Darke et al. (1985) and Diesel et al., (2010) found a low incidence of canine tail injuries in practice data, while in contrast to this a high incidence of tail injury and a protective effect of preventative tail docking in working dogs have been claimed by country sports organisations. The true incidence of tail injury for working dogs such as gundogs or terriers in pest control has therefore not been established yet. However, even if a benefit for the animal such as prevention of damage later on in life could be shown, docking to prevent damage later on as a result of humans' use of the animal could be considered questionable (Morton, 1992). The ethical debate about whether tail docking for non-therapeutic reasons should be allowed or not can be seen in the substantial number of opinions submitted to veterinary journals (e.g. Edwards, 1984; Fardell, 1984; Smith, 1984; ANON, 1992; Holt & Thrusfield, 1997; Seavers, 2000; Prescott-Prime, 2001; Clarke, 2001; Holt, 2006; Bower, 2006; De Bleser, 2006; Pearce, 2006; Nuttall, 2006; Wray, 2006; Gussett, 2009; Dee, 2009; Reynolds, 2009; Squires, 2010) and the number of organisations that have composed information about why non-therapeutic tail docking in dogs should or should not be permitted, such as the British Veterinary Association, Dogs Trust, One-Kind, RSPCA and Advocates for Animals versus The Kennel Club, various country sports organisations (such as the British Association for Shooting and Conservation), the Scottish Countryside Alliance, Scottish Gamekeepers Association) and the Council of Docked Breeds to name only some.

2.2.8 Tail docking in species other than dogs within the UK

Tail docking of cattle and horses (for other reasons than as a therapeutic action) has been banned by the Docking and Nicking of Horses Act 1949 and most recently the Animal Welfare Act 2006 and the Animal Health and Welfare (Scotland) Act 2006. The Mutilations (Permitted Procedures) (England) Regulation 2007 does not allow tail docking of cattle or horses. This legislation technically allows for tail docking of sheep and pigs. However, it is stated in Schedule 3 of these regulations that in pigs "the procedure may only be carried out where measures to improve environmental conditions or management systems have first been taken to prevent tail-biting, but there is still evidence to show that injury to pigs' tails by biting has occurred. The method used must involve quick and complete severance of the tail. An anaesthetic and additional prolonged analgesia must be administered where the animal is aged 7 days or over." Regarding sheep (Schedule 5 of these regulations) a minimum tail length is set, banding is only allowed in animals younger than 7 days and an anaesthetic must be administered if other methods of tail docking are used. Similar legislation exists in Wales (The Mutilations (Permitted Procedures) (Wales) Regulations 2007) with Schedule 3 (Pigs) and Schedule 5 (Sheep) being exactly as in England. Similar legislation exists in Scotland (The Prohibited Procedures on Protected Animals (Exemptions) (Scotland) Regulations 2010) in which Schedule 2 states: tail docking may be performed only by a quick method and only "where there is evidence that injuries to the tails of other pigs have occurred and where other measures to improve environmental conditions or management systems have been taken in order to prevent tail-biting". Therefore strictly speaking routine tail docking in piglets is not permitted. In sheep, Schedule 5 of the Scottish Regulations differs from English legislation by stating that docking in over 3 month old sheep must be carried out by a veterinary surgeon, and that surgical docking may only be carried out by a veterinary surgeon (therefore analgesia is not mandatory). The "Code of Recommendations for the Welfare of Livestock – Sheep" (Defra, 2002) states that "farmers and shepherds should consider carefully whether tail docking within a particular flock is necessary", and that it should "only be carried out if failure to dock would lead to subsequent welfare problems due to dirty tails and potential fly strike". Similar recommendations (e.g. Defra, 2003 - Pigs (England): Code of Recommendation for the Welfare of Livestock: Pigs (PB7950)) exist for pigs, explaining that tail docking in pigs should only be used as a last resort.

Signs of pain and distress during and after docking have been described in pigs (Marchant-Forde et al., 2009; Noonan et al., 1994; Sutherland et al., 2008), and changes to their nerve structure or sensitivity were identified in docked pigs (Simonsen et al., 1991). Neuromas have been identified also in docked lambs (French & Morgan, 1992) and there is some evidence for increased pain sensitivity following acute intense pain in lambs (Kent et al., 2000). Signs of pain were also clear in tail docking of lambs with differing methods (hot docking iron versus rubber ring method) (Grant, 2004; Molony et al., 1993), and that age may have little effect on pain caused by combined castration and tail docking (Molony et al., 1993). In cattle (heifers) tail docking at 3 weeks of age caused behavioural changes indicating sensitivity to heat and cold, and changes in the body surface temperature of the tail (when tested as ~2 year olds) that are comparable to changes in human amputees with phantom limb pain (Eicher et al., 2006)

Chapter 3
Study 1: Survey of tail injuries sustained by working gundogs and terriers in Scotland

3.1 Abstract

Working dog owners were invited to take part in an internet survey regarding the 2010/2011 shooting season, which was designed to estimate the prevalence of tail injuries, assess the risk of tail injuries in undocked working dogs, and identify risk factors for tail injuries. Of 2860 working dogs 13.5% sustained at least one tail injury during that shooting season. Undocked spaniels and hunt point retrievers (HPR) were at greatest risk of tail injury with 56.6% of undocked spaniels and 38.5% of undocked HPR sustaining at least one tail injury. There was no statistically significant difference in the risk of tail injury among dogs of the same breed group docked by one-third, half or shorter. In order to prevent one tail injury sustained during work between five and 15 spaniels or HPR would need to be docked as puppies, depending on the proportion of puppies that go on to become working dogs, assuming a typical litter size of five puppies.

3.2 Introduction

Until recently about one-third of breeds currently eligible for registration in the UK were either sometimes or "customarily" docked (The Kennel Club, 2013; Bennett & Perini, 2003). Tail docking of dogs for non-therapeutic reasons has however recently been banned in the United Kingdom in 2007 when the Animal Welfare Act 2006 came into force, and the Animal Health and Welfare (Scotland) Act 2006 does not allow for any exemptions to the tail docking ban. Whether or not tail docking is ethically justifiable depends very much on whether the likely pain at removal and potential risk of complications is outweighed by the dog's greater long-term welfare such as protection from greater suffering if not performed (Morton, 1992; Bennett & Perini, 2003). However, reliable data on the incidence of tail injuries in working dogs does not exist and although studies by Darke et al. (1985) and Diesel et al. (2010) found a rather low incidence of canine tail injuries in practice data, a much higher incidence of tail injury and a protective effect of preventative tail docking in working dogs have been claimed by some country sports organisations. In the existing literature prevalence estimates for tail injury in dogs vary from 0.29% (Diesel et al., 2010) using clinical practice data, to 5% in a retrospective study of gundog injuries (Houlton, 2008), up to 15% (46/319) in a non-peer reviewed privately conducted report (Bruce-Jones, 2010). Informal estimates from members of BASC, Scotland suggested that the incidence of tail injury in undocked dogs exceeds 50%, while figures contained within the Northern Ireland Assembly, Committee for Agriculture and Rural Development report on the Welfare of Animal Bill: Countryside Alliance Ireland (2010) suggest that 78% of undocked dogs sustain a tail injury in their first year of work.

This study, an online survey for owners of working dogs (gundogs and terriers used in pest control) in Scotland, was therefore designed to estimate the prevalence of minor and major tail injuries sustained by working dogs over a single season, assess the risk of tail injuries in undocked working dogs, and identify risk factors for tail injuries.

3.3 Materials and Methods

3.3.1 Survey implementation

An online questionnaire was designed using "Survey Monkey" and advertised through three major country sports organisations: the Scottish branch of the British Association for Shooting and Conservation (BASC, Scotland), the Scottish Countryside Alliance (SCA) and the Scottish Gamekeepers Association (SGA). The survey was activated to receive responses between 8/08/2011 and 3/10/2011 and included predominantly retrospective questions about any injuries that dogs sustained during the one year survey period between 01/08/2010 and 31/07/2011. Participants were required to have their permanent residence in Scotland and to own a working gundog or a terrier in pest control. It was emphasised that owners should take part in the survey regardless of whether or not their dogs had sustained injuries during the time in question. Completion of the questionnaire was only allowed once per IP address but participants were able to exit and resume the survey at a later time. If requested, participants (n=39) were sent a paper version of the questionnaire. The (internet) survey consisted of 20 questions and responses were stored automatically as participants progressed through the survey. Participants were not able to return to previously answered questions. Some questions were answerable as free text; others were presented as multiple-choice questions or as drop-down menus. To examine the potential for non-responder bias the survey was subsequently administered to a set of gamekeepers and BASC members, who had not responded to the original online survey, during the SGA's Annual General Meeting and BASC's "Gamekeeper day". The breed groups were defined according to the Kennel Club (2013) and contain breed crosses within the group. Breeds represented in this survey and breed groups are listed in Table 3.1.

Table 3.1. A list of dog breeds and breed groups in the survey

Breed category	N breeds	Breeds represented in the survey
HPR	9	Brittany, German Shorthaired Pointer, German Wirehaired Pointer, Hungarian Vizsla/Hungarian Wirehaired Vizsla, Italian Spinone, Korthall Griffon, Münsterländer, Slovakian Rough Haired Pointer, Weimaraner
Pointer or Setter	4	English Pointer, English Setter, Gordon Setter, Irish Setter (and crosses between breeds within this breed category)
Retriever	4	Labrador Retriever, Golden Retriever, Flat Coated Retriever, Chesapeake Bay Retriever
Terrier	11	Bedlington Terrier, Border Terrier, Lakeland Terrier, Cairn Terrier, Fell Terrier, Jack Russell Terrier, Lucas Terrier, Fell Terrier, Patterdale Terrier, Russian Black Terrier, Scottish Terrier
Spaniel	5	Clumber S., Cocker S./Field Cocker S., English Springer Spaniel, Field S., Welsh Springer Spaniel
Other	15	Border Collie, Beagle, Belgian Shepherd, Boxer, Poodle, Doberman, French Mastiff, German Shepherd, Greyhound, Hannovarian Schweisshund, Lurcher, New Zealand Huntaway, Rottweiler, Dachshund/Teckel, Whippet.

3.3.2 Statistical analysis

Data were automatically downloaded from "Survey Monkey" into an Excel spreadsheet. Dogs that were reported by owners to have natural bobtails (genetic brachyury/ dogs born with a short tail) (n=16) were removed from the dataset before analysis. All statistical analyses were performed using Stata 11 (S.E.) statistical software. Epi-Info 6 was used to calculate statistical power. A sample size calculation showed that a total of 100 cases of tail injury, with many more responses relating to dogs without tail injury, would yield more than 80% statistical power to identify odds ratios of at least 2 (or 0.5), with 95% confidence, given an exposure prevalence in the uninjured population of between 14% and

64%. Given a conservative prevalence estimate of tail injury of 5% the original aim was therefore to gather responses relating to 2000 dogs, of which at least 100 would have sustained a tail injury in the last year.

Simple statistical comparisons of proportions between different groups were carried out using chi-square tests. Univariable, multivariable and finally mixed-effects multivariable logistic regression models were produced for all outcome variables. A forward selection procedure was used for all model building. Variables with P-values < 0.2 as well as any considered biologically plausible were considered for inclusion in the multivariable model. Variables were ordered by AIC (Akaike information criterion) and log likelihood values prior to sequential insertion into a single level multivariable regression model. Variables were retained in the multivariable model if likelihood ratio test P values were <0.05. The Wald test P value was used when comparing categories with the reference category for categorical variables. The hierarchical nature of the data set, with dogs clustered within respondent, was accounted for by inclusion of respondent as a random effect in all final multivariable models. Models adjusted for this potential clustering are reported. The fit of final multivariable models was assessed using the Hosmer-Lemeshow goodness-of-fit test.

3.4 Results

3.4.1 Survey participants' details

Characteristics of the survey participants are listed in Table 3.2. A total of 1035 respondents participated in the survey. The true response rate is unknown as the number of dog owners within the organisations is unknown, but deducting from the 10,000 BASC Scotland members addressed, of whom as many as 4500 were estimated to be dog owners (Colin Shedden, personal communication), the response rate within BASC Scotland was estimated to be 712 of 4500 or 15.8% of dog owners from the one organisation. Of 1035 respondents 848 (81.9%) completed the whole survey. Participants were mostly members of the organisations the survey had been promoted through, but 287 (27.7%) also named "word of mouth" or "other" as their source of awareness. Most respondents described their primary activity relating to working dogs as being a "recreational shooter" (62.3%; 632/1015) or "other" (20.3%; 206/1015), which was frequently detailed as "beater and picker up" (112/1015; 11.0%), either alone or in combination with other roles. A total of 2860 dogs were owned by 1005 respondents, who stated that they owned at least one dog during the period of the survey.

A total of 354 out of 897 dog owners (39.5%) in the survey reported that one or more of their dogs had sustained an injury (to the tail and to other body parts), and 29.3% of all dog owners reported that one or more of their dogs had sustained a tail injury during the survey period. 21.6% (181/839)] of owners stated that the tail docking ban changed the way they used their dogs and 54.3% (457/842) stated that the docking ban has or would change their selection of dog breed or from where they would obtain a working dog. In total 15.5% of dog owners (130/839) answered "yes" to both of these questions, that is that the ban changed their use of dogs and it changed their selection of breed and its source. However, 39.6% of owners (333/839) answered "no" to both, that is that the ban did not change their use of dogs nor did it change their choice of breed or where they would obtain a dog from.

Table 3.2. Number and percentage of respondents to the survey within each response category for selected variables. (BASC = British Association for Shooting and Conservation; SCA = Scottish Countryside Alliance; SGA = Scottish Gamekeepers Association).

		N participants (%)
Membership	BASC	712 (68.8)
	SCA	110 (10.6)
	SGA	226 (21.8)
	Other	160 (15.5)
	None	136 (13.1)
	Total	**1344***
"Other" Memberships	Scottish Association for Country Sports	33
	British Deer Society	28
	Game and Wildlife Conservation Trust	17
	Kennel Club and various Gundog and Breed Clubs	17
	Game Conservancy	17
	National Organisation of Beaters and Pickers up	11
	National Gamekeepers Association	5
	Council of Docked Breeds	2
	Total	**130 of 1035 (12.6)**
Informed of survey by	BASC	626 of 1035 (60.5)
	SCA	49 (4.7)
	SGA	130 (12.6)
	Word of mouth	181 (17.5)
	Other (including internet forum, facebook, twitter, website)	106 (10.2)
	Total	**1092***
Primary activity relating to working dogs	Recreational Shooter	632 of 1015 (62.3)
	Gamekeeper	79 (7.8)
	Pest Controller	56 (5.5)
	Deer Stalker	42 (4.1)
	Other	206 (20.3)
	Total	**1015***
"Other" Primary activities	Recreational shooter (in combination)	16
	Game keeper (in combination)	10
	Pest controller (in combination)	14
	Deer stalker (in combination)	5
	Beater/Picker up (alone or in combination)	112
	Field trials	23
	Dog trainer	18
	Breeder	5
	Falconer	4
	Farmer	4
	Police dog handler	2
	Total	**213* of 1015 (21.0)**

Number of active working dogs owned	Dog owners	1005 (97.1)
	Active working dogs owned	2860
	Mean of dogs per owner (median)	2.85 (2)
Owners reporting any injury	Owners reporting an injury (tail or non-tail)	354 (39.5)
	Owners reporting no injury	543 (60.5)
	Total	**897 (100)**
Owners reporting tail injury	Owners reporting a tail injury	260 (29.3)
	No tail injury	627 (70.7)
	Total	**887 (100)**
Did the docking ban change use of dogs	Yes	181 (21.6)
	No	658 (78.4)
	Total	**839 (100)**
Did the docking ban change the selection of breed or location	Yes	457 (54.3)
	No	385 (45.7)
	Total	**842 (100)**

* Question for which several answers per participant were allowed (membership in several organisations, several sources of information about the online survey, several roles as primary activity with working dogs)

3.4.2 Characteristics of working dogs

The 48 dog breeds represented in the survey were grouped into 6 breed categories (Table 3.1). Each category also included any crosses between the breeds in it. Characteristics of the dogs included in the survey are listed in table 3.3. Of the 2860 active working dogs owned, the breed was specified in 2566 and the country of origin in 2368 responses. The majority of working dogs in the survey were either spaniels (51.8%) or retrievers (28.3%). HPR and terriers only made up 8.1% and 7.8%, respectively and pointers/setters and "other breeds" 1.7% and 2.3% of the total survey population. Most dogs were female (59%) and 22% of them were neutered whereas 14% of males were neutered.

About half of the dog population (1254; 52.9%) had their tails docked to some extent (20.4% docked by a third; 16.6% docked by half; 12.1% docked short and 3.8% with a tail tip dock only). A large number of dogs (1101; 46.4%) were undocked and 0.7% had natural bobtails. Among the spaniels 79.9% (n=991) had a docked tail (35.2% docked by a third; 25.7% docked by half; 12.9% docked short and 6.1% with a tail tip dock).

The majority (70.0%) of all dogs included in the survey originated from Scotland with 28.5% in England, Wales or Ireland. Among the spaniels 65.2% originated from Scotland. When comparing spaniels of different ages, that is those born before or after the introduction of the tail docking ban, the percentage of spaniels originating from Scotland decreased from 80.0 to 50.1% ($p<0.001$), while the percentage of docked working spaniels decreased from 91.6% to 68.1% ($p<0.001$) since the introduction of the docking ban. Import of HPR occurred very commonly (48.2%) with a slight increase from 44.3% to 51.4% ($P=0.33$) in dogs imported, since the introduction of the docking ban. In contrast the proportion of retrievers originating from Scotland increased slightly after the ban, but of course retrievers, being very much less likely to be docked, would have been largely unaffected by the docking ban.

Table 3.3. Characteristics of working dogs included in the survey

Variable	Category	N (%for each question)
Number of working dogs throughout the survey	Number of active working dogs	2860
	Number of dogs at the begin of questions relating to signalment	2566
	Number of dogs at the end of questions relating to signalment	2365
Breed group	Spaniel	1330 (51.8)
	Retriever	727 (28.3)
	HPR	207 (8.1)
	Terrier	200 (7.8)
	Pointer/Setters	43 (1.7)
	Other	59 (2.3)
	Total	**2566 (100)**
Age (years)	< 1	172 (7.3)
	1	232 (9.8)
	2	245 (10.4)
	3	250 (10.6)
	4	264 (11.2)
	5	226 (9.6)
	6	214 (9.1)
	7	172 (7.3)
	8	161 (6.8)
	9	117 (5.0)
	10	115 (4.9)
	11	60 (2.5)
	12	78 (3.30)
	13	28 (1.2)
	14	20 (0.9)
	15	11 (0.5)
	Total	**2365 (100)**
	Median dogs' age in years (mean; range)	5 (6; 0.5-15)
Gender	Female entire	1087 (45.9)
	Female neutered	308 (13.0)
	Male entire	837 (35.3)
	Male neutered	137 (5.8)
	Total	**2369 (100)**
Housed	Both inside and outside	497 (21.0)
	Indoors	751 (31. 7)
	Outdoors	1123 (47.4)
	Total	**2371 (100)**
Country in which bred	England	578 (24.4)
	Scotland	1657 (70.0)
	Ireland + Northern Ireland	49 (2.1)
	Wales	48 (2.0)
	Other	36 (1.5)
	Total	**2368 (100)**

Tail length	Docked short	287 (12.1)		
	Docked by half	394 (16.6)		
	Docked by one-third	484 (20.4)		
	Docked tail tip only	89 (3.8)		
	Natural bobtail	16 (0.7)		
	Undocked	1101 (46.4)		
	Docked to some extent	1254 (52.9)		
	Total	**2371 (100)**		
Tail length of spaniels		All*	≤ 4y	≥ 5y
	Docked short	160 (12.9)	47 (7.7)	111 (17.9)
	Docked by half	319 (25.7)	115 (18.8)	203 (32.6)
	Docked by one-third	436 (35.2)	207 (33.8)	228 (36.7)
	Docked tail tip only	76 (6.1)	48 (7.8)	28 (4.5)
	Natural bobtail	2 (0.2)	1 (0.2)	1 (0.2)
	Undocked	247 (19.9)	194 (31.7)	51 (8.2)
	Total of docked tails	991 (79.9)	417 (68.1)	570 (91.6)
Country in which bred (Spaniels)		All*	≤ 4y	≥ 5y
	England	351 (28.4)	246 (40.3)	104 (16.8)
	Scotland	806 (65.2)	306 (50.0)	495 (80.0)
	Ireland + North. Ireland	31 (2.5)	26 (4.3)	5 (0.8)
	Wales	33 (2.7)	20 (3.3)	13 (2.1)
	Other	15 (1.2)	13 (2.1)	2 (0.3)
	Total of Non-Scottish origin	430 (34.8)	305 (50.0)	124 (20.0)
	Total	1236 (100)	611 (100)	619 (100)
Country in which bred (HPR)		All*	≤4y**	≥ 5y***
	Total of Scottish origin	101 (51.8)	52 (48.6)	49 (55.7)
	Total of non-Scottish origin	94 (48.2)	55 (51.4)	39 (44.3)
	Total	195 (100)	107 (100)	88 (100)
Country in which bred (Retrievers)		All*	≤ 4y	≥ 5y
	Total of Scottish origin	579 (86.9)	273 (88.4)	303 (85.6)
	Total of non-Scottish origin	87 (13.1)	36 (11.7)	51 (14.4)
	Total	666 (100)	309 (100)	354 (100)
Number (%) of dogs bred in Scotland		All*	≤ 4y	≥ 5y
	Spaniels	806 (65.2)	306 (50.1)	495 (80.0)
	HPR	101 (51.8)	52 (48.6)	49 (55.7)
	Retrievers	579 (86.9)	273 (88.4)	303 (85.6)

*All dogs for which the variable is known, e.g. tail length or country (but not always the age).
**All dogs of ≤ 4y for which the variable is known
***All dogs of ≥5 y for which the variable is known

3.4.3 Injuries sustained over the shooting season

Details of injuries reported are listed in Table 3.4. A total of 880 owners of 2356 dogs completed this section of the survey. Of these dogs 490 (20.8%) were reported as having been injured, with a total of 979 tail and non-tail related injuries. Of those injured 47.1% (n=231) had sustained one or more injuries that did not involve the tail and 64.7% (n=317) had sustained one or more tail injuries. A total of 11.8% (n=58) had sustained tail as well as non-tail related injuries. Overall 20.8% of the total survey population were therefore reported as having had some sort of injury, with 13.5% having sustained a tail injury and 9.8% a non-tail related injury, including 2.5% who had sustained both types of injury.

Among all 1238 spaniels in the survey, 24.4% (n=302) had sustained an injury, of which 72.8% (n=220) had sustained tail related injuries, 39.4% (n=119) exclusively injuries to other body parts than the tail (non-tail related injuries) and 12.3% (n=37) both types of injury.

3.4.4 Injuries to body parts other than the tail (non-tail related injuries)

Data concerning non-tail injuries showed clearly that injuries to body parts other than the tail were common among all breed groups with 311 injuries in 231 of all 2356 dogs in the survey (9.8%). These injuries were mainly injuries to feet and legs (44.4%), abdomen (18.6%), head (16.4%) and chest (15.8%). Veterinary treatment for non-tail related injury was received by 64.1% of injured dogs (6.3% of all dogs). Non-tail related injuries were most commonly seen in the breed category “other” (9/50; 18%) and pointers/setters (6/42; 14.3%), followed by retrievers (67/656; 10.2%), HPR (19/192; 9.9%), spaniels (119/1238; 9.6%) and terriers (11/178; 6.2%). Figure 3.1 and 3.2 show the number of non-tail injuries reported per dog and prevalence estimates for non-tail injuries in the different breed groups.

Table 3.4. Details regarding all injuries sustained by dogs during the survey period.

Variable	Category	N (%)
Any injuries	Dogs injured	490 (20.8)
	Dogs with both tail and non-tail injuries	58 (2.5% of all dogs or 11.8% injured)
	Dogs with tail injury	317 (13.5% all dogs or 64.7% injured)
	Dogs with non-tail injury	231 (9.8% all dogs or 47.1% injured)
	Dogs with tail injury only	259 (11.0)
	Dogs with non-tail injury only	173 (7.3)
	Injuries	979 (2 per injured dog)
	Total number of dogs	**2356**
Non-tail related injuries	Dogs injured (≥1 injury)	231 (100 of injured)
	Dogs injured (≥2 injuries)	57 (24.7 of injured)
	Dogs injured (≥4 injuries)	4 (1.7 of injured)
	Total number of injuries	311 (1.35 per injured dog)
	Dogs receiving veterinary treatment	148 (6.3% of all dogs; 64.1% of injured dogs)
	Injuries receiving veterinary treatment	188 (60.5% of cases)
	Total number of dogs	**2356**
Non-tail related injuries (Dogs injured per breed group)	HPR	19 of 192 (9.9)
	Pointer or Setter	6 of 42 (14.3)
	Retriever	67 of 656 (10.2)
	Terrier	11 of 178 (6.2)
	Spaniel	119 of 1238 (9.6)
	Other	9 of 50 (18.0)
	Total	**231 of 2356 (9.8)**
Non-tail related injury cases (Location on body)	Abdomen	58 (18.6)
	Back	15 (4.8)
	Chest	49 (15.8)
	Feet/Leg	138 (44.4)
	Head	51 (16.4)
	Total number of injuries	**311 (100)**

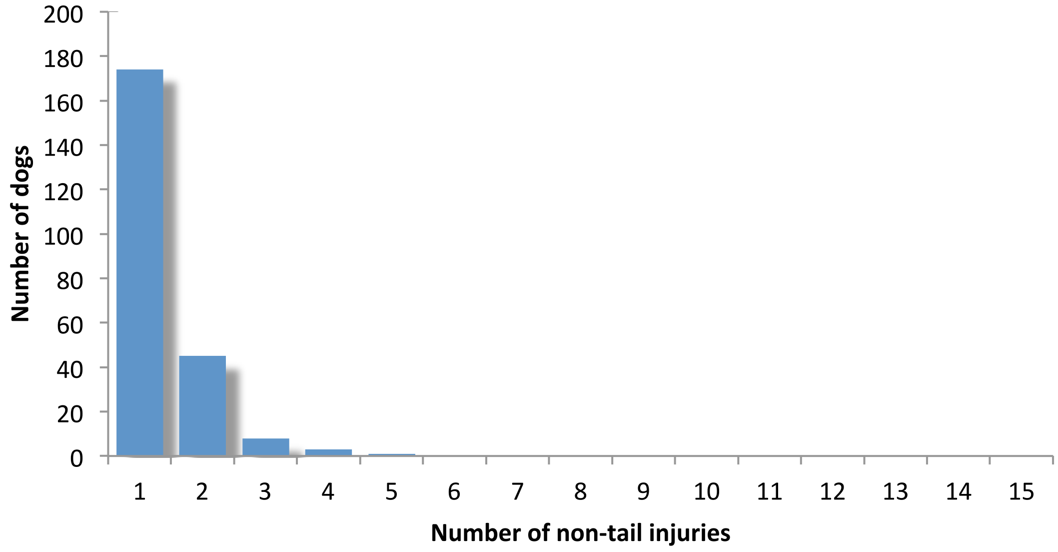

Figure 3.1. Histogram of the number of non-tail related injuries reported per dog

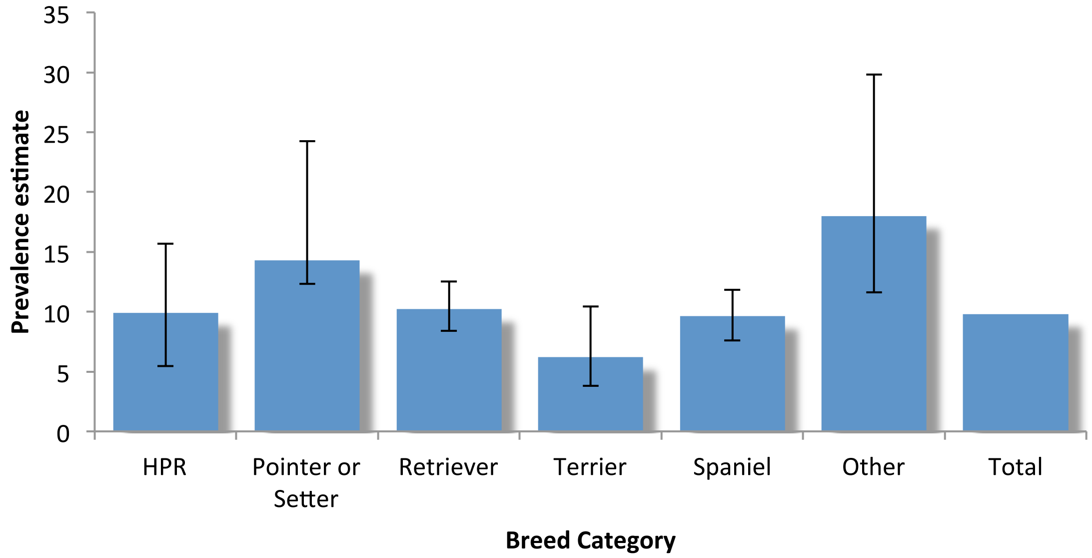

Figure 3.2. Prevalence estimate of non-tail injuries in each of the breed groups, showing 95% confidence intervals.

3.4.5 Tail injuries

Data regarding tail injuries are listed in in Table 3.5. Of the 2356 dogs whose owners completed this part of the questionnaire, 317 dogs (13.5%) had sustained at least one tail injury during the one shooting season concerned. The number of tail injuries per affected dog is shown in Figure 3.3. Almost 42% (132/317) of these dogs had sustained two or more tail injuries and 13.2% (42/317) four or more tail injuries during the 2010/2011 shooting season.

Spaniels (17.8%; 221/1238; p <0.001) and HPR (15.6%; 30/192; p <0.001) were significantly more likely to have sustained at least one tail injury compared to pointer/setters, retrievers or terriers, combined (7.0%; 61/876) (Figure 3.4). The prevalence estimates for spaniels compared to HPR, and for retrievers compared to pointers/setters or terriers were not significantly different.

Dogs with undocked tails (20.3%; 221/1091; p<0.001) or with a tail tip dock (19.5%; 17/87; p<0.001) were significantly more likely to have sustained a tail injury than dogs docked by one-third, half or short, combined (6.6%; 75/1142) (Figure 3.5). Among spaniels 55.6% (135/243) of undocked dogs and 21.6% (16/74) of dogs with a tail tip dock had experienced at least one tail injury during the survey period. Both undocked spaniels (p <0.001) and those with a tail tip dock (p<0.001) were significantly more likely to have sustained at least one tail injury than spaniels docked by one-third, half or short, combined (7.5%; 66/880) (Figure 3.6). Undocked spaniels were also more likely to have sustained at least one tail injury than spaniels with a tail tip dock (p-value <0.001).

Only four HPR were reported to have a tail tip dock making comparison with this group difficult (Figure 3.7). Undocked HPR (38.5%; 25/65; p-value < 0.001) were significantly more likely to have sustained at least one tail injury than HPR that were docked by one-third, half or short combined (3.4%; 4/118).

Veterinary treatment for a tail injury was received by 32.5% of dogs with a tail injury or 4.9% of all dogs in the survey (Figure 3.8). Veterinary treatment for a tail injury was significantly more common in HPR than in spaniels (p<0.001) and in pointer/setters, retrievers or terriers, combined (p<0.001); and in spaniels than in pointer/setters, retrievers or terriers, combined (p<0.001).

Table 3.5. Characteristics of tail injuries sustained by working dogs during the survey period

Variable	Category	N (%)
Tail injury	Dogs injured (≥1 injury)	317 (100)
	Dogs injured (≥2 injuries)	132 (41.6)
	Dogs injured (≥4 injuries)	42 (13.2)
	Total number of injuries listed	671 (2.1 per injured dog)
	Total number of dogs	**2356**
Dogs with at least one tail injury per breed group	HPR	30 of 192 (15.6)
	Pointer or Setter	1 of 42 (2.4)
	Retriever	51 of 656 (7.7)
	Terrier	9 of 178 (5.1)
	Spaniel	220 of 1238 (17.8)
	Other	6 of 50 (12.0)
	Total	**317 of 2356 (13.5)**
Tail injury per tail length	Natural bobtail	2 of 16 (12.5)
	Undocked (naturally long)	221 of 1091 (20.3)
	Docked tail tip only	17 of 87 (19.5)
	Docked by 1/3	42 of 479 (8.8)
	Docked to intermediate length (~1/2)	25 of 392 (6.4)
	Docked short	8 of 271 (3.0)
	Total	**315 of 2336 (13.5)**
Tail injury per tail length (Spaniels)	Natural bobtail	1 of 2 (50.0)
	Undocked (naturally long)	135 of 243 (55.6)
	Docked tail tip only	16 of 74 (21.6)
	Docked by 1/3	39 of 430 (9.1)
	Docked to intermediate length (~1/2)	22 of 293 (7.0)
	Docked short	5 of 157 (3.2)
	Total	**218 of 1221 (17.9)**
Tail injury per tail length (HPR)	Natural bobtail	0 of 5 (0.0)
	Undocked (naturally long)	25 of 65 (38.5)
	Docked tail tip only	1 of 4 (25.0)
	Docked by 1/3	1 of 27 (3.7)
	Docked to intermediate length (~1/2)	1 of 37 (2.7)
	Docked short	2 of 54 (3.7)
	Total	**30 of 192 (15.6)**
Tail injury per tail length (Retrievers)	Natural bobtail	0 of 4 (0.0)
	Undocked (naturally long)	49 of 638 (7.7)
	Docked tail tip only	0 of 3 (0.0)
	Docked by 1/3	0 of 4 (0.0)
	Docked to intermediate length (~1/2)	1 of 2 (50.0)
	Docked short	0 of 3 (0.0)
	Total	**50 of 654 (7.7)**
Dogs receiving veterinary treatment for tail injury	HPR	16 of 192 (8.3)
	Pointer or Setter	0 of 42 (0.0)
	Retriever	14 of 656 (2.1)
	Terrier	3 of 178 (1.7)

(for all dogs per breed category)	Spaniel	80 of 1238 (6.5)
	Other	2 of 50 (4.0)
	Total	**115 of 2356 (4.9)**
Proportion of dogs with tail injury receiving veterinary treatment (per breed category)	HPR	16 of 30 (53.3)
	Pointer or Setter	0 of 1 (0)
	Retriever	14 of 51 (27.5)
	Terrier	3 of 9 (33.3)
	Spaniel	80 of 220 (36.4)
	Other	2 of 6 (33.3)
	Total	**103 of 317 (32.5)**

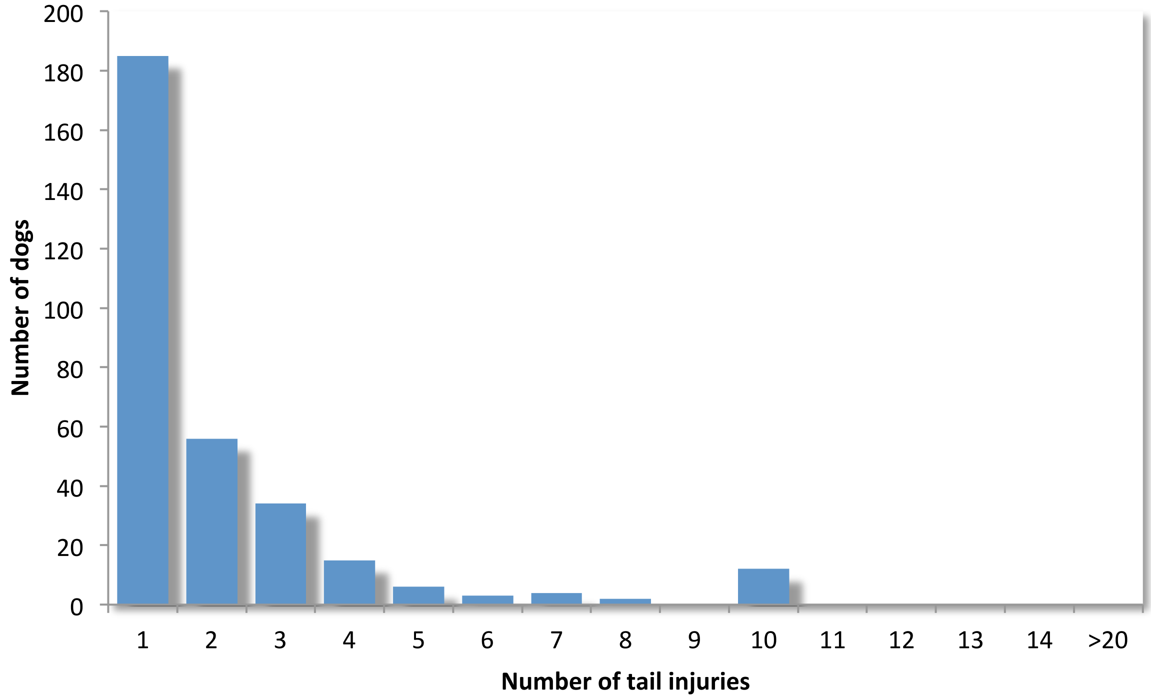

Figure 3.3. Histogram of the number of occurrences of tail injuries per affected dog

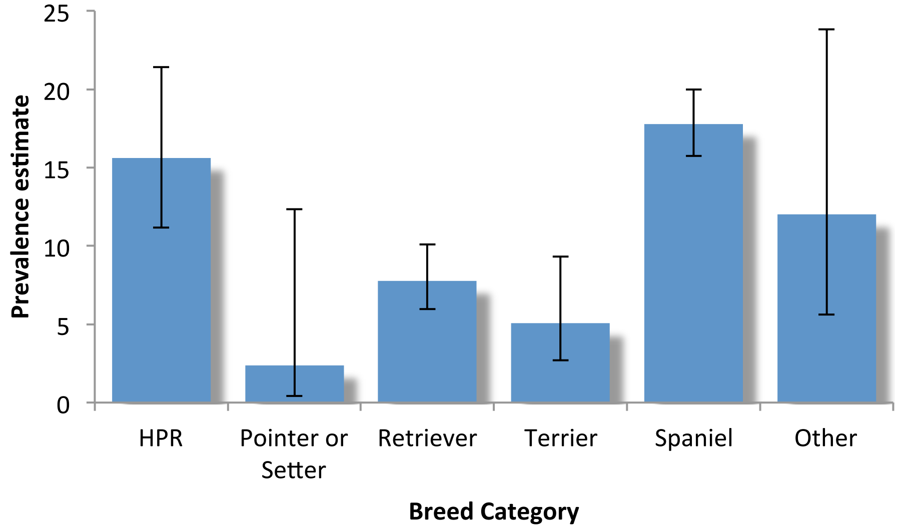

Figure 3.4. Prevalence estimate (%) for tail injury for each breed category of working dogs (showing 95% confidence intervals)

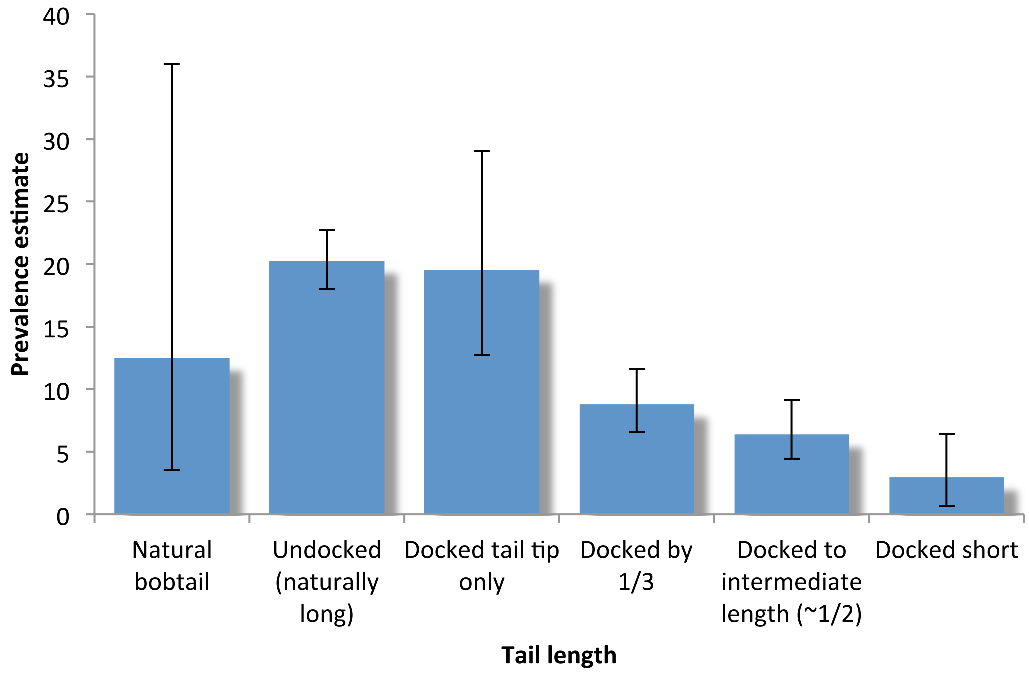

Figure 3.5. Prevalence estimate (%) for tail injury per tail length among all dogs surveyed (showing 95% confidence intervals)

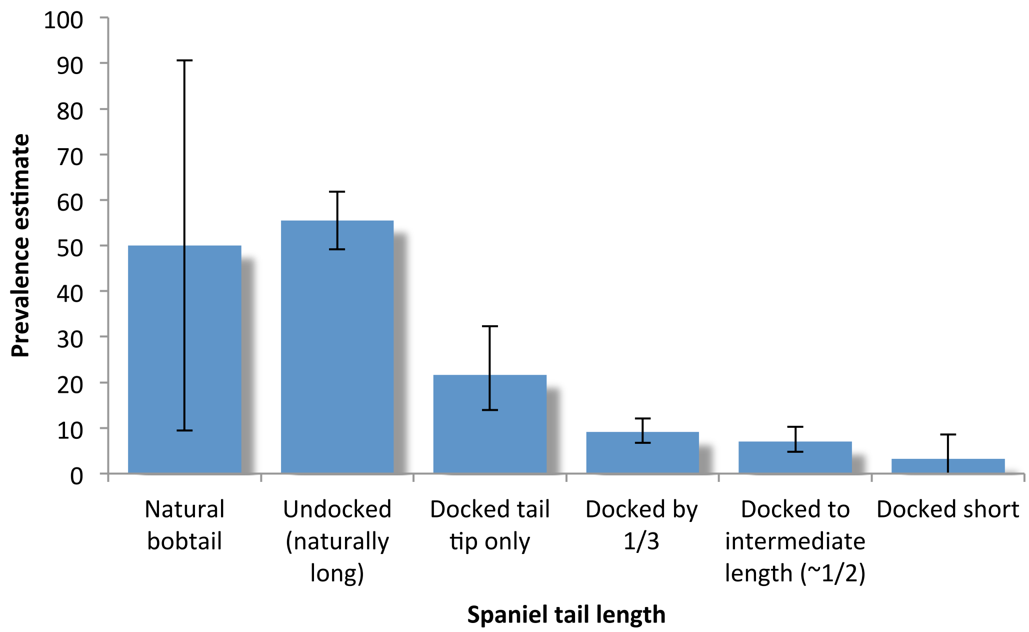

Figure 3.6. Prevalence estimate (%) for tail injury occurrence by tail length category among spaniels (showing 95% confidence intervals)

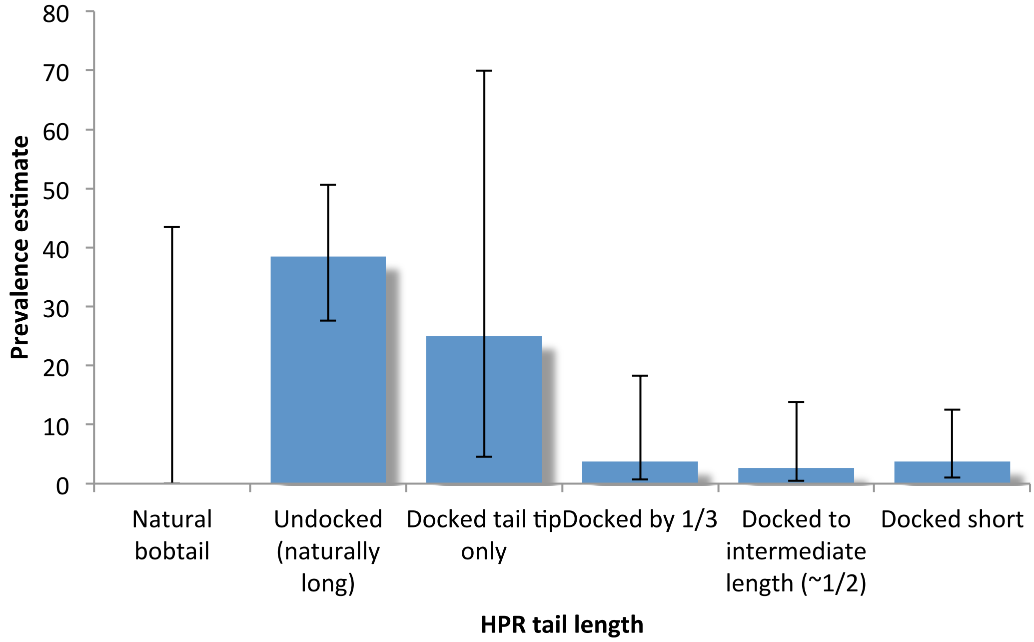

Figure 3.7. Prevalence estimate (%) for tail injury in HPR by tail length category (showing 95% confidence intervals)

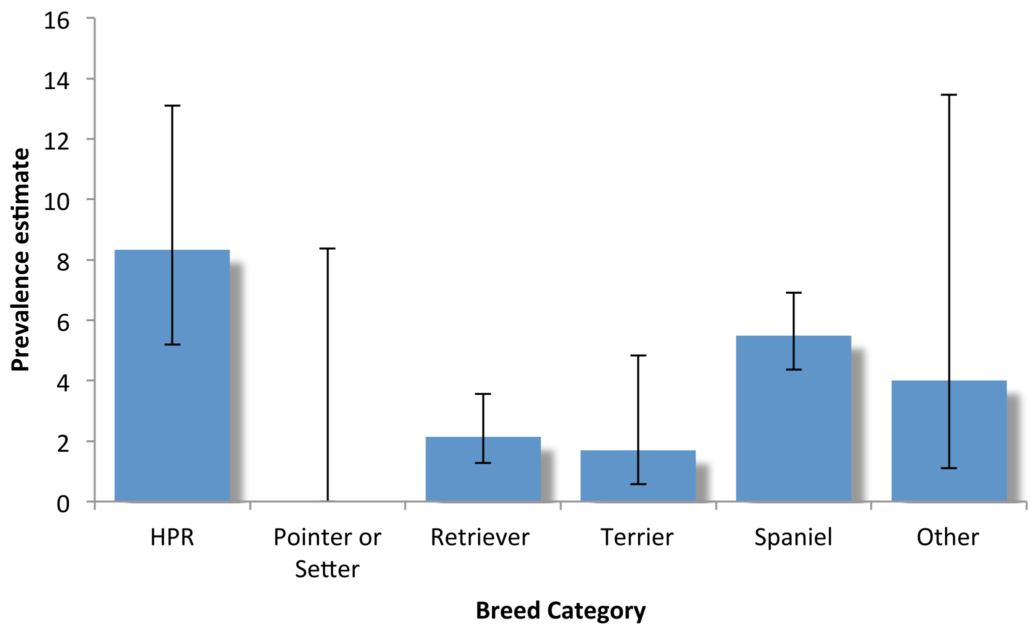

Figure 3.8. Prevalence estimate (%) for dogs receiving veterinary treatment for tail injuries by breed group (showing 95% confidence intervals)

3.4.6 Details of a "worst tail injury" in dogs during the survey period

The owners of 299 dogs that had sustained one or more tail injuries over the survey period gave a detailed description of their dogs' one "worst tail injury" sustained during the survey period and the circumstances during which it had occurred (table 3.6). These tail injuries were mainly tail tip damage (in 72.9% of cases) and lacerations other than on the tail tip (in 19.7% of cases). Fractures, dislocations and other tail injuries (such as "limber tail", an acute caudal myopathy) amounted to 7.4% of all cases.

In order to approximate the duration of wound-healing and recovery, owners were asked how long it took to exercise their dog again "normally" after the injury, and while some dogs were able to do this either on the same day or after one day (in 33% of cases), a similar proportion needed up to one week (41%) or up to one month (25%) to do so. However, only one percent of dogs were unable to continue their role as a working dog after the tail injury.

The vast majority (84.6%) of worst tail injuries had occurred during work or training (including field trials) rather than at home in the house or in a kennel, or during a recreational walk or during transport. These work-related injuries occurred predominantly during "rough shoots" (in 49.2% of cases) or "driven shoots" (in 40.5% of cases) rather than during wildfowling, pest control, deer stalking, falconry or other activities. The environment in which these tail injuries were commonly inflicted was usually identified as woodland (36.8%) or cover (44.3%). The circumstances in which worst tail injuries occurred varied among breed groups to some extent: In spaniels 82.3% (181 of 220) of cases occurred during work or training, 3.2% (n=7) in a kennel and 7.7% (n=17) during a recreational walk and only 1.4% (n= 3) in the house. In HPR 76.7% (n=23 of 30) occurred during work or training, 6.7% (n=2) in a kennel, 10% (n=3) in the house and one each (3.3%) during transport or a recreational walk. In retrievers 68.6% (n=35 of 51) occurred during work or training, 15.7% (n=8) in a kennel and only one each during a recreational walk, in the house, or during transport.

Across all breeds, brambles and gorse were reported as the cause of the majority of "worst tail injuries" (37.7% and 17.4% respectively) with other important but less common causes being "tail caught in branches" (12.7%) and "other causes" (10.9%). Causes varied slightly for different breed categories: Primary causes for a "worst tail injury" in spaniels were brambles (43.9%) and gorse (21.2%), in HPR fences (20.7%), branches (20.7%), hitting a wall and "other causes" (each in 17.2%), and in retrievers brambles (25.0%), hitting a wall (18.2%), branches and "other causes" (both in 15.9%).

Veterinary treatment for a worst tail injury was received by 34.4% of all dogs affected, 32.9% of affected spaniels and 53.3% of affected HPR (table 6). In total 103 of 2356 dogs (4.4%; 95% confidence interval (CI) 3.7%-5.4%) were reported as having received veterinary treatment for a worst tail injury. Of 192 HPR, 16 (8.3%; CI 5.2%-13.0%) and of 1238 spaniels, 68 (5.5%; CI 4.4%-7.0%) received veterinary treatment for their worst tail injury. Veterinary treatment for a worst tail injury was received by 6.9% of all undocked dogs in the study and 9.2% of tail tip docked dogs, both of which were significantly more common than in dogs docked by one-third, half, or short combined (both p-values <0.001). There was no significant difference between the probability of worst tail injuries receiving veterinary treatment in those dogs docked by one-third and those docked shorter than by one-third.

Among spaniels 5.6% of all spaniels in the survey and 18.5% of undocked spaniels as well as 10.4% of spaniels with a tail tip dock received veterinary treatment for a worst tail injury. Veterinary treatment occurred therefore marginally more often in undocked spaniels than in those docked at the tail tip, but significantly more often in undocked spaniels compared to spaniels docked by one-third or spaniels docked by one-third, half or short combined ($p<0.001$). Veterinary treatment due to a worst tail injury also occurred more often in spaniels with a tail tip dock compared to those docked by one-third, half or short combined ($p<0.001$). Hence, as was shown in dogs overall, docking spaniels shorter than one-third does not appear to be associated with a reduction in the prevalence of worst tail injuries receiving veterinary care. Despite their relatively low numbers a similar picture emerged in affected HPR in that undocked HPR received veterinary treatment due to a worst tail injury significantly more often than those docked by one-third, half, or short combined ($p<0.001$).

3.4.7 Validation of survey results by comparison with a group of initial non-responders

A comparison of initial responders and non-responders is summarised in table 3.7. Both sets of data were remarkably similar overall, especially regarding injury data. The prevalence of tail injury in docked or undocked dogs of different breeds was not statistically significantly different between initial responders and non-responders (all $p > 0.2$). However, non-responders owned fewer spaniels but more terriers and pointer/setters and their dogs were more often housed outside (despite a similar number of dogs per owner in each group). More owners in the non-responder group reported that the ban changed their use of dogs yet not breed selection or where they would get the dog from, and members of this group were also more likely to own a dog that was bred in Scotland.

Of the non-responders 44.2% (34 of 77) had been aware of the survey earlier and named a variety of reasons for not having taken part earlier: having been too busy (12 of 34; 35.3%), believing that the survey was only for spaniel owners (5 of 34; 14.71%), having had no computer (5 of 34; 14.7%), believing that it would not change the ban anyway (4 of 34; 11.8%) and not having had any problems with tail injury in their dogs (5 of 34; 14.7%).

Table 3.6. Details regarding the worst tail injuries listed by working dog owners

Variable	Category	N (%)
Type of (worst) tail injury	Tail tip damage	218 (72.9)
	Lacerations other than on tip	59 (19.7)
	"Broken tail"	9 (3.0)
	Dislocated tail	5 (1.7)
	Other	8 (2.7)
	Total	**299 (100)**
Time until dog was able to exercise normally	Same day	54 (18.1)
	1 day	44 (14.7)
	Up to 1 week	121 (40.5)
	Up to 1 month	76 (25.4)
	Permanently unable to work	4 (1.3)
	Total	**299 (100)**
When injured (all breeds)	At home (In House)	7 (2.3)
	At home (In Kennel)	17 (5.7)
	During transport	3 (1.0)
	Recreational walk	19 (6.4)
	In work or training (including field trials)	253 (84.6)
	Total	**299 (100)**
Type of work when injured (all breeds)	Driven game shoot	102 (40.5)
	Rough shoot	124 (49.2)
	Wildfowling	1 (0.4)
	Pest control	8 (3.2)
	Deerstalking	4 (1.6)
	Falconry	1 (0.4)
	Other	12 (4.8)
	Total	**252**
Type of terrain when injured	Moorland	20 (7.9)
	Farmland	26 (10.3)
	Woodland	93 (36.8)
	Cover	112 (44.3)
	Farmyard	1 (0.4)
	Other	2 (0.8)
	Total	**254 (100)**
Veterinary treatment for a worst tail injury in dogs overall (per breed category)	HPR	16 of 192 (8.3)
	Pointer or Setter	0 of 42 (0.0)
	Retriever	14 of 656 (2.1)
	Terrier	3 of 178 (1.7)
	Spaniel	68 of 1238 (5.5)
	Other	2 of 50 (4.0)
	Total	**103 of 2356 (4.4)**
Proportion of dogs with a worst tail injury receiving veterinary treatment	HPR	16 of 30 (53.3)
	Pointer or Setter	0 of 1 (0)
	Retriever	14 of 47 (29.8)
	Terrier	3 of 8 (37.5)
	Spaniel	68 of 207 (32.9)
	Other	2 of 6 (33.3)
	Total	**103 of 299 (34.4)**

Veterinary treatment received for a worst tail injury (per tail length)	Natural bobtail	1 of 16 (6.3)
	Undocked (naturally long)	75 of 1091 (6.9)
	Docked tail tip only	8 of 87 (9.2)
	Docked by 1/3	6 of 479 (1.3)
	Docked to intermediate length (~1/2)	10 of 392 (2.6)
	Docked short	3 of 271 (1.1)
	Total	**103 of 2336 (4.4)**
For Spaniels: Veterinary treatment received for a worst tail injury (per tail length)	Natural bobtail	1 of 2 (50.0)
	Undocked (naturally long)	45 of 243 (18.5)
	Docked tail tip only	7 of 67 (10.4)
	Docked by 1/3	6 of 424 (1.4)
	Docked to intermediate length (~1/2)	7 of 315 (2.2)
	Docked short	2 of 157 (1.3)
	Total	**68 of 1221 (5.6)**
For HPR: Veterinary treatment received for a worst tail injury (per tail length)	Natural bobtail	0 of 5 (0.0)
	Undocked (naturally long)	13 of 65 (20.0)
	Docked tail tip only	1 of 4 (25.0)
	Docked by 1/3	0 of 27 (0.0)
	Docked to intermediate length (~1/2)	1 of 37 (2.7)
	Docked short	1 of 54 (1.9)
	Total	**16 of 192 (8.3)**
For Retrievers: Veterinary treatment received for a worst tail injury (per tail length)	Natural bobtail	0 of 4 (0.0)
	Undocked (naturally long)	13 of 638 (2.0)
	Docked tail tip only	0 of 3 (0.0)
	Docked by 1/3	0 of 4 (0.0)
	Docked to intermediate length (~1/2)	1 of 2 (50.0)
	Docked short	0 of 3 (0.0)
	Total	**14 of 654 (2.1)**

Cause of injury if known	All dogs (%)	Spaniels (%)	HPR (%)	Retriever (%)
Fences	20 (7.3)	8 (4.2)	6 (20.7)	4 (9.1)
Brambles	104 (37.7)	83 (43.9)	4 (13.8)	11 (25.0)
Gorse	48 (17.4)	40 (21.2)	3 (10.3)	3 (6.8)
Fern	13 (4.7)	10 (5.3)	0	1 (2.3)
Rhododendron	7 (2.5)	6 (3.2)	0	1 (2.3)
Piece of metal on ground	1 (0.4)	0	0	0
Ice	2 (0.7)	1 (0.5)	0	1 (2.3)
Bite	1 (0.4)	1 (0.5)	0	0
Caught in door	2 (0.7)	0	0	1 (2.3)
Caught on branches	35 (12.7)	21 (11.1)	6 (20.7)	7 (15.9)
Hit against wall	20 (7.3)	7 (3.7)	5 (17.2)	8 (18.2)
Other	30 (10.9)	18 (6.5)	5 (17.2)	7 (15.9)
Total n dogs	276*	189*	29*	44*

*several answers allowed, hence more causes than injuries e.g. 283 causes, 276 injuries

Table 3.7. A comparison of data from the original online survey (responders) with data from a group of British Association for Shooting and Conservation (BASC) and Scottish Gamekeepers Association (SGA) members (non-responders) who had not responded to the original survey. (Showing Chi-squared p-value unless specified otherwise)

Category	**Non-responders** (n=77 owning 222 dogs)	**Responders** (n=1005 owning 2860 dogs)	**P-value**
Median dogs per owner (mean; range)	2 (2.87; 1-9)	2 (2.8; 1-21)	0.20[¥]
Median dogs age (mean; range)	5 years (6; 0.5-14)	5 years (6; 0.5-15)	0.97[¥]
Gamekeeper			
Yes	46 (60)	79 (8)	
No	29 (38)	925 (92)	<0.001
Dogs housed			
Inside (%)	41 (21.6)	751 (40.1)	
Outside (%)	149 (78.4)	1123 (59.9)	<0.001
Did the ban on tail docking change your use of dogs?			
Yes (%)	25 (33.3)	181 (21.5)	
No (%)	50 (66.7)	659 (78.5)	0.01
Did the ban change your selection of breed or source of new dog?			
Yes (%)	40 (53.3)	457 (54.2)	
No (%)	35 (46.7)	386 (45.8)	0.88
Number of different breed groups owned:			(Each breed group compared to all others)
Spaniels (%)	90 (40.5)	1330 (51.8)	0.001
HPR (%)	13 (5.9)	207 (8.1)	0.24
Retrievers (%)	74 (33.3)	727 (28.3)	0.11
Terriers (%)	27 (12.2)	200 (7.8)	0.02
Pointer/Setters (%)	10 (4.5)	43 (1.7)	0.008*
Gender of dogs			
Male	103 (46.7)	974 (41.1)	
Female	118 (53.3)	1395 (58.9)	0.11
Dog acquired from Scotland			
Yes	163 (78.0)	1659 (70.1)	
No	46 (22.0)	709 (29.9)	0.02
Owner reporting at least one tail injury			
Yes	22 (30.0)	260 (29.3)	
No	53 (70.0)	628 (71.7)	0.99
Number of dogs with at least one tail injury	25 of 220 (11.4)	317 of 2356 (13.5%)	0.38
Number of spaniels with at least one tail injury	17 (18.9)	220 (17.8)	0.79

Number of undocked spaniels with at least one tail injury	13 (54.2)	135 (55.6)	0.90
Number of HPR with at least one tail injury	1 (7.7)	30 (15.6)	0.44
Number of retrievers with at least one tail injury	5 (6.9)	51 (7.8)	0.80
Number of terriers with at least one tail injury	0 (0)	9 (5.1)	0.23
Number of pointer/setters with at least one tail injury	9 (0)	1 (2.4)	NA
Owner reporting at least one non-tail injury Yes	12 (16.0)	161 (18.3)	0.61
Number of dogs with at least one non-tail related injury	15 (6.8)	231 (9.8)	0.15
Number of spaniels with at least one non-tail related injury	4 (4.5)	119 (9.6)	0.10
Number of HPR with at least one non-tail related injury	0 (0)	19 (9.9)	NA/0.23

¥Mann-Whitney test; *Fisher exact test

3.4.8 Multivariable modelling

Mixed effects multivariable models were built for the following outcomes and groups of dogs:

1. Any tail injury in all dogs
2. Any tail injury in spaniels only
3. Any tail injury in HPR only
4. Tail injury requiring veterinary treatment in all dogs

The final mixed effects multivariable logistic regression models for each of these outcomes are shown in Tables 3.8-3.9.

Tail length was statistically significant in all models, with undocked tails being consistently more likely to be injured than tails that had been docked. However, the form of this variable that produced the best fitting model varied between models. When modelling any tail injury as the outcome in either all dogs or just spaniels a tail-tip dock was associated with a five to six fold reduction in the likelihood of tail injury (odds ratios = 0.18 and 0.14), compared to undocked dogs. Docking by one-third, half or short were all associated with an approximately 20 to 25-fold reduction in the likelihood of tail injury (odds ratios between 0.03 and 0.05), compared to undocked dogs. There was no statistically significant difference in the likelihood of tail injury between dogs docked by one-third, half or short. In HPR there was no statistically significant difference in the likelihood of tail injury for dogs with undocked tails and those with a tail-tip dock. However, docking by one-third, half or short were all associated with an approximately 15 to 25-fold reduction in the likelihood of tail injury (odds ratios between 0.04 and 0.07), compared to undocked dogs or dogs with a tail tip dock. In the model including all dogs, breed was also significantly associated with the likelihood of tail injury, with HPR and spaniels being 11 and 22 times more likely to have been reported to have sustained an injury, respectively compared to retrievers, pointers/setters, terriers or other breeds, combined. No other variables were retained in the models for individual breed types. There was a statistically significant degree of clustering at the level of the respondent. In addition, inclusion of respondent as a random effect had a significant impact on the magnitude of some of the odds ratios included in final multivariable models. For example in the single level, multivariable model of tail injuries in all dogs the odds ratio associated with spaniels was 11.8, but when accounting for clustering within respondent this odds ratio almost doubled to 22.1 (Table 3.8). However, the inclusion of respondent as a random effect had no influence on the variables actually included within any of the models.

When modelling a tail injury that was reported to require veterinary treatment as the outcome in either all dogs of just spaniels there was no statistically significant difference in the likelihood of tail injury for dogs with undocked tails and those with a tail-tip dock. Docking by one-third, half or short were associated with a reduction in the likelihood of tail injury that ranged from six to 25-fold (odds ratios between 0.16 and 0.06). There was no statistically significant difference in the likelihood of tail injury between dogs docked by one-third, half or short.

In addition, breed was also significantly associated with the likelihood of a tail injury reported to require veterinary treatment, with HPR and spaniels being 12 and eight times more likely to have been reported to have sustained an injury, respectively compared to retrievers, pointers/setters, terriers or other breeds. In the model that used all dogs, those that were five years of age or more were approximately half as likely to have been reported to have had a tail injury that required veterinary treatment than dogs that were less than five-years old at the time of the survey.

Table 3.8. Mixed effects multivariable logistic regression models describing the association between a. tail length and breed and the likelihood of tail injury; b. tail length and the likelihood of tail injury in spaniels; and c tail length and the likelihood of tail injury in HPR.

Outcome variable	Explanatory variable	Odds ratio	P-value	95% Confidence Interval
Tail injury in all working dogs	Tail length			
	Undocked (Reference)	1		
	Tail tip dock	0.18	<0.001	0.08 – 0.4
	Docked by one-third	0.05	<0.001	0.03 – 0.09
	Docked to half	0.04	<0.001	0.02 – 0.07
	Docked short	0.05	<0.001	0.03 – 0.1
	Breed			
	Retriever, Pointer/Setters, Terrier or Other (Reference)	1		
	HPR	10.9	<0.001	5.3 – 22.3
	Spaniel	22.1	<0.001	13.1 – 37.2
	Degree of clustering within respondent (*Rho) = 0.36*		<0.001	
Tail injury in spaniels	Tail length			
	Undocked (Reference)	1		
	Tail tip dock	0.14	<0.001	0.06 – 0.3
	Docked by one-third	0.04	<0.001	0.02 – 0.08
	Docked to half	0.03	<0.001	0.01 – 0.06
	Docked short	0.04	<0.001	0.02 – 0.1
	Degree of clustering within respondent (*Rho) = 0.37*		<0.001	
Tail injury in HPR	Tail length			
	Undocked or tail tip dock	1		
	(Reference)	0.04	0.014	0.003 – 0.5
	Docked by one-third	0.07	0.008	0.01 – 0.5
	Docked to half	0.04	0.001	0.006 – 0.26
	Docked short			
	Degree of clustering within respondent (*Rho) = 0.39*		0.03	

Table 3.9. Mixed effects multivariable logistic regression model describing the association between tail length, breed and age and the likelihood of a tail injury that required veterinary treatment.

Variable	Odds ratio	P-value	95% Confidence Interval
Tail length			
Undocked or tail tip dock (reference)	1		
Docked by one-third	0.06	<0.001	0.02 – 0.16
Docked to half	0.16	<0.001	0.07 – 0.36
Docked short	0.06	<0.001	0.02 – 0.23
Breed			
Retriever, Pointer or Setter, Terrier or Other (reference)	1		
HPR	11.8	<0.001	4.4 – 31.4
Spaniel	8.3	<0.001	4.1 – 17.0
Age			
Less than five years old (reference)	1		
Five years and older	0.48	0.017	0.28 – 0.85
Degree of clustering within respondent (*Rho) = 0.38*		0.001	

3.4.9 Number Needed to Treat (NNT)

The number needed to treat (NNT) here is the number of puppies needed to be docked to avoid one tail injury and is detailed in Table 3.10. Given the lack of evidence suggesting any reduction in the likelihood of tail injury in dogs docked by half or shorter compared to dogs docked by one-third, the number of dogs that would need to be docked by one-third to avoid one tail injury was used to calculate the number needed to treat using the following calculation (NNT; NNT = 1/attributable risk). The NNT was calculated from both prevalence estimates and odds ratios (where available) and varied depending on the proportion of the litter assumed to become working dogs. Using a typical litter size of five puppies the NNT was calculated assuming that one, three or all five of the puppies became working dogs. To prevent one tail injury in all working breeds the NNT would be between five and 45 and to prevent one tail injury in spaniels or HPR the NNT would be between five and 15 puppies. To prevent one tail injury that required veterinary treatment in all working breeds one would need to dock by one-third between 20 and 90 puppies; and to prevent one tail injury that required veterinary treatment in spaniels, between 10 and 30 puppies would need to be docked.

Table 3.10. The number of dogs needed to be docked by one-third (Number Needed to Treat (NNT) to avoid one tail injury in a working dog, and the actual number of puppies and litters (assuming an average of five puppies per litter) that would need to be docked. For example, one would need to dock six spaniels to prevent one injury requiring veterinary treatment. If on average only one dog (from a typical litter of five puppies) became a working dog, one would need to dock six litters or 30 puppies. If one could guarantee all five puppies went on to work from all litters one would need to dock 2 litters or 10 puppies.

Prevention of	NNT (*calculated from prevalence estimate; $^{\#}$calculated from odds ratio)	Actual number of puppies & number of litters (five puppy litters) to dock to prevent one tail injury in a working dog, given: *Number of dogs per litter that become working dogs*		
		1	*3*	*5*
Any tail injury in all working breeds	9*	45 (9)	15 (3)	10 (2)
	$5^{\#}$	25 (5)	10 (2)	5 (1)
Any tail injury in spaniels (or HPR)	3* (3)*	15 (3)	5 (1)	5 (1)
	$2^{\#}$ $(3)^{\#}$	10 (2)	5 (1)	5 (1)
A tail injury requiring veterinary treatment in all working breeds	18*	90 (18)	30 (6)	20 (4)
A tail injury requiring veterinary treatment in spaniels	6*	30 (6)	10 (2)	10 (2)

3.5 Discussion

Despite the fact that canine tail docking has been a controversial topic over a long period of time, resulting in a number of published letters and comments (e.g. Edwards, 1984; Fardell, 1984; Smith, 1984; ANON, 1992; Holt & Thrusfield, 1997; Seavers, 2000; Prescott-Prime, 2001; Clarke, 2001; Holt, 2006; Bower, 2006; De Bleser, 2006; Pearce, 2006; Nuttall, 2006; Wray, 2006; Gussett, 2009; Dee, 2009; Reynolds, 2009; Squires, 2010) there is only one peer reviewed study presenting prevalence data on injuries including tail injuries in active working gundogs (Houlton, 2008) with which the current survey could be compared. Anecdotal evidence of increased risk in undocked working dogs has been presented by Airlie Bruce-Jones (2010) and Strejffert (1992). Two important peer reviewed publications on tail injuries are those by Darke et al. (1985) and Diesel et al. (2010), both of which used clinical databases of veterinary practices to assess prevalence and the role of breed and tail length in tail injuries. The present study therefore represents unique information on the risk of tail injury in working gundogs and terriers in Scotland.

Tail injuries occurred quite frequently in the study population with 29% of working dog owners who responded to the survey reporting a tail injury in one or more of their dogs and 13.5% of all dogs in the survey reported as sustaining at least one tail injury during the 12 month period covered by the survey. Spaniels and HPR were significantly more likely to have sustained a tail injury (with 17.8% and 15.6% of the population affected) than “other breeds” (12.0%), retrievers (7.8%), terriers (5.1%) or pointers/setters (with 2.4%), especially if undocked. In this study population 55.6% of all undocked spaniels sustained at least one tail injury. Similarly 38.5% of all undocked HPR sustained at least one tail injury. These findings concur with the results of the earlier studies, which indicated that undocked working spaniels were at high risk (Houlton, 2008) and that docked dogs were at significantly lower risk of sustaining a tail injury (Diesel et al., 2010).

Multivariable logistic regression models also indicated that breed and tail length were both significantly associated with the likelihood of tail injury with spaniels being 22 times and HPR 11 times more likely to have sustained a tail injury, and spaniels being eight times and HPR 12 times more likely to have sustained a tail injury that received veterinary treatment, compared to other breed groups of significant numbers (Terriers, retrievers and pointer/setters). Having a shortened tail appeared to be protective to some extent. A tail tip dock was associated with an approximately five-fold reduction in the risk of tail injury and being docked by one-third or shorter was associated with an approximately 20-fold reduction in the likelihood of tail injury for all dogs in the survey. Notably there was no statistically significant difference in the likelihood of tail injury in dogs docked by one-third, half or short, and the similarity in odds ratios would suggest no apparent added benefit in terms of protection from tail injury when docking dogs shorter than by one-third. A similar result was observed when modelling the likelihood of tail injury for working spaniels alone. When comparing HPR docked by one-third or more with undocked HPR or those with a tail tip dock, there was a similar 15-25-fold reduction in the likelihood of tail injury. There was no significant difference in the likelihood of tail injury between undocked or tail tip docked HPR. However, it is important to note that there were only four HPR with a tail tip dock included in the survey so the statistical power to identify a difference in risk would have been limited.

The high prevalence of tail injuries and the increased risk of tail injuries in undocked working dogs of some breeds would therefore suggest a potential benefit from docking working spaniels' and HPR's tails by one-third or more. However, the same cannot be stated for other dog breeds, partly due to the low number of dogs docked within these breeds (e.g. only 15 of 623 retrievers were docked), which makes statistical comparisons regarding different tail lengths difficult. Interestingly 7.7% of retrievers had sustained tail injuries during the survey period, mostly sustained during work 68.6% (n=35 of 51) or kennelling 15.7% (n=8). In Labrador retrievers a hairless tail tip as result of chronic trauma is well known by working dog owners and colloquially called "happy tail" as injury typically occurs due to the dogs' enthusiastic tail wagging while in the kennel or house. Yet the breed has never been included in the discussions about preventative docking - presumably because they were historically never a docked breed and are popularly considered to need a long tail for retrieving from water. In contrast, traditionally docked breeds such as terriers had a relatively low prevalence for tail injuries in the survey (5.5%; despite 35% of the terrier survey population having been undocked in contrast to only about 20% in spaniels). A reintroduction of tail docking may be potentially appropriate for some breeds or breed groups but clearly not all working dogs or all previously traditionally docked working dogs, such as terriers, many of which have a naturally shorter tail (The Kennel Club, 2013).

Tail injuries reported in this survey were almost exclusively tail tip injuries and lacerations. The majority of tail injuries and "worst tail injuries" were treated at home and veterinary treatment was received by about one-third of all dogs (32.5%). This is presumed to be because the majority of injuries were not likely to be immediately life threatening and due to owners' experience in home treating them. HPR had a generally higher frequency of veterinary treatment (53.3% of affected dogs) the reasons for which remain unclear, but might be due to injuries being more obvious in this breed group or HPR being prone to more severe tail damage potentially due to different causes.

The majority (84.6%) of tail injuries detailed under worst tail injury were sustained during work, especially during driven (41%) and rough (49%) shoots, mainly in "woodland" (37%) or "cover" (44%), and only 9.7% occurred at home. This contrasts the causes of tail injury seen in a pet population in which only 17.5% of tail injuries were outdoor-related (Diesel et al., 2010). In the current study brambles and gorse were named as the most common cause for these tail injuries overall. The causes for tail damage were quite different in HPR, with tail injuries being almost equally caused by fences, branches, because of the tail hitting a wall and “other causes”, but not because of brambles and gorse. In retrievers, causes were mainly brambles and “hitting a wall”. Within spaniels tail injuries happened mainly during work or training including field trials (82.3%) and only rarely during a “recreational walk” (7.7%) or kennelling (3.2%). In HPR, the majority of tail injuries (76.7%) occurred during work or training, but 17% had occurred at home (in the house or a kennel). Those frequencies are very similar to those seen in retrievers in which they occurred mainly at work or training (69%) and during kennelling (16%). Attention to an improvement of housing may therefore potentially prevent a substantial proportion of tail injuries in HPR and retrievers.

The aim of this study was to elucidate specifically tail injuries in working dogs, however it is important to know how these compare to other injuries sustained within the same population over the same time. Injuries to any body part occurred very frequently in the working gundog and terrier population in this survey with 39% of owners reporting an injury in their dogs and 21% of dogs being affected by tail and non-tail related injury within the one year survey period, which is similar to a report by Houlton (2008) who reported 25% of a working gundog population injured or lame. Injuries to other body parts than the tail were sustained by 9.8% of dogs in the present survey, and owners sought treatment for the majority of affected dogs (64.1%) and the majority of cases (60.5%), almost twice as often as for tail injuries, presumably because of their potential to be immediately life threatening or more severe functional consequences. Non-tail related injuries were less likely to be recurrent compared to tail injuries: only 24.7% of affected dogs had sustained more than one injury in contrast to 41.6% in those affected by tail injury. These non-tail related injuries were not more common in spaniels and HPR than in other breed groups.

It is an important aspect of tail docking that the procedure has to be done within the first five days after birth, long before being at risk of work-related tail injury. However, it is quite likely that not all puppies of a typical working dog litter would actually go on to work and be at risk of work related tail injury - hence the widely varying estimates of the number needed to treat (NNT) which were based on docking by one-third (given that there was no apparent benefit of docking shorter than by one-third), comparison to undocked dogs, and the assumption that either all five, three or one puppies of a litter become working dogs. A lower risk for tail injury in pet dogs compared to working dogs is clear as only 9.7% of tail injuries in the present study were sustained in the house, during transport or during recreational walks, and tail injuries appear to be quite rare in pet populations (Darke et al., 1985, Diesel et al., 2010), therefore docked puppies that do not go on to be working dogs will not receive the same benefit from being docked.

The number of spaniels or HPR that would need to be docked by one-third to avoid one tail injury over one shooting season were estimated to be between 5 and 15, depending on how many of a litter would become working dogs. The NNT to avoid one tail injury that required veterinary treatment in a shooting season was calculated as between 10 and 30 for spaniels and between 20 and 90 for all working dogs. These NNT estimates are substantially lower than the approximately 500 described by Diesel et al., (2010), which included far fewer working dogs and many more pet dogs. Given the fact that the current paper was specifically focused on working dogs, the dogs most at risk of tail injury and most affected by the ban on tail docking, we suggest that the figures calculated as part of this study are much more likely to represent the likely impact should legislation be altered to allow docking in working spaniels and HPR or indeed all working dogs.

The current survey highlights a substantial decrease in the proportion of spaniels originating from Scotland since the tail docking ban came into force (from 80% in ≥5 year old spaniels to 50% in ≤4 year old spaniels). In addition, anecdotal reports of Scottish breeders sending bitches to relatives or friends outside Scotland for whelping, so that the puppies could be legally docked, are not uncommon. The decrease in the proportion of Scottish-sourced HPR was less marked dropping from 56% to 49%. Both trends are also reflected in the fact that 54% of owners stated that the tail docking ban had changed their selection of breed and/or from where they would obtain a dog.

Due to the previous customary docking of spaniels and HPR and therefore complete absence of selection for tail phenotype, breeds within these groups may exhibit unsuitable tail phenotypes today, such as overly long, thin or kinked tails in some individuals. However, future breeding for ideal tail conformation appears highly unlikely as long as docked animals are easily obtainable from the neighbouring countries of England, Wales and Ireland.

An important limitation of this study was the fact that the survey was publicised through country sports associations, which were clearly critical of the complete tail docking ban in the past and proactive in their attempts to allow preventative tail docking in working gundogs and terriers (Petition PE1230 to the Scottish parliament). A bias toward survey participants opposed to the tail docking ban for working gundogs is therefore possible, which may have increased the prevalence of tail injuries reported in this survey. However, country sports organisations are the only representation for owners of working gundogs and terriers and the target population of working gundog owners in Scotland could not have been reached efficiently, fast and economically enough by any other means.

Participation in the survey was surprisingly low given that the tail docking legislation had been hotly debated, given that there may be as many as 100,000 active shooters across all shooting disciplines in Scotland owning an estimated 45 000 or more working dogs (C. Shedden, personal communication), and given that the survey was advertised directly to approximately 4,500 working dog owning members of the Scottish arm of BASC, 8,000 SCA and 5000 SGA members, the latter including 1200 gamekeepers nearly all of which are dog owners (with an estimated number of 5000 working dogs (Maureen Bailey (Scottish Gamekeepers Association) – personal communication)). Yet, only 1005 owners of working gundogs and terriers participated and it remains unknown whether dog owners did not take part because they were unaware of the survey; did not have the opportunity to participate due to lack of time and internet access; or whether owners did not feel motivated to take part e.g. due to their dogs being unaffected by tail injuries or not being in favour of a return to tail docking. Partly due to this relatively low response rate an analysis of non-responder bias was conducted. Estimates of the prevalence of tail injury were not significantly different between initial responders and gamekeepers attending a gamekeeper day and a SGA annual general meeting, and who had not taken part in the original survey. This comparison with “non-responders” did however show bias towards spaniels and HPR, potentially because some owners believed that the original survey was exclusively about these particular breeds. This may have increased the overall prevalence of tail injuries in all working dogs, but would not have affected specific breed group prevalence estimates.

Because this is a report about the prevalence and causes of tail injuries in working dogs and not a review of tail docking *per se*, ethical and medical concerns are not discussed here in detail. However, it should be mentioned that there is still little scientific data regarding the absence, presence or level of pain perception of puppies during canine tail docking. However, the only study on this topic in dogs did indicate pain responses during and after tail docking (Noonan et. al., 1996). At the same time there is an increasing awareness of human neonatal pain perception (Fitzgerald & Walker, 2009), its assessment (Herr et al.,

2006) and the necessity to limit and ameliorate potentially painful procedures in human neonates pharmacologically and non-pharmacologically (Lönnqvist, 2010; Johnston et al., 2011). It has been reported that certain procedures performed on human neonates can trigger hyperalgesia later on in life (Taddio et al., 1997). Whether or not tail amputation in canine neonates would trigger hyperalgesia remains unknown.

Neuroma formation has been described from six dogs (including five Cocker Spaniels) after tail amputation at 1-4 years old (Gross & Carr, 1990) and it is unknown whether spaniels may be predisposed for the development of neuromas. There is also a general lack of data regarding complications arising from routine tail docking or a potential negative impact on these animals later on in life, such as hyperalgesia, nor is there work on complications arising from tail amputation in adult dogs or the possibility of subsequent phantom sensation. The possible negative effects of canine tail docking such as faecal/urinary incontinence, perineal hernia, loss of counterbalance and decreased ability to express normal body language have been summarised by Wansborough (1996). However, the risk of the latter side effects would probably be limited if tail docking were limited to removal of one-third of a tail.

Tail docking cannot remove the risk of subsequent tail injury entirely, therefore gundog owners should be encouraged to reduce the risk of tail injury further by ensuring that dogs are housed in suitable kennels and where possible selecting less hazardous areas for a shoot. These approaches would also aid in decreasing the risk for all body injuries.

Animal welfare groups have established "five freedoms" to ensure an animal's welfare. These include "freedom from pain, injury and disease and freedom from fear and distress" (http://www.wspa-international.org/helping/animalfriendlyliving). Similarly the Animal Welfare Act (2006) aims to prevent pain, suffering, injury and disease. Responsible dog ownership, regardless of whether the dog is a pet or a working dog, should therefore be striving to fulfil these requirements, especially since being a working gundog appears to carry a considerable risk for tail- as well as non-tail injuries and every dog owner and dog handler has a duty of care to keep their animal as safe as possible, regardless of whether it is a pet or used for paid work or for recreation. This means ideally: kennelling dogs in suitable kennels (a particular issue in retrievers with almost 16% of tail injuries occurring in a kennel, but also in the HPR and spaniel population), selecting less hazardous areas for a shoot or field trial, training for good recall and directional training to prevent the dog from going into obviously challenging cover, and land management that would decrease obviously detrimental cover such as gorse/bramble thicket. Duty of care may however also potentially mean prevention of frequent tail injury by early and humane docking combined with the measures mentioned above – as docking does not eliminate all risk of tail injury and certainly not the risk for injury to other body parts.

If amendments were made to allow for docking in working spaniels and HPR, best practice clinical procedures (e.g. as described by Schoen & Sweet, 2009) should be established and enforced adequately to ensure that routine tail docking pups of working dog lines was conducted as humanely and safely as possible.

The results from this survey clearly indicated that working spaniels and HPR (but not terriers or pointer/setters) were at increased risk of sustaining tail injuries, especially if undocked. In addition, the work shows that docking HPR and spaniels by one-third (but not shorter) would be sufficient to significantly decrease the risk of tail injury in these breeds.

Chapter 4

Study 2: Tail injuries in dogs of working breeds – Clinical practice data from 16 rural and urban veterinary practices in Scotland

4.1 Abstract

The aim of the work described in this chapter was to calculate the risk of tail injuries that required veterinary examination for dogs in general and specifically for working dog breeds. The study investigated dogs that had visited one of 16 veterinary practices in Scotland between 2002 and 2012, depending on data availability. Data were obtained from practices that were distributed across Scotland and either known to service working dogs that had been identified with tail injuries in Study 1, considered to be representative of areas with high numbers of working dogs, or were selected from parts of Scotland to improve geographical coverage. A total of 585 tail injuries were recorded from a population of 99,368 dogs visiting 16 veterinary practices between 2002 and 2012, which constitutes an overall prevalence of 0.59% (95% confidence interval 0.54 to 0.64%). Of these 585 tail injuries 275 were recorded in working breeds which were represented by a total population of 30,869 dogs. This equates to an overall prevalence of 0.90% (confidence interval 0.79 to 1.00%) in working dog breeds. It was calculated that approximately 232 dogs would need to be docked as puppies to prevent one tail injury that required a veterinary examination in these working breeds. Working breeds were at a significantly higher risk of sustaining a tail injury that required a veterinary examination than other (non-working) breeds. In order to prevent one tail amputation in spaniels, 320 spaniel puppies would need to be docked soon after birth. The prevalence of tail injury examined by a veterinary surgeon in spaniels after the introduction of the new legislation (1.01%) was 2.3 times greater than the prevalence before new legislation was introduced (0.44%).

4.2 Introduction

Canine tail docking has until recently been common practice in Great Britain but it has also been a controversial issue which led to recent legislative changes. It has since been disputed whether or not the complete tail docking ban in Scotland may have had a negative influence on working dogs, through an increase of tail injuries. Despite the limitations of veterinary practice data, in particular to confirm whether or not a dog is in fact an active working dog, it is a valuable source of information and the only existing objective documentation of tail injuries over a long period of time. An earlier study conducted by Darke et al., (1985) found that dogs of usually undocked breeds (undocked dogs) were at increased risk (1.28 times more likely) of suffering a tail injury compared to dogs of breeds that are usually docked (docked dogs), however this association was not statistically significant. A more recent study commissioned by the Welsh Assembly Government with financial support from the Scottish Government and Defra, and carried out by the Royal Veterinary College and Bristol University during 2008 and 2009 examined the number and type of tail injuries in dogs across Great Britain (Diesel et al., 2010) by collecting of data from 52 veterinary practices in England, Scotland and Wales over one single year. The study found that the risk of tail injuries in the general dog population registered at these veterinary practices was low with 0.23 % of dogs affected, but that undocked dogs were significantly more likely to suffer a tail injury ($P<0.001$). Most tail injuries occurred at home or kennels and tail injuries were strongly related to breed. One major limitation of the study was the lack of dogs of working breeds which made it impossible to address whether undocked dogs of certain working breeds were more likely to sustain a tail injury than the general dog population.

The objective of the present study was therefore to estimate the prevalence of major tail injuries in working and non-working breed types and describe the types of tail injuries that required veterinary examination in dogs of working breeds within the breed groups hunt point retrievers (HPR), spaniels, pointers/setters, retrievers and terriers. In addition the number of puppies that would need to be docked, soon after birth, to prevent one tail injury that required veterinary examination or one tail injury that required amputation was calculated. The prevalence of tail injury requiring veterinary examinations before and after the introduction of the legislation was also calculated for spaniels.

4.3 Materials and methods

4.3.1 Participants and procedures

Without a reliable estimate regarding the prevalence of tail injury in working dogs or dogs of working breeds it was not possible to conduct a reliable sample size calculation prior to the study. However, anticipating a 20% response-rate from veterinary practices, as was the case in the study by Diesel et al. (2010), we aimed to acquire data from 20 companion animal or mixed practices across Scotland. Therefore, a list with contact details of all mixed and small animal veterinary practices in Scotland that were treating dogs (n=352) was purchased from the Royal College of Veterinary Surgeons (RCVS 2011), and veterinary practices were contacted directly. Survey participants were also recruited following the internet survey described in Chapter 3 (study 1), in which owners of working dogs were invited to name the veterinary practice they most frequently attended. We were therefore able to specifically target veterinary practices (n=56) that had been named by four or more participants in the internet survey, and were therefore believed to be more likely to have a higher number of true working dogs amongst their patients than others, hence ensuring a relatively high number of working dogs included in the study. These were all located outside cities and are included within "rural practices". In addition to targeting these practices and in order to get a representative sample from across Scotland some practices were also targeted based on their geographical location. Similarly, a number of urban practices were approached so that potential differences in the prevalence of tail injuries in these different environments could be examined.

At the commencement of the study all veterinary practices listed were sent an email with an invitation to participate in the study. Due to a low response rate those practices that had been made a priority because of their likelihood of having a high working dog clientele or because of being urban or because of their geographic location across Scotland were subsequently additionally invited to take part by telephone. A total of 87 veterinary practices were contacted in this way, with an ensuing original participation rate of 19.5%
(Assuming all 352 practices received and read the email sent to them by us inviting to take part in the study, the participation rate would have been 4.5%).
Once practices gave their written permission to allow access to tail injury-related information, the relevant practice management software companies were approached and

arrangements made for data transfer. As in the online survey (Chapter 3): Breed group contained purebred as well as crosses within the group, i.e. the breed group “Pointer and Setter” contained English Pointer, English Setter, Gordon Setter, Irish Setter and their crosses.

4.3.2 Data analysis

Data mining software (WordStat, Provalis research) was used to identify all dogs that had sustained a tail injury by searching for specified keywords within the records. We defined tail injury as laceration, contusion, fracture, dislocation and self-trauma and dictionaries were created that contained each of these words and variations of it, such “cut” meaning laceration or “break” meaning fracture. Each keyword was placed into a category, thus enabling the search for records that contained one or more categories in combination (e.g. searching for a record that contained “tail” and “injury” or “tail” and “amputation”. Each clinical record that contained any of the keywords was checked manually to confirm a tail injury and to determine what kind of veterinary treatment was given, e.g. amputation or bandaging. The data from each veterinary practice was grouped by year using Microsoft Access to calculate the prevalence per practice per year. The prevalence of tail injury in different breeds with associated 95% confidence intervals was calculated using the method described by Wilson (1927), which is appropriate when expecting low prevalence estimates. As there was limited other signalment data available consistently enough and in sufficient quantities across all practices to enable meaningful analysis only breed type was investigated in a univariable manner.

4.3.3 Statistical analysis

Statistical analysis was performed using Microsoft Office Excel 2007 (for data management) and Minitab 16 (for analysis). Associations between tail injuries and each of the following variables: working or non-working breed, rural or urban location of veterinary practices and tail injuries before and after the tail docking ban were investigated using chi-square tests. Regarding the comparison of before versus after the tail docking ban, it was necessary to introduce a lag period of 18 months for the dogs born after the ban to begin working. Numbers needed to treat (NNT) calculations were made using the following formula: NNT=1/Attributable Risk. The attributable risk (AR) is the difference between the prevalence in exposed and non-exposed groups, in this case undocked and docked dogs, respectively. Confidence intervals around NNT were calculated using the formula provided by Newcombe (1998).

4.4 Results

Of the 87 veterinary practices that were contacted directly, 17 practices originally agreed to participate in the study. However, due to the varying cooperation of different practice management software providers, only 10 of these practices could subsequently be used for analysis. In addition to these, seven of the 265 veterinary practices that had been contacted solely via email agreed to be part of the study. However, again due to the varying cooperation of practice management software providers, only six of these practices were subsequently used. Therefore, data from a total of 16 veterinary practices from across Scotland (Figure 4.1) was included in the analysis. These 16 participating veterinary practices supplied 2.64 million clinical records from 99,368 dogs for the years 2002 – 2012 (Table 4.1). The number of years of data which practices were able to supply was most often limited by having changed practice management software providers within these years. The number of records obtained per year and also the number of dogs seen per year by all veterinary practices included in the study is described in Table 4.1 with practices divided into "urban" or "rural".

Figure 4.1. Map of veterinary practices included in the analysis

Table 4.1. Number of clinical records and number of dogs per year for all dogs surveyed in all veterinary practices as well as for rural practices and urban practices separately.

	Rural practices		**Urban practices**		**Total**	
Year	Number of records	Number of dogs	Number of records	Number of dogs	Number of records	Number of dogs
2002	34711	7887	8755	1923	43466	9810
2003	37846	8158	8743	1806	46589	9964
2004	85092	11450	10005	1839	95097	13289
2005	110885	12890	10693	1888	121578	14778
2006	128299	13770	10090	1806	138389	15576
2007	211879	19826	10495	1763	222374	21589
2008	284968	27437	59891	5601	344859	33038
2009	360924	30914	99436	6589	460360	37503
2010	397690	32436	106539	6525	504229	38961
2011	447422	33277	133165	9173	580587	42450
2012	55713	7962	33499	4635	89212	12597
Total	2155429	79432	491311	19936	2646740	99368

4.4.1 Prevalence and risk of tail injury requiring veterinary treatment

The overall prevalence of a tail injury, amongst dogs taken to a veterinary surgeon in Scotland between 2002 and 2012 was 0.59% (95% confidence interval (CI): 0.54 to 0.64%) (Table 4.2). In any one year the prevalence ranged from 0.11% (95%CI: 0.6 to 0.2%) to 0.33% (95%CI: 0.22 to 0.45%). However, these two estimates were derived from the first two years of clinical records in which fewer dogs were included. In the more recent years, in which at least 20,000 dogs were included (2007-2011), the prevalence estimate of tail injury examined by a veterinary surgeon ranged from 0.21% (95%CI: 0.17 to 0.27%) to 0.3% (95%CI: 0.25 to 0.36%).

The prevalence of a tail injury examined by a veterinary surgeon in working dog breeds was 0.90% (95%CI: 0.79 to 1.0%) compared to a prevalence of 0.53% (95%CI: 0.46-0.57%) in non-working breeds. Working dog breeds were 1.7 times (95%CI: 1.49 to 2.06) more likely to have sustained a tail injury examined by a veterinary surgeon than non-working breed dogs ($p<0.001$).

The prevalence estimates of tail injury examined by a veterinary surgeon for different breed types are given in Table 4.3. Within the working breeds pointer/setters were most likely to have sustained a tail injury requiring veterinary examination: 1.69% (95%CI: 0.97

to 2.93%). Pointer/setters (relative risk (RR) = 3.31 (95%CI: 1.87-5.87)), HPR (RR = 2.58 (95%CI: 1.56-4.24), spaniels (RR = 2.35 (95%CI: 1.86-2.97) and retrievers (RR = 1.81 (95%CI: 1.47-2.22) were all significantly more likely to have sustained a tail injury examined by a veterinary surgeon than non-working dogs (p <0.001).

Table 4.2. Prevalence of tail injury per year for all dogs in all veterinary practices. The same dogs would appear in the practice data over more than one year, therefore the sum of dogs per year is more than the total of dogs reported, and the prevalence of tail injury is therefore less than the prevalence for all years examined.

Year	Number of dogs with tail injuries	Number of dogs	Prevalence %	95% CI
2002	31	9810	0.32	0.22-0.45
2003	11	9964	0.11	0.06-0.20
2004	27	13289	0.20	0.14-0.30
2005	36	14778	0.24	0.18-0.34
2006	35	15576	0.22	0.16-0.31
2007	48	21589	0.22	0.17-0.29
2008	71	33038	0.21	0.17-0.27
2009	111	37503	0.30	0.25-0.36
2010	90	38961	0.23	0.19-0.28
2011	102	42450	0.24	0.20-0.29
2012	23	12597	0.18	0.12-0.27
Total	585	99368	0.59	0.54-0.64

Tail amputation was reported in 20.2% (118) of cases of tail injury, the majority of which were due to unspecified injuries (51) or lacerations (38). The remaining 80.8% injuries were treated with a combination antibiotics and dressings or recorded as untreated. The overall prevalence of tail injuries severe enough to require amputation was 0.12% (95%CI: 0.10-0.14%) (Table 4.3). The prevalence of tail amputation in working breeds ranged from 0.4% (95%CI: 0.28-0.57%) in spaniels to 0.11% (95%CI: 0.07-0.18%) in retrievers.

Table 4.3. Prevalence of tail injury for different breed groups and breed types (95% CI = 95% confidence interval)

Breed category	Number of dogs (%)	Number of tail injuries	Prevalence %	95% CI
HPR	1219 (4.00)	16	1.31	0.81- 2.12
Pointer/setters	711 (2.3)	12	1.69	0.97-2.93
Retrievers	13914 (45.1)	128	0.92	0.77-1.09
Terriers	7514 (24.3)	29	0.39	0.27-0.55
Spaniels	7511 (24.3)	90	1.20	0.98-1.47
Total working breeds	30869 (100)	275	0.90	0.79-1.00
Total non-working breeds	60831	310	0.53	0.46-0.57
Total	99368	585	0.59	0.54-0.64

Overall working breeds were 2.19 (95%CI: 1.53-3.14; $p < 0.001$) times more likely to have sustained a tail injury that required amputation than non-working breeds. Compared with non-working breeds, spaniels and HPR were 4.57 (95%CI: 2.95-7.09; $p < 0.001$) and 3.76 (95%CI: 1.37-10.32; $p = 0.03$) times, respectively more likely to have sustained a tail injury that required amputation.

4.4.2 Types of injury

Of the 585 tail injuries recorded, 29.2% (95% CI 25.69-33.04%) were unspecified injuries, 24.6% were lacerations or bleeding (21.30-28.26%), 13.2% (95% CI 10.66-16.14) were recorded as blunt trauma or contusions, 4.44% (95% CI 3.05-6.43%) were fractures and 0.51% (95% CI 0.17-1.50%) dislocations (Table 4.4).

Table 4.4. Number of tail injuries and types of tail injury of all dogs affected by tail injury

Type of tail injury	Number of tail injuries	Prevalence %	95% CI
Unspecified Injury	171	29.23	25.69-33.04
Fracture	26	4.44	3.05-6.43
Dislocation	3	0.51	0.17-1.50
Contusion	77	13.16	10.66-16.14
Laceration	144	24.62	21.30-28.26
Self-trauma	34	5.81	4.19-8.01
Chronic injury	12	2.05	1.18-3.55
Unspecified injury + Amputation	51	8.72	6.69-11.28
Fracture + Amputation	16	2.74	1.69-4.40
Laceration + Amputation	38	6.50	4.77-8.79
Chronic Injury + Amputation	13	2.22	1.30-3.76

4.4.3 Prevalence of tail injuries before and after the tail docking ban

A total of 140 tail injuries were recorded within a population of 63,417 dogs that visited a veterinary practice from the 1st January 2002 to the 29th April 2007 (when the legislation came into force). To allow for dogs that were born after the introduction of the tail docking ban to begin work, it was necessary to introduce a lag period of 18 months. Therefore injuries attributed to the period after the imposition of the ban on tail docking are only those injuries that occurred from January 2009 onwards. A total of 326 tail injuries were recorded from a population of 130,169 between January 2009 and 2012. There was no significant difference in the prevalence of tail injuries in all dogs before and after the ban on tail docking (p-value = 0.21) and there was also no statistically significant difference in prevalence before versus after the ban for working breeds only (p-value = 0.42). However, the risk of tail injury, requiring a veterinary examination, in spaniels after the ban was statistically significantly greater, being 2.3 times higher than the risk before the ban (95%CI = 1.23-4.21; p-value = 0.009). There were 14 tail injuries in 3161 (0.44%) spaniels before the ban and 36 tail injuries in 3569 (1.01%) spaniels after January 2009.

4.4.4 Number Needed to Treat

A series of number needed to treat calculations were made assuming that with the intervention (e.g. tail docking by one-third soon after birth) the risk of tail injury would reduce to the level seen in non-working dogs (Table 4.5). These calculations were also based on the assumption that all puppies from a litter would go on to become working dogs at risk of work-related tail injury. Between 81 and 135 spaniel, HPR or pointer/setter puppies would need to be docked by one-third to prevent one tail injury that required a veterinary examination in those breed groups. NNT estimates to prevent one tail amputation were much greater with a minimum of 320 (95%CI = 207-527) spaniel puppies needing to be docked to prevent one tail amputation in that breed group.

Table 4.5. The number of puppies of different breed groups that would need to be docked in order to prevent one tail injury that required a veterinary examination or one tail amputation.

NNT to prevent (95% Confidence Intervals)	Breed group					
	Spaniels	HPR	Pointer/ Setters	Terriers	Retrie-vers	All working dog breeds
One tail injury that required a veterinary examination	135 (98-196)	117 (60-288)	81 (41-197)	*	217 (156-327)	232 (181-313)
One tail amputation	320 (207-527)	415 (133-2583)	1877 (*)	3085 (*)	4893 (*)	964 (616-1854)

* The prevalence estimate for Terriers was lower than that for non-working breeds so NNT resulted in a negative figure.
(*) The 95% confidence interval spanned 1.

4.5 Discussion

This study aimed to estimate the risk of tail injuries that were examined at veterinary practices across Scotland for working dog breeds and other breeds of dogs and it was found that working dog breeds were at a significantly increased risk of sustaining a tail injury than non-working breeds ($p<0.001$). However, the number of true working dogs within these working breeds remains unknown, as this was not stated in clinical records. We assumed that collecting data from veterinary clinics that were commonly used by owners of active working dogs that had taken part in the online survey would include a significant number of true working dogs resulting in estimates that are likely to be a better reflection of the true prevalence in active working dogs.

The risk of tail injury for all breeds was 0.59% (95% confidence interval 0.54 to 0.64%), which is higher than the prevalence estimate calculated by Darke et al. (1985) for the dog population of the University of Edinburgh Small Animal Hospital (0.39%). It is also higher than the weighted risk of 0.23% found by Diesel et al. (2010). These differences are most likely due to differences in the study population. The study by Darke et al. (1985) was also conducted almost 30 years ago before the ban on non-therapeutic tail docking. The differences in risk may additionally be due to the relatively low number of 12,129 dogs examined by Darke et al., (1985) in contrast to the 99,368 dogs in the current study. The confidence interval of the prevalence estimate reported by Darke et al. (1985) indicates rather wide limits (95% CI 0.29-0.51%) in contrast to the estimates contained within the current study, demonstrating greater certainty around the prevalence estimate contained within the current work.

The disparity between the current study and the survey by Diesel et al. (2010) may be due to the fact that only one year of practice data was used in that study, in contrast to the current study where several years of data were acquired from each practice. The estimate calculated in the current study would be more representative of a lifetime estimate whereas as the estimate from the work by Diesel et al. (2010) is an annual prevalence. Indeed, their estimate more closely resembles the per year estimates generated in the current study. Another difference was the random selection of veterinary practices by Diesel et al. (2010), which resulted in only a small number of true working dogs being included in their study population. In contrast the current study was able to target specific veterinary practices known to be commonly used by owners of working dogs.

The present study found a statistically significant difference in the prevalence of tail injury between working breeds and other dog breeds that are not usually used for work ($p<0.001$), between pointers/setters and retrievers ($p=0.043$) and between pointers/setters and terriers ($p<0.001$). This demonstrates that dogs of working breeds are generally at increased risk of sustaining a tail injury that required a veterinary examination compared to dogs of other breeds, and that dogs of some working breeds are clearly at greater risk than others. Pointer/setter breeds were 4.37 times more likely than terriers, 1.84 times more likely than retrievers, 1.41 times more likely than spaniels and 1.29 times more likely than HPRs to have sustained a tail injury that required veterinary examination. However, pointers/setter and retriever breeds have historically not been docked, and the re-introduction of docking, would most significantly affect HPRs, spaniels and terriers all of which were commonly docked before the tail docking ban.

There was no statistically significant difference in the prevalence of tail injuries, in all breeds or all working breeds before compared to after the introduction of the tail docking legislation. Possible explanations for this might be that the tail docking ban did not cause a noticeable increase in the occurrence of tail injuries (e.g. tail length is not associated with the risk of tail injury across all breeds), or that importing docked dogs from other parts of Great Britain, partially minimised the impact of the complete ban on tail docking in Scotland. However, there was a significant difference in the prevalence of tail injuries requiring veterinary examination in spaniels before and after the introduction of the legislation. This highlights the breed group both at greatest risk of tail injury but also that were most affected by the legislation, being the group most frequently docked prior to the ban on tail docking. Clearly the proportion of docked dogs would have slowly decreased since the docking ban making a difference in risk in the more recent years more apparent. It is also important to remember that there is nothing to stop dogs bred outside of Scotland from being docked as a puppy and living and working in Scotland. Therefore the impact of this may have been to underestimate the risk of tail injury in working dog breeds working in Scotland. It was not possible to investigate differences in the prevalence of tail injury requiring veterinary examination in other breed groups due to either the low number of injuries or the low frequency of docking before the ban.

A more detailed analysis of the clinical data regarding the success of treatment and resolution of tail injuries versus amputation following tail injury and the potential negative effects following amputation was not attempted in this survey but may be an area for future work. Possible long-term implications of tail amputation (which would apply to dogs docked as puppies as well as to those docked as adults) have been discussed by Morton (1992) and Bennett & Perini (2003), and neuroma formation following tail amputation, due to the intra-surgical dissection of spinal nerve roots in the tail, has been reported by Gross & Carr (1990) from a small population of tail-amputated dogs, most of which were spaniels. An unknown proportion of tail amputations would lead to neuroma formation and thus chronic pain.

We found in this study that 232 dogs of working breeds would need to be docked as puppies to prevent one tail injury examined by a veterinary surgeon which is approximately half of the number described earlier by Diesel et al. (2010) possibly due to the higher proportion of working dogs in the current study and more years of data from each practice. The number of puppies that would need to be docked to prevent one tail injury examined by a veterinary surgeon or to prevent one tail amputation varied widely between different breed groups. It may be appropriate to therefore consider changes to the current legislation based on breed group rather than all working dogs. For example, the calculated NNT for spaniels was consistently much lower than the equivalent NNT for terriers or retrievers.

The potential longer term benefit of docking a puppy's tail has to be weighed against the presence of pain during and after docking (Noonan et al., 1996). It had been argued earlier (Katz, 1977), that neonates would not feel pain as their nerve pathways were not sufficiently myelinated to transmit painful stimuli. This has since been strongly argued against by many authors and there is evidence indicating that neonates have similar, if not increased, sensitivity to pain as adults (Morton, 1992; Noonan et al., 1996; Fitzgerald & Beggs, 2001; McVey, 1998).

One of the limitations of the investigation was the assumption that there was indeed a high proportion of active working dogs within the study population. Although all was done to include as many working dogs as possible there is no guarantee that this was in fact achieved. Inclusion of pet working dogs in the working dogs breed groups would only have resulted in an underestimate of prevalence of tail injury in these groups, assuming that tail injuries are predominantly work-related (as was shown in the internet survey. Hence the prevalence estimates of tail injury requiring veterinary examination or amputation provided here should be regarded as likely minima

It is clear that this study did not evaluate the prevalence of all tail injuries but only those seen by a veterinarian and that we are therefore reporting only the prevalence of more significant tail injuries. The decision to take a dog to a veterinary surgeon is partly dependent on owner experience of such injuries e.g. working dog owners might have experienced a tail injury in their dogs before and therefore might have had some expertise in dealing with this type of injury without veterinary treatment. The true prevalence of tail injuries is therefore likely to be higher than described in this study. Indeed Study 1 indicated that the prevalence estimates presented here may represent approximately one-third of all tail injuries sustained by working dogs.
As mentioned earlier there was limited additional data available in sufficient quantities to enable meaningful analysis. Signalment data such as age and gender for example was not consistently available. Therefore only breed type was investigated in a univariable manner However the aim of this study was not to identify risk factors for tail injury at veterinary practices but to estimate prevalence of tail injury at veterinary practices.

This study is the most comprehensive survey of tail injuries treated in veterinary practices across Scotland. Tail injuries were rarely seen at veterinary practices with only 0.6% of the total dog population that visited a veterinary practice affected, but approximately one in five of these tail injuries did result in amputation. Dogs of working breeds were found to be at significantly greater risk of sustaining a tail injury than dogs of other breeds. Within the working breeds those belonging to the pointers/setters were at highest risk of tail injury requiring veterinary examination while terriers were at lowest risk of tail injury. Based on these analyses 232 dogs of working breeds would have to be docked as pups to prevent one tail injury seen at a veterinary practice. However, when calculated for each breed group the NNT varied considerably for both tail injury and amputation. It is also important to remember that despite the efforts made to include as many true working dogs as possible, a large proportion of dogs of working breeds are likely to have been pet dogs reducing the prevalence estimate calculated in the current study. In other words the true prevalence of tail injury requiring veterinary treatment in active working dogs is likely to be higher than reported in this work.

Chapter 5

Study 3: Prospective study on tail injuries sustained by active working gundogs and terriers in pest control during one shooting season

5.1 Abstract

A total of 408 individual working dogs were followed over several months to document the occurrence, type of tail injuries and potentially associated environmental factors. Self-enrolment - related bias through enrolment because of tail injury and incorrect reporting were common and complicated the data evaluation. Results were therefore reported for and examined by creating three different groups based on correct enrolment and reporting of tail injuries. Despite the failure of the original study design, data were compared to some extent. All results should be interpreted with some caution. However, 3.2% to 10.8% of working dogs, 5.0% to 15% of spaniels, and 20% to 50% of undocked spaniels sustained a tail injury during the survey, depending on enrolment/reporting group. Tail injuries occurred almost exclusively in spaniels, represented by 65% to 67% of the total dog population in the survey. Tail injuries were mainly caused by brambles and gorse and sustained during work in 71% to 80% of cases, but were not more common in dogs with a high number of working days or in dogs housed outside. Amputation as the result of tail injury during the survey period had been discussed, planned or executed in about 50% of dogs affected by a tail injury during the survey. Veterinary treatment for a tail injury was rare (10 – 12%). Most dogs injured during the survey had sustained a tail injury previously.

5.2 Introduction

Whether or not tail docking is beneficial for dogs is a hotly debated topic between governments, veterinary associations and animal welfare organisations on one side and country sports and certain breed organisations on the other. Figures from the BASC, Scotland suggest that there are up to 45,000 dogs that work in Scotland at some point during the shooting season, and approximately 5000 dogs would be used by gamekeepers.

About 40% of these are estimated to be spaniels and 20% hunt point retrievers (HPR), many of which would be undocked (Dr Shedden, (BASC, Scotland) & Maureen Bailey (Scottish Gamekeepers Association), personal communication). In the existing literature prevalence estimates for tail injury in dogs vary from 0.29% (Diesel et al., 2010) in clinical practice data to figures contained within the Northern Ireland Assembly, Committee for Agriculture and Rural Development report on the Welfare of Animal Bill: Countryside Alliance Ireland (2010) suggesting that 78% of undocked dogs sustain a tail injury in their first year of work. This constitutes an enormous variation in prevalence and prohibits any conclusions regarding the frequency of tail injuries in Scottish gundogs and terriers in pest control. The existing literature does also not provide specific information on the severity of tail injuries nor how these injuries were sustained. A prospective case control study was therefore conducted to complement the earlier conducted retrospective online survey and the examination of veterinary practice clinical data. The aim of the study was to provide robust evidence on the incidence, exact causes and types of minor and major tail injury and identify statistically significant associations between breed, tail length or work and the likelihood of tail injury in working dogs.

5.3 Materials and Methods

This prospective study was advertised through newsletters and the organisations' homepages of the Scottish branch of the British Association for Shooting and Conservation (BASC, Scotland), the Scottish Countryside Alliance (SCA) and the Scottish Gamekeepers Association (SGA) in order to reach owners of working dogs prior to the start of the 2011/2012 shooting season. An advertisement to take part in this prospective study was also included within the earlier conducted online survey on tail injuries. Owners of working gundogs and terriers interested in enrolling were sent an information and enrolment form by mail or email (see Appendix 1) in which they were asked to provide details of all their active working gundogs. Once enrolled owners were asked to inform the investigating researcher of any tail injuries as soon as possible after their occurrence, and provide a description of the tail injury, digital photographs of the injury, breed of dog, length of tail (docked to what degree/ undocked), whether the injury was sustained during work or other activities, in what sort of terrain, the probable cause, and whether veterinary treatment had been sought. If injured dogs were within driving distance from Glasgow, these injuries were to be verified by a researcher in person. These dogs formed the case group. Apart from providing information about their own dogs' injury owners of injured dogs were also asked to provide information (on breed, gender, age and tail length) for other dogs that had worked on the same day or were exposed to the same environment with the injured dogs but who had not been injured. These dogs made up the (unaffected) control group. Ideally, four control dogs for each case dog were anticipated.

All participants were contacted at the end of the shooting season in February to close the survey officially and to confirm that all injuries had been reported and to find out how many days the dogs had worked throughout the season since each individual enrolment date.

Prevalence and relationship of a variety of risk factors and tail injury was to be evaluated retrospectively. Tail injuries were to be categorised as either minor or major. The information gathered for the control dogs would be i.e. breed of dog, tail length (docked or undocked) work being done at the time, type of terrain and vegetation, how long it took to heal and whether it eventuated in amputation.

In order to identify statistically significant associations between breed, tail length or work and the likelihood of tail injury, we intended to develop conditional logistic regression models accounting for the matched nature of the control selection, resulting in estimates of the odds of tail injury given different lengths of tail (docked and undocked) and potentially an estimate of the odds of injury per tail length, for different breeds and for different types of work. It was planned to stratify these analyses by breed. For example, we expected that the majority of tail injuries would be sustained by spaniels and in these cases only unaffected Spaniels would be used as controls.

5.4 Results

The survey started with first enrolments on 28/9/2011 and ended officially 20/2/2012 by an email or telephone call to all participants informing them and ascertaining that all tail injury related data collected was correct.

The enrolment of working gundogs and terriers in pest control regardless of breed, tail length and tail injury status was encouraged. Unfortunately, enrolment into the study due to or after a tail injury was frequent, as was having been invited to take part in the study by colleagues and friends because of the dog having had tail injuries previously or because of being an undocked spaniel or HPR. Another frequently encountered problem was owners trying to enrol at the end of the survey period to report previous injuries that had occurred earlier on during the shooting season. It was also common that participants reported tail injuries only at the end of the study and not soon after they had actually occurred, which led to there being very few complete and reliable descriptions and hence a lack of data on control dogs. The results are therefore described for three groups of participants:

Group 1 including all those enrolled;
Group 2 all except those owners who were invited by someone who was aware of the study and who was aware of the dog having already sustained tail injuries, any retrospective enrolments and those who enrolled because of the reported injury;
Group 3 included only those who enrolled before the occurrence of any tail injuries and fully complied with the requirement for immediate reporting.

The signalment of dogs and injury data are shown in Tables 5.1-5.3. Injuries were counted as they had been reported regardless of time elapsed between injuries, assuming no recurrence. Data were not of sufficient detail to enable us to reliably identify recurrent injuries.

5.4.1 Data regarding participants and dogs enrolled

In total 157 – Group 1 (146 – Group 2/143 – Group 3) dog owners with 408 (393/376) dogs were enrolled in the survey, with a mean of 2.6 (2.7/2.6) dogs per owner (Table 5.1). By far the most common breed enrolled was the spaniel, which made up 66.9% (66.1/65.2%) of the survey population, followed by retrievers with 19.4% (20.1/20.5%) and HPR breeds with 6.9% (6.4/6.9%). A total of 57.1% (57.0/56.1%) of the survey population were females and 42.9% (43.0/43.9%) males and 61.3% of dogs were five years of age or less, and only 38.7% older than five years. Housing of the dogs enrolled was outdoor housing in 42.7% (43.8/43.4%), indoor living in 35.3% (33.8/33.8%) or mixed indoor/outdoor living (22.1/22.4/22.9%). A total of 44.9% (43.0/41.0%) of all dogs enrolled, 31% (28/24%) of the spaniels and 28.57% (23.08, 23.08%) of the HPR were undocked. Many dogs had sustained tail injuries previously. Interestingly 19.1% (17.6/14.6%) of all dogs, 24.9% (22.7/19.2%) of spaniels, 8.9% (8.9/6.5%) of retrievers, 8.7% (8.7/8.7%) of terriers but none of the 28 HPR had suffered from previous tail injuries.

Injury prevalence estimates (Table 5.2) varied enormously between the enrolment/reporting groups the participants were assigned to (Groups 1-3), and ranged from 10.8% to 7.4% and 3.2% for the group with correct enrolment and correct reporting (Group 3). A relatively small increase in the number of dogs (from Group 3 to 1) resulted in a substantial increase in prevalence estimates highlighting the problems associated with these data relating to enrolment due to injury or enrolment at the end of the shooting season.

Owners reported that the dogs that sustained tail injuries during the survey period (n=44/29/12) either had their tail amputated afterwards in 18.2/13.8/33.3% of cases, or had a veterinary appointment for amputation in the immediate future (34.1/31.0/16.7%). Tail amputation due to injury during the survey period was therefore expected, planned or had already been done within the survey period in 52.3% (44.8/50.0%) of injured dogs.

5.4.2 Data regarding tail injuries by breed and tail length

Tail injuries were sustained by 44 (29/12) dogs or 10.78% (7.38/3.19%) of the dog population. When comparing the prevalence of tail injuries per breed group it is clear that spaniels were the most affected group with 40 of the 44 (27 of 29/12 of 12) affected dogs being spaniels and a prevalence of 14.7% (10.4/4.89%) within spaniels in the survey. The only other breed groups with tail injuries were HPR with 7.14% (0/0) and retrievers with 2.5% (2.5/0) prevalence. Other breed groups such as terriers and pointer/setters were not affected by tail injury in the study. Only four dogs affected by tail injury were "other than spaniel" which meant that we could only analyse details on tail injury for spaniels but not any other breed group.

The vast majority of dogs affected by tail injuries were undocked: e.g. in the first group with all enrolments 40 of 44 dogs affected were undocked, two docked by one-third and two docked by half in all dogs enrolled; in the second group 26 of 29 dogs were undocked, and only two affected dogs docked by one-third, and one docked by half; in the third group 11 of 12 affected dogs were exclusively undocked.

Tail injury occurred in 21.9% (15.4/7.1%) of undocked dogs compared to 1.8% (1.4/0.5%) of docked dogs; and in 42.4% (32.9/18.3%) of undocked spaniels compared to 2.13% (1.6/0.5%) of docked spaniels.

Since only the spaniel group was affected in substantial numbers this was the only breed group in which injury per tail length could be examined in any way: In spaniels 36 of the 40 (24 of 27/11 of 12) dogs affected by tail injury (or 90.0/88.9/91.7%) were undocked dogs. The highest prevalence of tail injury per age was in one year old dogs with 27.3% (18.3/11.1%) of dogs of that age being affected.

Table 5.1 Signalment of all owners and dogs enrolled (1. group), all dogs except those who were enrolled because of tail injuries (2. group), and minus dogs whose injuries were only reported retrospectively in February 2012 (3. group).

Signalment	**Category**	**All dogs (Group 1)**	**All dogs except owners "invited", retrospective enrolments, or enrolment because of reported injury (Group 2)**	**Remaining dogs except those reporting an injury during final call in February (Group 3)**
		n dog (% population)	**n dog (% population)**	**n dog (% population)**
Owner and dog	**Owner total**	157	146	143
	Dog total	408	393	376
	Dogs per owner	408:157; 2.60	393:146; 2.69	376:143; 2.63
	Dogs injured	44 (of 408; 10.78)	29 (of 393; 7.38)	12 (of 376; 3.19)
Breed	**Spaniel**	273 (66.91)	260 (66.16)	245 (65.16)
	HPR	28 (6.86)	26 (6.37)	26 (6.91)
	Retriever	79 (19.36)	79 (20.10)	77 (20.48)
	Terrier	23 (5.64)	23 (5.85)	23 (6.11)
	Pointer/Setter	3 (0.74)	3 (0.76)	3 (0.80)
	Other	2 (0.49)	2 (0.51)	2 (0.53)
	All breeds	**408 (100)**	**393 (100)**	**376 (100)**
Gender	**Female (entire/neutered)**	233 (57.11) (179/54)	224 (57.00) (172/52)	211 (56.12) (161/50);
	Male (entire/neutered)	175 (42.89) (160/15)	169 (43.00) (154/15)	165 (43.88) (151/14)
	Total (entire/neutered)	**408 (100) (86.76/13.24)**	**393 (100) (82.95/17.05)**	**176 (100) (82.98/17.02)**
Age	**<1**	25 (6.13)	23 (5.85)	22 (5.85)
	1	55 (13.48)	49 (12.47)	45 (11.97)

	2	39 (9.56)	36 (9.16)	33 (8.78)
	3	55 (13.48)	51 (12.98)	50 (13.30)
	4	46 (11.27)	46 (11.70)	41 (10.90)
	5	30 (7.35)	30 (7.63)	28 (7.45)
	>5	158 (38.73)	158 (40.20)	157 (41.75)
Housing type	**Indoor**	144 (35.29)	133 (33.84)	127 (33.78)
	Outdoor	174 (42.65)	172 (43.77)	163 (43.35)
	both	90 (22.06)	88 (22.39)	86 (22.87)
	All housing	**408 (100)**	**393 (100)**	**376 (100)**
Tail length	**Undocked (long)**	183 (44.85)	169 (43.00)	154 (40.96)
	Docked (Tail tip)	11 (2.70)	11 (2.80)	11 (2.93)
	Docked (by 1/3)	85 (20.83)	85 (21.63)	83 (22.07)
	Docked (by 1/2)	88 (21.57)	87 (22.14)	87 (23.14)
	Docked (short)	40 (9.80)	40 (10.18)	40 (10.64)
	Natural bobtail	1 (0.25)	1 (0.25)	1 (0.27)
	Docked by 1/3 or shorter	213 (52.21)	212 (53.94)	210 (55.85)
Tail length spaniels	**Undocked (long)**	85 (31.14)	73 (28.08)	60 (24.49)
	Docked (Tail tip)	11 (4.03)	11 (4.23)	11 (4.49)
	Docked (by 1/3)	78 (28.57)	78 (30.00)	76 (31.02)
	Docked (by 1/2)	71 (26.00)	70 (26.92)	70 (28.57)
	Docked (short)	28 (10.26)	28 (10.77)	28 (11.43)
	Nat bobtail	0 (0)	0 (0)	0 (0)
	All tail lengths	**273 (100)**	**260 (100)**	**245 (100)**
Tail length HPR	**Undocked (long)**	8 (28.57)	6 (23.08)	6 (23.08)
	Docked (Tail tip)	0	0	0
	Docked (by 1/3)	5	5	5
	Docked (by 1/2)	9	9	9
	Docked (short)	6	6	6
	Nat bobtail	**0**	**0**	**0**
	All tail lengths	**28 (100)**	**26 (100)**	**26 (100)**
Previous tail injury	**Spaniel**	68 (of 273; 24.91)	59 (of 260; 22.69)	47:245 (19.18)
	HPR	0 (of 28; 0)	0 (of 26; 0)	0:26 (0)
	Retriever	7 (of 79; 8.86)	7 (of 79; 8.86)	5:77 (6.49)
	Terrier	2 (of 23; 8.70)	2 (of 23; 8.70)	2:23 (8.70)
	Pointer/Setter	0 (of 3; 0)	0 (of 3; 0)	0:3 (0)
	Other	1 (of 2; 50)	1 (of 2; 50)	1:2 (50)
	All breeds	78 (of 408; 19.12)	69 (of 393; 17.56)	55:376 (14.63)
	injured dog	32 (of 44; 72.72)	23 (of 29; 79.31)	9 (of 12; 75.00)
	Dogs injured and amputated	15 (of 23; 65.22)	9 (of 13; 69.23)	4 of 6; (66.67)
	Dogs injured and not amputated	17 (of 20; 85.00)	14 (of 15; 93.33)	4 (of 4; 100)
	Uninjured dog	46 (of 364; 12.64)	46 (of 364; 11.54)	46 (of 364; 12.64)
Further veterinary treatment of dogs needed	**None**	20 (of 44; 45.45)	15 (of 29; 51.72)	6 (of 12; 50.00)
	Yes	24 (of 44; 54.55)	14 (of 29; 48.28)	6 (of 12; 50.00)
	Non-invasive	1 (of 44; 2.27)	1 (of 29; 3.45)	0 (of 12; 0)
	Amputation (likely/planned)	15 (of 44; 34.09)	9 (of 29; 31.03)	2 (of 12; 16.67)
	Amputated	8 (of 44; 18.18)	4 (of 29; 13.79)	4 (of 12; 33.33)
	Total amputation	23 (of 44; 52.27)	13 (of 29; 44.83)	6 (of 12; 50.00)

Table 5.2. Injured working dogs per breed, tail length and other potential risk factors (*included days lost due to injury according to owner)

Category	**Variable**	**All dogs**	**All dogs except owners "invited", retrospective enrolments, or enrolment because of reported injury**	**Remaining dogs except those reporting an injury during final call in February**
		n dog (% of population)	**n dog (% of population)**	**n dog (% of population)**
Current injury (per breed)	**Spaniel**	40 (of 273; 14.65)	27 (of 260; 10.38)	12 (of 245; 4.89)
	HPR	2 (of 28; 7.14)	0 (of 26; 0)	0 (of 26; 0)
	Retriever	2 (of 79; 2.53)	2 (of 79; 2.53)	0 (of 77; 0)
	Terrier	0 (of 23; 0)	0 (of 23; 0)	0 (of 23; 0)
	Pointer/Setter	0 (of 3; 0)	0 (of 3; 0)	0 (of 3; 0)
	Other	0 (of 2; 0)	0 (of 2; 0)	0 (of 2; 0)
	All breeds	44 (of 408; 10.78)	29 (of 393; 7.38)	12 (of 376; 3.19)
Current injury (per previous injury)	**Previous injury**	32 (of 78; 41.03)	23 (of 69; 33.33)	9 (of 55; 16.35)
	No previous injury	12 (of 330; 3.64)	6 (of 324; 1.85)	3 (of 321; 0.93)
	Total	44 (of 408; 10.78)	29 (of 393; 7.38)	12 (of 376; 3.19)
Current injury (per tail length)	**Undocked (long)**	40 (of 183; 21.86)	26 (of 169; 15.38)	11 (of 155; 7.10)
	Docked (all lengths)	4 (of 224; 1.79)	3 (of 223; 1.35)	1 (of 221; 0.45)
	Docked (Tail tip)	0 (of 11; 0)	0 (of 11; 0)	0 (of 11; 0)
	Docked (by 1/3)	2 (of 85; 2.35)	2 (of 85; 2.35)	0 (of 83; 0)
	Docked (by 1/2)	2 (of 88; 2.27)	1 (of 87; 1.15)	1 (of 87; 1.15)
	Docked (short)	0 (of 40; 0)	0 (of 40; 0)	0 (of 40; 0)
	Nat bobtail	0 (of 1; 0)	0 (of 1; 0)	0 (of 1; 0)
	All tail lengths	44 (of 408; 10.78)	29 (of 393; 7.38)	12 (of 376; 3.19)
Current injury (per tail length in spaniels)	**Undocked (long)**	36 (of 85; 42.35)	24 (of 73; 32.88)	11 (of 60; 18.33)
	Docked (all lengths)	4 of 188; 2.13)	3 (of 187; 1.60)	1 (of 185;0.54)
	Docked (Tail tip)	0 (of 11; 0)	0 (of 11; 0)	0 (of 11; 0)
	Docked (by 1/3)	2 (of 78; 2.56)	2 (of 78; 2.56)	0 (of 76; 0)
	Docked (by 1/2)	2 (of 71; 2.82)	1 (of 70; 1.43)	1 (of 70; 0)
	Docked (short)	0 (of 28; 0)	0 (of 28; 0)	0 (of 28; 0)
	Nat bobtail	0 (of 0; 0)	0 (of 0; 0)	0 (of 0; 0)
	All tail lengths	40 (of 273; 14.65)	27 (of 260; 10.38)	12 (of 245; 4.89)
Current injury (per tail length in HPR)	**Undocked (long)**	2 (of 8; 25.00)	0 (of 0; 0)	0 (of 0; 0)
	Docked (Tail tip)	0 (of 0; 0)	0 (of 0; 0)	0 (of 0; 0)
	Docked (by 1/3)	0 (of 5; 0)	0 (of 0; 0)	0 (of 0; 0)
	Docked (by 1/2)	0 (of 9; 0)	0 (of 0; 0)	0 (of 0; 0)
	Docked (short)	0 (of 6; 0)	0 (of 0; 0)	0 (of 0; 0)
	Nat bobtail	0 (of 0; 0)	0 (of 0; 0)	0 (of 0; 0)
	All tail lengths	2 (of 28; 7.14)	0 (of 0; 0)	0 (of 0; 0)

Current injury (in Retrievers)	**Undocked (long)**	2 (of 79; 2.53)	2 (of 79; 2.53)	0 (of 77; 0)
Current injury (per age in years)	**<1**	2 (of 25; 8)	0 (of 23; 0)	0 (of 22; 0)
	1	15 (of 55; 27.27)	9 (of 49; 18.37)	5 (of 45; 11.11)
	2	6 (of 39; 15.39)	3 (of 36; 8.33)	0 (of 33; 0)
	3	8 (of 55; 14.55)	4 (of 51; 7.84)	3 (of 50; 6.00)
	4	7 (of 46; 15.22)	7 (of 46; 15.22)	2 (of 41; 4.88)
	5	2 (of 30; 6.67)	2 (of 30; 6.67)	0 (of 28; 0)
	>5	4 (of 158; 2.53)	4 (of 158; 2.53)	2 (of 157; 1.27)
	Total	44 (of 408; 10.78)	29 (of 393; 7.38)	12 (of 376; 3.19)
Current injury (in undocked spaniels, per age in years)	**<1**	2 (of 14; 14.29)	0 (of 12; 0)	0 (of 12; 0)
	1	12 (of 22 (54.55)	8 (of 18; 44.44)	5 (of 15; 33.33)
	2	6 (of 9; 66.67)	1 (of 5; 20.00)	0 (of 5; 0)
	3	8 (of 13; 61.54)	3 (of 10; 30)	2 (of 9; 22.22)
	4	7 (of 13; 53.85)	7 (of 13; 53.85)	2 (of 8; 25.00)
	5	1 (of 3; 33.33)	1 (of 3; 33.33)	0 (of 2; 0)
	>5	4 (of 11; 36.36)	4 (of 11; 36.36)	2 (of 9; 22.22)
	Total	40 (of 85; 47.06)	24 (of 73; 32.88)	11 (of 60; 18.33)
Current injury (per gender)	**Female**	28 (of 233;12.02)	19 (of 224; 8.48)	6 (of 211; 2.84)
	Male	16 (of 175;9.14)	10 (of 169; 5.92)	6 (of 165; 3.64)
Current injury (per housing type)	**Indoor**	22 (of 144; 15.28)	11 (of 133; 8.27)	5 (of 127; 3.94)
	Outdoor	15 (of 174; 8.62)	13 (of 172; 7.56)	4 (of 163; 2.45)
	both (indoor and outdoor)	7 (of 90; 7.78)	5 (of 88; 5.68)	3 (of 86; 3.49)
	All housing	44 (of 408; 10.78)	29 (of 393; 7.38)	12 (of 376; 3.19)
Current injury (per housing type in spaniels)	**Indoor**	18 (of 96; 18.75)	9 (of 87; 10.34)	5 (of 83; 7.14)
	Outdoor	15 (of 118; 12.71)	13 (of 116; 11.21)	4 (of 107; 3.74)
	both (indoor and outdoor)	7 (of 59; 11.86)	5 (of 57; 8.77)	3 (of 55; 5.45)
	All housing	40 (of 273; 14.65)	27 (of 260; 10.38)	12 (of 245; 4.89)
Current injury per working days	**Injured (mean days)**	802* days in 44 dogs; mean: 18.23	625* days in 29 dogs: mean: 21.55	221* days in 11 with this detail: mean 20.09
	Uninjured (mean days)	8954 days in 364 dogs; mean: 24.94		
	All dogs (mean days)	9657 days in 408 dogs; mean: 23.96		

5.4.3 Data on tail injuries

Data regarding tail injuries are listed in Table 5.3. A total of 155 (125/45) tail injuries were reported from 44 (29/12) dogs. This is a mean of 3.52/4.31/3.75 tail injuries per affected dog. The number of owner-reported tail injuries per affected dog is shown in Figure 5.1. A total of 96.8% (97.6/100%) of all tail injuries occurred in spaniels (n=150/122/45). And of these 83.3% (80.8/93.3%; n=125/101/42) occurred in undocked individuals, who made up 31.1% (28.1/24.5%) of all spaniels; 14% (16.8/0%) occurred in spaniels docked by one-third (who made up 28.6% (30.0/31.0%) of all spaniels), and 2.7% (2.4/6.7%) occurred in spaniels docked by half (who made up 26.0% (26.9/28.6%) of the spaniel population).

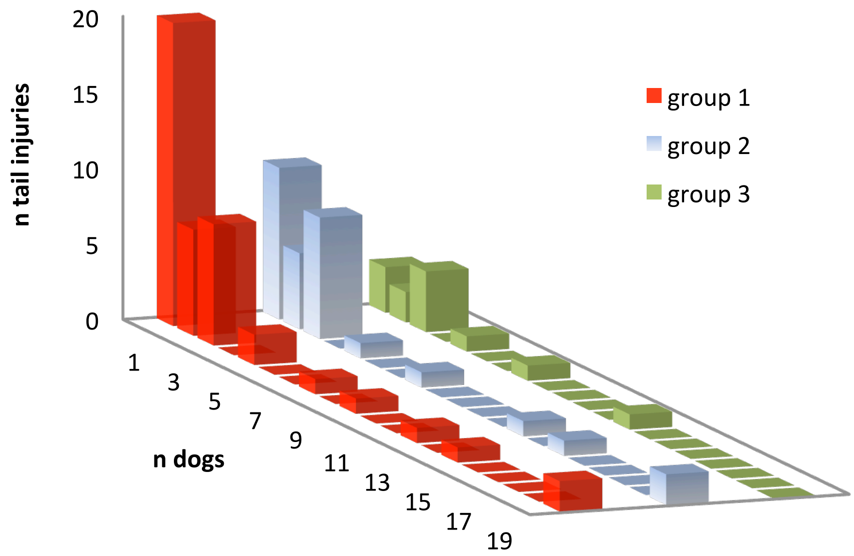

Figure 5.1. Number of owner-reported tail injuries for the three enrolment/reporting groups of dogs

Table 5.3. Injuries as reported by owners (in all dogs, dogs minus those enrolled because of injury, and minus those dogs whose injuries were only reported retrospectively in February)

Category	Variable	All dogs	All dogs except owners "invited", retrospective enrolments, or enrolment because of reported injury	Remaining dogs except those reporting an injury during final call in February
		n injury (%)	n injury (%)	n injury (%)
Total number of tail injuries	Spaniel	150 (96.77)	122 (97.60)	45 (100)
	HPR	2 (1.29)	0	0
	Retriever	3 (1.94)	3 (2.40)	0
	Terrier	0	0	0
	Pointer/Setter	0	0	0
	Other	0	0	0
	All breeds	155 (100)	125 (100)	45 (100)
Total number of tail injuries (in spaniels)	Undocked (long)	125 (83.33)	101 (80.80)	42 (93.33)
	Docked (Tail tip)	0	0	0
	Docked (by 1/3)	21 (14.00)	21 (16.80)	0
	Docked (by 1/2)	4 (2.67)	3 (2.40)	3 (6.67)
	Docked (short)	0	0	0
	Nat bobtail	0	0	0
	All tail lengths	150 (100)	125 (100)	45 (100)

5.4.4 Injury type, environment the injury was sustained in and other potential risk factors

Tail injuries occurred during work in 80.3% (81.6/71.0%) of cases. Most of the 53 (40/22) injuries sustained at work, training or field trials were sustained during driven shoots (64.15/62.5/45.5%) and rough shoots (32.1/32.5/45.45%) than in hunting or other activities. Rough shoots included also field trials. Work related injuries (including training) were mainly sustained in woodland and cover in all three groups with the main causes of work related tail injury and tail injury in general being gorse, brambles and fern.

Table 5.4. Causes for tail injuries sustained during the prospective study after reclassifying injuries occurring within 7 days of each other as well as those reported retrospectively with little data as recurrences; *Several answers possible per injury

Category	**Variable**	**All dogs and corrected injuries**	**All dogs and corrected injuries minus invited, retrospective enrolments, or enrolment because of reported injury**	**Remaining dogs and corrected injuries minus February reported**
		n injury (%)	**n injury (%)**	**n injury (%)**
Injury acquired where	At home/ on a walk	13 (of 66) (19.70)	9 (of 49) (18.37)	9 (of 31) (29.03)
	In work or training	53 (of 66) (80.30)	40 (of 49) (81.63)	22 (of 31) (70.97)
Work accidents (including training/trial)	Driven shoot	34 (64.15)	25 (62.50)	10 (45.45)
	Rough shoot	17 (32.08)	13 (32.50)	10 (45.45)
	Other	2 (3.77)	2 (5.00)	2 (9.09)
	Total work injuries	**53 (100)**	**40 (100)**	**22 (100)**
Terrain (work injuries; % of injuries, total >100%)*	Woodland	27 (50.94)	19 (47.50)	9 (40.90)
	Farmland	15 (28.30)	10 (25.00)	8 (36.36)
	Moorland	6 (11.32)	5 (12.50)	4 (18.18)
	Cover	24 (45.28)	17 (42.50)	9 (40.90)
	Other	2 (3.77)	2 (5.00)	2 (9.09)
	Total terrain	**74**	**53**	**32**
	Total injuries	**53**	**40**	**22**
Suspected cause (work injuries)*	Gorse	34 (of 53; 64.15)	26 (of 53; 65.00)	18 (of 22; 81.81)
	Brambles	20 (37.74)	15 (37.50)	7 (31.82)
	Fern	11 (20.75)	11 (27.50)	6 (27.27)
	Broom	5	5	5
	Rhododendron	1	0	0
	Fallen branches	2	7	1
	Fences	2	1	1
	Other	9	8	6
	Unknown	3	3	0
	Total cause	**87**	**76**	**44**
	Total injuries	**53**	**40**	**22**
Suspected cause (all injuries)*	Gorse	36 (of 66; 54.54)	28 (of 49; 57.14)	20 (of 31;64.52)
	Brambles	26 (39.39)	21 (42.86)	13 (41.94)
	Fern	13 (19.70)	13 (26.53)	8 (25.81)
	Broom	7	7	7
	Rhododen-dron	1	0	0
	Fallen branches	10	9	3

	Fences	3	2	2
	Other	7	7	6
	Unknown	5	3	0
	Total cause	**108**	**90**	**59**
	Total injuries	**66**	**49**	**31**

5.5 Discussion

The aim of this part of the research project was to investigate tail injuries in active working gundogs and dogs in pest control in Scotland through a prospective case control study. Incorrect enrolment (explicitly because of an injury or on the day of injury or because dog owners were invited by others due to their dogs having had previous tail injuries) and incorrect reporting of tail injuries (not immediately after the incident) by a substantial number of participants made this impossible and it was difficult to draw conclusions from the data collected.

In an attempt to make use of the data participants were grouped depending on their correct enrolling and reporting. Only a small number of owners (and their dogs) correctly enrolled and participated in the study. Further statistical analysis or interpretation of the data collected as part of this study was not attempted due to the lack of statistical power. Nevertheless some areas for future investigation may be apparent from the superficial examination of the data:

The highest prevalence of tail injury appeared to be in younger dogs (1 year olds overall and spaniels less than 4 years of age). However the values varied substantially across the three enrolment/reporting groups. Most injuries were sustained during work related activities (mostly during driven and rough shoots, the latter including field trials) and were reported to have been caused by brambles, gorse and fern. However, injured dogs did not work more days than other dogs, as shown in the study by Houlton (2008) where there was no association between any injury and days worked for any breed. This may of course be due to the frequent "late" enrolment as a result of an injury, the inaccurate reporting of days worked and lack of statistical power.

Most dogs that were injured during the survey had previously sustained a tail injury. However, whether a previous tail injury lead to another tail injury during the survey varied substantially between the three groups of participants probably reflecting motivation and timing for enrolment with the proportion being much lower in those who enrolled and reported correctly.

Amputation was planned or had been performed in approximately 50% of dogs that had sustained a tail injury. However, having been injured before the survey did not make amputation more likely since previous tail injury was surprisingly more common in those dogs whose owners did not opt for amputation during or immediately after the survey. It is possible that some owners become "used" to repeated minor tail injuries, tolerate them and learn to manage them themselves without the need for veterinary intervention. Indeed veterinary treatment after a tail injury was received for only 10% to 12% of injuries. It appears therefore that tail injuries are often manageable and do not necessarily need veterinary treatment in the majority of cases. The severity of the majority of injuries or the frequency of major injuries is therefore likely to be low, despite amputation being planned or having been conducted in 50% of the injured dogs, often at the end of the shooting season. This apparent disconnect requires further investigation, but may also be a product of the small and potentially biased participants enrolled in this study.

Some of the problems encountered in the present study might have been minimised by setting aside the time to accommodate weekly email and telephone contact with all participants to remind participants to report injuries, however it could be argued that the lack of reporting by many may reflect the importance tail injuries represent in the owners' daily lives: they occur, they are often insignificant, and heal spontaneously without further consequence.

Chapter 6
General discussion and conclusions

Canine tail docking has been a controversial topic for a long time, yet peer reviewed literature on the topic is scarce and peer-reviewed data specifically on tail injuries in working dogs is non-existent. The present study therefore represents unique information on the risk of tail injury in working gundogs and terriers in Scotland. The primary questions that we aimed to answer were at what risk of tail injury undocked working dogs are in Scotland, whether undocked working dogs of certain breeds experience a higher incidence of tail injury than others and what the incidence, cause and type of tail injury is in docked as well as undocked working and non-working spaniels, hunt point retrievers (HPR) and terriers.

To address these aims three separate but related studies were conducted:
Study 1 – An online survey for working dog owners regarding the occurrence of tail injury in their dogs.
Study 2 – An analysis of veterinary clinical data regarding tail injuries examined by a veterinary surgeon in dogs of working breeds (and other breeds) in Scotland.
Study 3 – A prospective case-control study of tail injuries sustained by active working dogs throughout a shooting season.

Major findings of study 1 were that 13.5% of dogs in the survey sustained one or more tail injuries during the 12 months examined. Spaniels (17.8%) and HPR (15.6%) were significantly more likely than other working dogs to have sustained at least one tail injury. Dogs with undocked tails (20.3%) or with docked tail tips (19.5%) were significantly more likely to have sustained a tail injury than dogs docked by one-third or shorter. 55.6% of undocked spaniels and 38.5% of undocked HPR had sustained at least one tail injury during the 12 month period. Importantly, there was no significant difference in the prevalence of tail injury within dogs of the same breed group if docked by one-third, half or shorter. Between five and 15 spaniel or HPR puppies would need to be docked by one-third to prevent one reported tail injury in a working spaniel or HPR, and between 10 and 30 spaniels or 20 and 90 working dogs, to avoid one tail injury that was examined at a veterinary practice. The tail injuries reported in this survey were in the vast majority due to work related activities and were almost exclusively tail tip injuries and lacerations elsewhere on the tail. Injury to other body parts was sustained by 9.8% of dogs in the study.

The main findings of study 2, a survey of tail injuries within veterinary practice data, were the overall prevalence of tail injury of 0.59% (amongst dogs taken to a veterinary surgeon in Scotland between 2002 and 2012), and a significantly ($P<0.001$) greater prevalence in working breeds (0.90%) compared to other breeds (0.53%). Working breed dogs were 1.7 times more likely to have sustained a tail injury examined by a veterinary surgeon than non-working breed dogs. Amongst the working breed groups 1.7% of pointer/setters, 1.3% of HPR and 1.2% of spaniels had sustained a tail injury. Spaniels were 2.3 times more likely to have sustained a tail injury that required a veterinary examination if born after than if born before the introduction of the legislation on tail docking. Among spaniels 1.01% of those born after the introduction of the legislation on tail docking and taken to a veterinary surgeon had sustained a tail injury, whereas the figure for those born before the introduction of the legislation on tail docking was 0.44%. Between 81 and 135, pointer/setter, HPR or spaniel puppies would need to be docked by one-third to prevent one tail injury that required a veterinary examination in these breed groups, and approximately one in five tail injuries seen by a veterinarian end in amputation of the tail.

Unfortunately study 3, which aimed to investigate tail injuries in active gundogs and dogs in pest control in Scotland through a prospective case control study, could not be conducted as planned due to poor compliance. Therefore only minimal analyses were performed and we can therefore only make very few deductions e.g. that the majority of tail injuries were caused by brambles, gorse and fern, were sustained during work and training, and were almost exclusively tail tip injuries. A minority of tail injuries (between 10% and 12%) were reported as having been examined by a veterinarian.

Study 1 and 2 demonstrated that tail injuries occurred relatively frequently within the survey population of active working dogs in study 1 (13.5%) and that they occurred significantly more frequently in working dog breeds (0.90%) compared with non-working breeds (0.53%) within the clinical data of study 2, which also showed a higher than previously reported prevalence of tail injury of 0.59% across all breeds. We can therefore say that active working dogs and dogs of working breeds appear to be at increased risk of tail injury compared to non-working dogs or breeds. Both studies clearly showed that spaniels (17.8%) and HPR (15.6%) were at increased risk, while terriers, which were until recently very commonly docked and which were one of the breed groups that country sports organisations strongly believed should be docked had an extremely low prevalence for tail injuries and would certainly not appear to benefit from being docked. Study 1 showed that HPR and spaniels within the study population were at especially high risk if undocked, with 36.5% of undocked HPR and 55.6% of undocked spaniels having experienced at least one tail injury during the survey period, which confirmed earlier indications to this effect by Houlton (2008) and Diesel et al. (2010). There was also a significantly greater prevalence of tail injury within spaniel breeds (study 2) after the tail docking ban when compared to before, indicating that being undocked had a significant influence on prevalence at least within spaniel breeds. However, while a shortened tail appeared to be protective to some extent, there was no apparent added protection from tail injury when being docked shorter than by one-third, for all dogs or for spaniels alone, in the survey population of study 1.

The results from both studies therefore provide important evidence on which to base a discussion regarding changes to the current legislation on tail docking in working dogs in Scotland, and suggest that docking by one third (executed with pain relief as described by Schoen and Sweet, 2009) may be recommended at least for spaniels and HPR, that are likely to become working dogs, to avoid the majority of tail injuries and therefore improve the welfare of these two groups of dogs.

However, before routine docking of breed groups can be recommended, several other aspects should be taken into account: Study 1 revealed that tail injuries were only examined by a veterinarian in about one third of cases (and "worst cases") of tail injury and in about half of the tail injuries sustained by HPR. Tail injuries were mostly sustained during work related activities and were almost exclusively tail tip injuries and to some extent lacerations elsewhere on the tail. It may therefore be challenging to compare these tail tip injuries/lacerations, which were more often than not treated at home, presumably without pain medication, with the pain and damage expected due to docking. While popular opinion within the shooting community indicates that tail docking in puppies less than five days old is not painful, the only study on this topic (Noonan et al., 1996) suggests otherwise and more research into pain perception in pups is clearly indicated.

It may also be important to take into consideration that injuries to other body parts than the tail were sustained by almost 10% of dogs in the retrospective survey (study 1), and that owners sought treatment for the majority of these cases (60.5%), almost twice as often as for tail injuries. Non-tail related injuries were less likely to be recurrent compared to tail injuries (24.7% versus 41.6%), and spaniels and HPR were not more commonly affected than other breed groups, however this means that even when docked a working gundog would be still at considerable risk of sustaining other work related injuries as well as having some risk of sustaining a tail injury since docking would not eliminate the risk for tail injury completely.

Moreover, the majority of dog owners in study 1 described themselves as "recreational shooter" (62.3%) or "other" (20.3%), which was frequently detailed as "beater and picker up" (112/1015; 11.0%). This means that their dogs would be working on shoots within the framework of a hobby or lifestyle, rather than these dogs being working dogs in the strict sense (e.g. search and rescue dogs). Gundog owners have the same duty of care as any other dog owner which means they have a duty to ensure their dogs' welfare by providing the five freedoms, especially in this context: "freedom from pain, injury and disease and freedom from fear and distress". Therefore engaging in a hobby or lifestyle that frequently results in tail and non-tail injuries and would benefit from removal of parts of the tail is ethically debatable in itself. It could even be argued that it is essentially similar to and therefore as much of a concern as obesity and diabetes in companion animals caused by their owner's lifestyle – that is lack of exercise and unhealthy feeding of the animal. Owners of gundogs and terriers in pest control have to ensure that the dogs (if kennelled) are housed in suitably designed kennels that help ensure the best level of welfare for the dogs and that injuries are avoided by selecting less hazardous areas for a shoot or field trial, training for good recall and directional training to prevent the dog from going into obviously challenging cover, and providing pain relief and medical care for those injured.

It also needs to be considered that not all puppies of a typical working dog litter would actually become or remain active working dogs and be at risk of work related tail injury, and that those who do not would therefore also not receive the same protective benefit of being docked since only 9.7% of tail injuries in the present study were reportedly sustained in the house, during transport or during recreational walks, and since tail injuries appear to be quite rare in pet populations (Darke et al., 1985; Diesel et al., 2010). There is so far no official data on how many pups per litter do in fact become working dogs. Therefore the NNT in study 1 are based on the assumption that one, three or five pups would become and remain active working dogs, and even though NNTs were substantially lower than previously reported by Diesel et al. (2010) or Darke et al. (1985) it should be taken as an estimate only. NNTs found in study 2 were also substantially lower (NNT of 232) than previously reported by these authors, but varied widely between breed groups: 81 pointer/setters, 117 HPR or 135 spaniels would need to be docked as puppies to avoid one tail injury examined by a veterinarian; and 320 spaniels or 415 HPR would need to be docked as puppies to avoid one tail amputation later on in life. Because the majority of dogs in the working breed groups in this survey are likely to be pet dogs and non-active working dogs these estimates are likely under-estimates of the true situation in working dogs. Determining a threshold NNT that could be considered to be sufficiently low to justify routine docking in working dogs would be arbitrary in the absence of a quantitative welfare measure that could be applied to both docking and injuries occurring at work.

Many ethical and medical concerns have been mentioned in letters and peer reviewed articles on the docking of dogs' tails, yet there is still little scientific data regarding the pain perception of puppies due to tail docking, the potential of it causing hyperalgesia, the potential of neuroma formation, and other potential negative health impacts on these animals immediately due to docking or later on in life. The potential longer term benefit of docking a puppy's tail has to be weighed against the presence of pain during and after docking (Noonan et al., 1996). It had been argued (Katz, 1977), that neonates would not feel pain as their nerve pathways were not sufficiently myelinated to transmit painful stimuli. This has since been strongly disputed by many authors and there is evidence indicating that neonates have similar, if not increased, sensitivity to pain as adults (Morton, 1992; Noonan et al., 1996; Fitzgerald & Beggs, 2001; McVey, 1998). Possible long-term implications of tail amputation (which would apply to dogs docked as puppies as well as to those docked as adults) have been discussed by Morton (1992) and Bennett & Perini (2003), and neuroma formation following tail amputation, due to the intra-surgical dissection of spinal nerve roots in the tail, has been reported in dogs by Gross & Carr (1990), potentially leading to severe chronic pain. Neuroma formation due to docking has also been described in other species.

It was obvious, however, that there was (at least in the population of dogs in study 1) a substantial decrease in the proportion of spaniels originating from Scotland since the tail docking ban had come into force (from 80% in ≥5 year old spaniels to 50% in ≤4 year old spaniels), and many owners opted to import docked spaniels from nearby countries where docking of working breeds/ breed types is permitted, in reaction to the tail docking ban in

Scotland. Therefore, future breeding for a more ideal tail conformation (such as tail-set, tail length and hair-structure) or a more considerate use of undocked dogs appears highly unlikely as long as docked animals are easily obtainable from neighbouring countries of England, Wales and Ireland.

A clear limitation of study 1 was the unavoidable recruitment of biased participants through country sports organisations which were clearly in favour of a reintroduction of tail docking in working breeds, and which may have increased the prevalence of reported tail injuries in this survey - a potential bias we could only test for by recruiting non-responders from the same groups. However, country sports organisations are the only representation for owners of working gundogs and terriers and the target population of working gundog owners could not have been reached by any other means.
Another limitation was potentially the very low number of participants, given that the tail docking legislation had been hotly debated, which could indicate that the majority of working gundog (and terrier) owners was indifferent about this survey and a potential reintroduction of tail docking or did not take part because their dogs had not sustained tail injuries to be reported. This could have resulted in an overestimation of tail injuries in this survey.

Study 2 succeeded in gathering approximately 10 years of data from each veterinary practice and is therefore the most comprehensive survey of tail injuries treated in veterinary practices (across Scotland). It was designed to offer an insight into tail injuries within working dog breeds and other dog breeds that are presented to veterinarians. The obvious limitation of this study was that the study examined dogs of working dog breeds and not active working dogs, and that the proportion of active working dogs within these working dog breeds would remain unknown, as this is not usually stated in clinical records. This therefore likely led to an underestimation of the true prevalence in study 2. It was hypothesised though that veterinary clinics that were known to be commonly used by owners of active working dogs, would include a significant number of true working dogs resulting in estimates that are likely to be a reasonably good reflection of the true prevalence in active working dogs or at least enable comparison with other practices and across time, (before versus after the introduction of the tail docking ban in Scotland). Another limitation of this study was that only those tail injuries presented to veterinarians rather than all that occurred would be measured, which might be, based on results of study 1, only one third of all tail injuries sustained. Despite its limitations the use of veterinary data was believed to be invaluable in providing objective information on the incidence of tail injuries.

The finding of Study 2 that pointer/setter breeds were at highest risk for tail injury in veterinary clinic data was in conflict with Study 1, in which pointers and setters were found to be at lowest risk for tail injury (2.4%). One possible explanation of this may be their popularity as pet dogs and decreased use as working dogs resulting in relatively low numbers of pointer/setters in study 1 (n=42), only one of which had sustained a tail injury. It is also possible that pointer/setters that do sustain a tail injury may me more likely to sustain a severe injury (because of the type of tail or the type of work) or are possibly more likely to be taken to the veterinarian because owners are not as accustomed to frequently occurring injuries as spaniel and HPR owners. Due to the contradiction between study 1 and 2 in regard to this a separate study on tail injuries in pointer/setters may be of value.

Because the third (prospective) study failed no conclusions should be drawn other than perhaps descriptive obvious results such as the majority of tail injuries being caused by brambles, gorse and fern, sustained during work and training, and being almost exclusively tail tip injuries, which appears to be highly consistent with the results of study 1. While it is difficult to draw conclusions, some areas for future investigation became apparent from the superficial examination of the data from this third study, such as the highest prevalence of tail injury being in younger dogs (1 year olds overall and spaniels less than 4 years of age). Also: only very few tail injuries (between 10% and 12%) were reportedly treated by a veterinarian and a very high proportion of those treated resulted in amputation. However, having been injured before the survey did not make amputation more likely since previous tail injury appeared to be more common in those dogs whose owners did not opt for amputation during or immediately after the survey. It is possible that some owners tolerate repeat minor tail injuries in their dogs and learn to manage them without veterinary intervention. It appears therefore that tail injuries are rarely severe and most would not necessarily need veterinary treatment. And it could be speculated that the owner’s opinion rather than medical need dictates whether amputation will follow or not. This does require further investigation.

Other future research regarding tail injuries in working dogs could clarify:

- The number of pups per litter (especially in spaniels and HPR) that become working dogs, the proportion of those dogs that is found unsuitable for working purposes and therefore rehomed as pet, and the working life span of spaniels and HPR.

- Detailed analysis of clinical data regarding the success of treatment and resolution of tail injuries versus amputation following tail injury and the potential negative effects following amputation.
- Scientific analysis of the pain perception in puppies due to tail docking, the potential for it to cause hyperalgesia, the potential for neuroma formation, and other potential negative health impacts on these animals immediately due to docking or later on in life.
- The problem of tail injuries in retrievers (apparent in 7.7% of retrievers in study 1 and often colloquially called "happy tail") should not be forgotten over the discussions of the reintroduction of tail docking in working dogs and an investigation about the extent, causes and treatment of tail injury in retrievers would be important for their welfare, seeing that they are such a commonly kept sporting dog (and pet dog).

In summary, Scotland's Animal Health and Welfare laws are by far the most stringent compared to those in England, Wales, Northern Ireland and Ireland in regards to tail docking in dogs. As these countries are located close to Scotland many owners in the first study have opted to buy docked working spaniels from these rather than purchase an undocked spaniel from Scotland. We found that the introduction of the tail docking ban in Scotland appeared to have had a significant influence on the prevalence of tail injury in spaniels seen at veterinary practices and that undocked spaniels and HPR were significantly more at risk of sustaining a tail injury than those docked by one-third or shorter. These and other results in this study certainly encourage a discussion of the existing legislation on allowing docking of certain working dogs such as working spaniels and HPRs. On the other hand ethical considerations remain regarding the application of a NNT to avoid one amputation due to tail injury, which in most cases would be sustained due to recreational use. A continued debate and further research are required, not only on whether preventive tail docking should occur but also on a gold standard surgical method of preventive docking.

Appendix

Appendix 1: Paper version of the online questionnaire for owners of working dogs (Study 1)

University of Glasgow | School of Veterinary Medicine

Scottish survey of injuries in working gundogs and terriers in pest control

Thank you for taking the time to participate in this survey.

The study has been commissioned by the Scottish Government and will be conducted by the University of Glasgow, School of Veterinary Medicine.

It is supported by organisations such as the Royal College of Veterinary Surgeons (RCVS), the British Veterinary Association (BVA) and the British Small Animal Veterinary Association (BSAVA), the Scottish branch of the British Association for Shooting and Conservation (BASC, Scotland), the Scottish Countryside Alliance (SCA) and the Scottish Gamekeepers Association (SGA).

To take part in this survey you must have your permanent residence in Scotland and own a working gundog or a terrier in pest control.

It is imperative that owners of these types of dogs take part in this survey regardless of whether or not their dogs had injuries over the 12 months between 01/August/2010 and 31/July/2011.

Please complete this questionnaire only once (either by hand or on the computer) and send it back to us via mail (address at the end of the questionnaire) or email it back.

You can call us on: 0141-330 8437 or email us: r.lederer.1@research.gla.ac.uk
if you have any questions or comments.

The survey consists of a maximum of 18 questions. You can let us know at the very end of the survey if you think you made a mistake or you were unsure about some parts.
The information you provide will not be passed on to any other party or used for any other purpose.

The Scottish Government
RCVS SETTING VETERINARY STANDARDS
BSAVA BRITISH SMALL ANIMAL VETERINARY ASSOCIATION
BASC SCOTLAND
SCOTTISH COUNTRYSIDE ALLIANCE Love the countryside
THE SCOTTISH GAMEKEEPERS ASSOCIATION
BVA British Veterinary Association

Q1) Please enter the first half of your post code. Example: G51

Q2) Please indicate whether you are a member of the following organisations
(Tick one or more if appropriate; if you have ticked "other" please fill in which organisation).

a) British Association for Shooting and Conservation (BASC, Scotland)
b) Scottish Countryside Alliance
c) Scottish Gamekeepers Association (SGA)
d) None
e) Other (Please specify)

Q3) How did you hear about this survey?
a) Through the BASC
b) Through the SCA
c) Through the SGA
d) Word of mouth
e) Other (Please specify)

Q4) With reference to working dogs, which of the following best describes your primary activity?
a) Game keeper
b) Deer stalker
c) Recreational shooter
d) Pest control
e) Other (Please specify)

Q5) Please indicate how many dogs you owned that were used as gundogs or in pest control between 01/August/2010 and 31/July/2011. Please include dogs in training.

Number of dogs:

Q6+7) Please list the names and breeds of your dogs here in alphabetical order.
The number each dog is allocated here will be needed for further questions.

	Dog's name	Dog's breed (or breed cross)
Dog No. 1		
Dog No. 2		
Dog No. 3		
Dog No. 4		
Dog No. 5		
Dog No. 6		
Dog No. 7		
Dog No. 8		
Dog No. 9		
Dog No. 10		

Q8) Please provide the following information for all dogs referred to in the previous question that worked between 01/August/2010 and 31/July/2011. "Age" refers to each dog's age at the beginning of the period in question. Please choose from the available options where they are offered.

Dog No.	**Age in years:**	**Gender:** Female entire Male entire Female neutered Male neutered	**Breed category:** Hunt/Point/Retriever Pointer or setter Retriever Spaniel Terrier Other	**Predominant housing:** Indoors Outdoors Both	**Tail conformation at the begin of the period in question:** Docked short Docked to intermed. length (~1/2) Docked (by 1/3) Docked (tail tip only) Undocked (naturally long) Natural bobtail	**Bred in which country:** Scotland England Wales Northern Ireland Other
1						
2						
3						
4						
5						
6						
7						
8						
9						
10						

Q9) Did any of these dogs acquire **ANY INJURIES (including tail injuries)** between 01/August/2010 and 31/July/2011?

Yes	No

(If you answered "No" here please ignore Q10 – Q13 and continue with Q14)

Q10) Please provide details about **EACH INDIVIDUAL DOG'S INJURIES (Including tail injuries)** between 01/August/2010 and 31/July/2011. Use the affected dog's previously allocated number given to your dogs in Question 6 and label each of the incidents the dog had with a number from 1-10 under "Incident No.".

Example 1: Dog No.2 injured his paws 2 times during the time period, would look like this:

Dog No.	**Incident No.**	**Location of injury:**	**Veterinary treatment given:**	**How long until you were able to exercise the dog again normally?**
Dog No. 2	1	Feet	…	…
Dog No. 2	2	Feet	…	…

Example 2: Dog No.4 injured his abdomen and feet in the same incident, would look like this:

Dog No.	**Incident No.**	**Location of injury:**	**Veterinary treatment given:**	**How long until you were able to exercise the dog again normally?**
Dog No. 4	1	Abdomen	…	…
Dog No. 4	1	Feet	…	…

Dog No.	**Incident No.**	**Location of injury:** Head Chest Back Abdomen Feet Tail	**Veterinary treatment given:** Yes/No	**How long until you were able to exercise the dog again normally?** Same day 1 day Up to 1 week Up to 1 month Permanently unable to work

Q11) Even though you may have already indicated this in the previous question, please state here: **Did any of your dogs acquire a TAIL INJURY** between 01/August/2010 and 31/July/2011?

Yes	No

Q12) Please provide us with more details about these tail injuries. How many separate incidents of tail injuries were there for each affected dog during the period in question?
Please use the number your dog was given earlier in Question 6.

Dog No.	**Number or tail injuries**

Q13) Please answer the following questions **about the MOST SEVERE tail injury each affected dog acquired** between 01/August/2010 and 31/July/2011? Again use the number allocated to your dog earlier in Question 6. (Please select the one option that fits best)

Dog No.	**Type of tail injury:** "Broken tail" Dislocated tail Tail tip damage Lacerations other than on tip Other	**Veterinary treatment given:** Yes/ No	**How long until dog able to exercise normally:** Same day 1 day Up to 1 week Up to 1 month Permanently unable to work	**Where was the tail injury acquired:** At home (house) At home (kennel) During transport Recreational walk In work or training	**If injured at work what type of work:** Driven game shoot Rough shoot Wildfowling Pest control Deerstalking Falconry Other	**If in work in what type of terrain:** Moorland Farmland Woodland Cover Farmyard Other	**Cause of injury if known:** Wooden fence Wire fence Barb wire fence Brambles Fern Gorse Rhododendron Piece of metal on ground Ice Bite Caught in branches Caught in door Hit against wall Other

Q14) Which veterinary clinic treated your dog(s) between 01/August/2010 and 31/July/2011 or if there was no health problem: At which clinic were you registered as a client between 01/August/2010 and 31/July/2011?

Name:
Address 1:
Address 2:
City/Town:
Postal code:

Q15) May we approach the clinic specifically for your dog's medical files if needed?
(This information will be treated as strictly confidential)

Yes	No

Q16) Did the ban on non-therapeutic tail docking introduced in 2007 change the way you use your dogs?

Yes	No

Q17) Did the ban on non-therapeutic tail docking introduced in 2007 change your selection of dog breed or where you get new dogs from?

Yes	No

Q18) If you have answered yes to one of the previous two questions:
how did your use of or selection of dogs change?

Would you and your dog(s) be willing to participate in a future study?

This prospective study will help identify risk factors for tail injuries in more detail.
It will start in August 2011 and finish in February 2012.
We will follow a number of dogs over this period in time and document any injuries.
If you would you like to be contacted about this future study, please provide your contact address and phone/email here.

Name:
Address 1:
Address 2:
City/Town:
Postal Code:
Email Address:
Phone number:

Q20: If you have any comments please feel free to use the space below.
In case you gave us permission to access your dogs' clinical files, it would help us if you would write down your last name in this space.

Thank you for taking the time to complete this survey!

Please feel free to contact us.
You can call: 0141-330 8437 or email: r.lederer.1@research.gla.ac.uk

Contact address:
Rose Lederer
Boyd Orr Centre for Population and Ecosystem Health
School of Veterinary Medicine
College of Medical, Veterinary and Life Sciences
University of Glasgow
464 Bearsden Road
Glasgow G61 1QH

Appendix 2: Information letter, enrolment form and reporting form (Study 3)

University of Glasgow | School of Veterinary Medicine

September/2011

Information and enrolment form for participants in the prospective study on tail injuries in working gundogs and terriers

Thank you for your interest in this prospective study on tail injuries in working gundogs and terriers.
The study has been commissioned by the Scottish Government and will be conducted by the University of Glasgow, School of Veterinary Medicine, with input from organisations such as the Royal College of Veterinary Surgeons, the British Veterinary Association, the British Small Animal Veterinary Association, the Scottish Gamekeepers Association, the Scottish Countryside Alliance and the British Association for Shooting and Conservation (Scotland).
The prospective study will take part from September 2011 until February 2012. During this time we will follow working dogs and document the occurrence and type of tail injuries as they happen.

If you would like to take part in this study please fill in the enrolment form (see next page) with your contact details and a list of your current working dogs, and email this letter back to us.

Please keep this page with our contact details at hand (e.g. a printout of the page near your telephone), and call us as soon as possible once a tail injury occurred in one of your working dogs, either during work or off work. We will aim to consequently come to you and verify the injury. However, it would be helpful if you could take a photograph (digitally dated if possible) of the tail injury on the same day as the injury occurred.

If we have not heard from you by the end of the study (mid February) we will contact you and confirm that indeed no injury has occurred in any of your working dogs during the time in question.

Please contact us in case of injuries or if you have any further questions:

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Mob: +44 (0) 791 205 5865
Tim.Parkin@glasgow.ac.uk

Enrolment form:

I would like to take part in this prospective study on tail injuries in working gundogs and terriers.

Name:
Address 1:
Address 2:
City/Town:
Postal Code:
Email Address:
Phone numbers:

Please fill in your dogs' details: (Use the next page if you have more than 15 dogs)

	Dog's name	**Dog's breed (or breed cross)**	**Age in years**
Dog No. 1			
Dog No. 2			
Dog No. 3			
Dog No. 4			
Dog No. 5			
Dog No. 6			
Dog No. 7			
Dog No. 8			
Dog No. 9			
Dog No. 10			
Dog No. 11			
Dog No. 12			
Dog No. 13			
Dog No. 14			
Dog No. 15			

Dog No.	**Gender:** Female entire Male entire Female neutered Male neutered	**Predominant housing:** Indoors Outdoors Both	**Tail conformation:** Docked short Docked to intermediate length (~1/2) Docked (by 1/3) Docked (tail tip only) Undocked (naturally long) Natural bobtail
1			
2			
3			
4			
5			
6			
7			
8			
9			
10			
11			
12			
13			
14			
15			

Incident form
Prospective tail injury survey

Case #

Reported by (and when):
Date of injury:
Owners details:

(Tail) Injured dog's details:

Dog name	Breed:	Age:	Gender:

Did dog have previous tail injuries?

Dog's tail length at time of injury:

Docked short
Docked to intermediate length (~1/2)
Docked (by 1/3)
Docked (tail tip only)
Undocked (naturally long)
Natural bobtail

Has tail been docked due to previous injuries?

Details regarding the injury:

Type of tail injury:	**Veterinary treatment given:**	**Where was the tail injury acquired:**	**If injured at work what type of work:**	**If in work in what type of terrain:**	**Cause of injury if known:**
"Broken tail" Dislocated tail Tail tip damage Lacerations other than on tip Other	Yes/ No	At home (house) At home (yard) At home (kennel) During transport Recreational walk In work In training	Driven game shoot Rough shoot Wildfowling Pest control Deerstalking Falconry Field trial Other	Moorland Farmland Woodland Cover Farmyard Other	Wooden fence Wire fence Barb wire fence Brambles Fern (Bracken) Gorse Rhododendron Piece of metal on ground Ice Bite Caught in branches Caught in door Hit against wall Other:

Weather (temperature,rain/snow/ice) when incident occurred?
Any other injuries acquired during the same outing?
If veterinary treatment which vet clinic?
Photo taken?
Will we inspect the injury?

Total number of dogs on shoot/the same situation that were not injured:

Dog name	Breed	Age	Gender	Tail length (see above)

Appendix 3: Photographic Appendix

Picture 1-5. Range of tail injuries as photographed by the owners of working dogs during the prospective tail injury survey.


1


2


3


4

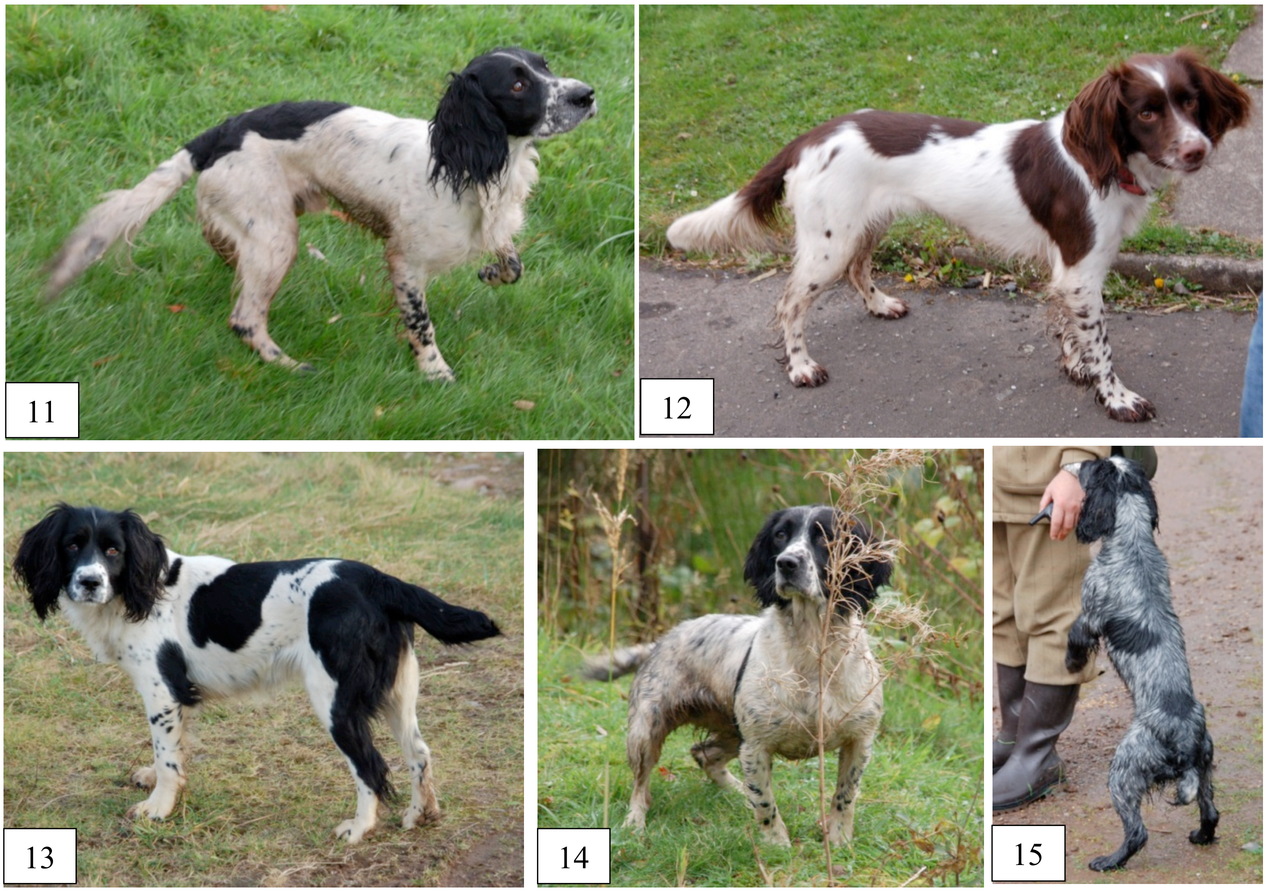

5

Picture 6-8. Gorse bushes and gundog amongst gorse bushes

Picture 9. Gundog in brambles

Picture 10. Gundogs around barb wire fencing

Picture 11-15. Tail lengths in spaniels; picture 11: Extremely long undocked tail with additional very long feathering in a young English Springer Spaniel (ESS); picture 12: well-proportioned undocked tail in a young ESS; picture 13: ESS docked by one-third; picture 14: ESS docked by half; picture 14: Cocker Spaniel docked short.



References

ANON (1992) BSAVA questionnaire on docking.
Journal of Small Animal Practice **33**: 247

Anti-docking Alliance (2013) Anti-dockingalliance.com (Last accessed: December 2013)

ARDALAN, A., KLUETSCH, C., ZHANG, A.B., ERDOGAN, M., UHLEN, M., HOUSHMAND, M., TEPELI, C., ASHTIANI, S. & SAVOLAINEN, P. (2011) Comprehensive study of mtDNA among Southwest Asian dogs contradicts independent domestication of wolf, but implies dog-wolf hybridization.
Ecology and Evolution **1(3)**: 373-385

BARON, R., BINDER, A., WASNER, G. (2010) Neuropathic pain: Diagnosis, pathophysiological mechanisms and treatment. *The Lancet Neurology* **9(8)**: 807–819

BENNETT, P.C. & PERINI, E. (2003) Tail docking in dogs: a review of the issues.
Australian Veterinary Journal **81**: 208-218

BLOOD, D.C. & STUDDERT, V.P. (1990) Balliere's Comprehensive Veterinary Dictionary. 2.nd edition, Baillere Tindall, London.

BOWER, J.M. (2006) Non-therapeutic docking of dogs' tails.
Veterinary Record **158(4):** 139

BOYKO, A.R., BOYKO, R.H., BOYKO, C.M., PARKER, H.G., CASTELHANO, M., COREY, L., DEGENHARDT, J.D., AUTON, A., HEDIMBI, M., KITYO, R., OSTRANDER, E.A., SCHOENEBECK, J., TODHUNTER, R.J., JONES, P., BUSTAMANTE, C.D. & OHTA, T. (2009) Complex population structure in African village dogs and its implications for inferring dog domestication history.
Proceedings of the National Academy of Sciences of the United States of America **33**: 13903

BOYKO, A.R., QUIGNON, P., LI, L., SCHOENEBECK, J.J., DEGENHARDT, J.D., LOHMUELLER, K.E., ZHAO, K., BRISBIN, A., PARKER, H.G., VONHOLDT, B.M., CARGILL, M., AUTON, A., REYNOLDS, A., ELKAHLOUN, A.G., CASTELHANO, M., MOSHER, D.S., SUTTER, N.B., JOHNSON, G.S., NOVEMBRE, J., HUBISZ, M.J., SIEPEL, A., WAYNE, R.K., BUSTAMANTE, C.D. & OSTRANDER, E.A. (2010) A simple genetic architecture underlies morphological variation in dogs. *Plos Biology,* **8(8)**: e1000451

BRUCE-JONES, A. (2010) BioSS: Working Dog Injury Survey Analysis by Bioss (Biomathematics & Statistics Scotland)

CLARKE, R. (2001) Response letter to "A breeder defends docking dogs' tails". *Australian Veterinary Journal* **79**: 95

CANFIELD, R. (1986) Anatomical aspects of perineal hernia in the dog. PhD doctoral thesis, University of Sydney

CLUTTON-BROCK, J. (1999) A natural history of domesticated mammals. Cambridge University Press, Cambridge, ed. 2, pp. 58

DARKE, P.G., THRUSFIELD, M.V. & AITKEN, C.G. (1985) Association between tail injuries and docking in dogs. *Veterinary Record* **116(15):**409

DAVIS, S.J.M. & VALLA, F.R. (1978) Evidence for domestication of the dog 12,000 years ago in the Natufian of Israel. *Nature* **276(5688)**: 608

DE BLESER, B. (2006) Non-therapeutic docking of dogs' tails. *Veterinary Record* **158(5)**: 175

DEE, L.G. (2009) Arguments for continuation of ear cropping and tail docking. *Journal of the American Veterinary Medical Association* **234(5)**: 598-599

Defra (2002) Code of Recommendations for the Welfare of Livestock – Sheep http://www.archive.defra.gov.uk/foodfarm/farmanimal/welfare/onfarm/documents/sheep.pdf (Last accessed December 2013)

Defra (2003) Pigs (England): Code of Recommendation for the Welfare of Livestock: Pigs (PB7950) https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/69369/pb7950-pig-code-030228.pdf (Last accessed December 2013)

DIESEL, G., PFEIFFER, D., CRISPIN, S. & BRODBELT, D. (2010) Risk factors for tail injuries in dogs in Great Britain. *Veterinary Record* **166(26):** 812-817

DRISCOLL, C.A., MACDONALD, D.W. & O'BRIEN, S.J. (2009) From Wild Animals to Domestic Pets, an Evolutionary View of Domestication. *Proceedings of the National Academy of Sciences of the United States of America* 106 (Suppl 1): 9971-9978

EDWARDS, A.M. (1984) Mutilations. *Veterinary Record* **114(21):** 528

EICHER, S.D., CHENG, H.W., SORRELLS, A.D. & SCHUTZ, M.M. (2006) Short Communication: Behavioural and physiological indicators of sensitivity or chronic pain following tail docking. *Journal of Dairy Science* **89**: 3047-3051

ELBERT, T., (2012) Pain from brain: Can we remodel neural circuitry that generates phantom limb pain and other forms of neuropathic pain? *Neuroscience Letters* **507**: 95-96

FARDELL, M.D. (1984) Tail docking. *Veterinary Record* **115(5):** 111-112

FITZGERALD, M. & BEGGS, S. (2001) The neurobiology of pain: developmental aspects. *Neuroscience* **7**: 246-257

FITZGERALD, M. & WALKER, S.M. (2009) Infant pain management: a developmental neurobiological approach. *Nature Reviews Neurology* **5**: 35-50

FLOR, H. (2002) Phantom limb pain: Characteristics, causes and treatment. *The Lancet Neurology* **1**: 182–189

FLOR, H., NIKOLAJSEN, L. & JENSEN, T. S. (2006) Phantom limb pain: A case of maladaptive CNS plasticity. *Nature Reviews Neuroscience* **7(11)**: 873–881

FOGLE, B. & MORGAN, T., (2000) The new encyclopedia of the dog. Dorling Kindersley Ltd. London, p 7

FRENCH, N.P. & MORGAN, K.L. (1992) Neuromata in docked lambs' tails. *Research in Veterinary Science* **52**: 389-390

GERMONPRÉ, M., SABLIN, M.V., STEVENS, R.E., HEDGES, R.E.M., HOFREITER, M., STILLER, M. & DESPRÉS, V.R. (2009) Fossil dogs and wolves from Palaeolithic sites in Belgium, the Ukraine and Russia: osteometry, ancient DNA and stable isotopes. *Journal of Archaeological Science* **36(2)**: 473-490

GERMONPRÉ, M., LÁZNICKOVÁ-GALETOVÁ M. & SABLIN, M.V. (2011) Palaeolithic dog skulls at the Gravettian Predmostí site, the Czech Republic. *Journal of Archaeological Science* **39**: 184-202

GIUMMARRA M.J., GIBSON, S.J., GEORGIOU-KARISTIANIS, N. & BRADSHAW, J.L. (2007) Central mechanisms in phantom limb perception: the past, present and future. *Brain Research Reviews* **54**:219-232

GRANT, C. (2004) Behavioural responses of lambs to common painful husbandry procedures. *Applied Animal Behaviour Science* **87**: 255-273

GRAY, M. M., SUTTER, N.B., OSTRANDER, E. A. & WAYNE R. K. (2010) The *IGF1* small dog haplotype is derived from Middle Eastern grey wolves. *BMC Biology* **8:** 16

GROSS, T.L. & CARR, S.H. (1990) Amputation neuroma of docked tails in dogs. *Veterinary Pathology Online* **27**:61-62

GUSSETT, R. (2009) Arguments for continuation of ear cropping and tail docking. *Journal of the American Veterinary Medical Association* **234(5)**: 598

HERR, K., COYNE, P.J., MANWORREN, R., MCCAFFERY, M., MERKEL, S., PELOSI-KELLY, J. & WILD, L. (2006) Pain assessment in the non-verbal patient:

position statement with clinical practice recommendations. *Pain Management Nursing* **7**: 44-52

HOLT, P.E. & THRUSFIELD, M.V. (1993) Association in bitches between breed, size, neutering and docking, and acquired urinary incontinence due to incompetence of the urethral sphincter mechanism. *Veterinary Record* **133**: 177-180

HOLT, P.E. & THRUSFIELD, M.V. (1997) Tail docking in dogs. *Australian Veterinary Journal* **6**: 449

HOLT, P.E. (2006) Non-therapeutic docking of dogs' tails. *Veterinary Record* **158**: 139

HOSGOOD, G. & HOSKINS, J.D. (1998) Small animal paediatric medicine and surgery. Butterworth Heinemann, Oxford, pp 239-241

HOULTON, J.E. (2008) A survey of gundog lameness and injuries in Great Britain in the shooting seasons 2005/2006 and 2006/2007. *Veterinary and Comparative Orthopaedics and Traumatology* **21:** 231-237

International Association for the study of Pain (2013)
http://www.iasp-pain.org/AM/Template.cfm?Section=Pain_Definitions
(Last accessed December 2013)

JOHNSTON, C.C., FERNANDEZ A.M. & CAMPBELL-YEO M. (2011) Pain in neonates is different. *PAIN* **152**: S65-S73

KATZ, J. (1977). The question of circumcision. *International Journal of Surgery* **62:** 490-492

KENT, J.E., JACKSON, R.E., MOLONY, V., & HOSIE, B.D. (2000)
Effects of acute pain reduction methods on the chronic inflammatory lesions and behaviour of lambs castrated and tail docked with rubber rings at less than two days of age. *The Veterinary Journal* **160**: 33-41

KOOIJMAN, C.M., DIJKSTRA, P.U., GEERTZEN, J.H.B., ELZINGA, A. &VAN DER

SCHANS, C.P. (2000) Phantom pain and phantom sensations in upper limb amputees: an epidemiological study. *Pain* **87**: 33-41

LARSON, G., PERRI, A., KARLSSON, E.K., LINDBLAD-TOH, K., WEBSTER, M.T., ANDERSSON, L., HO, S.Y.W., PETERS, J., STAHL, P.W., PIPER, P.J., LINGAAS, F., FREDHOLM, M., COMSTOCK, K.E., MODIANO, J.F., SCHELLING, C., AGOULNIK, A.I., LEEGWATER, P.A., DOBNEY, K., VIGNE, J. & VILÀ, C. (2012) Rethinking dog domestication by integrating genetics, archeology and biogeography. *Proceedings of the National Academy of Sciences of the United States of America* **109(23)**: 8878-8883

LEONARD, J.A., WAYNE, R.K., WHEELER, J., VALADEZ, R., GUILLÉN, S. & VILÀ, C. (2002) Ancient DNA evidence for Old World origin of New World dogs. *Science* **298(5598)**: 1613-1616

LINDBLAD-TOH, K., WADE, C.M., MIKKELSEN, T.S., KARLSSON, E.K., JAFFE, D.B., KAMAL, M., CLAMP, M., CHANG, J.L., KULBOKAS III, E.J., ZODY, M.C., MAUCELI, E., XIE, X., ALVAREZ, P., BIAGI, T., BROCKMAN, W., BUTLER, J., CHIN, C.-, COOK, A., CUFF, J., DALY, M.J., DECAPRIO, D., GNERRE, S., GRABHERR, M., KELLIS, M., KLEBER, M., LANDER, E.S., BREEN, M., THOMAS, R., WAYNE, R.K., BARDELEBEN, C., KOEPFLI, K.-, POLLINGER, J.P., OSTRANDER, E.A., KIM, L., PARKER, H.G., SUTTER, N.B., PONTING, C.P., GOODSTADT, L., HEGER, A., WEBBER, C., GALIBERT, F., HITTE, C., SMITH, D.R., DEJONG, P.J., KIRKNESS, E. et al. (2005) Genome sequence, comparative analysis and haplotype structure of the domestic dog. *Nature* **438(7069)**: 803-819

LÖNNQVIST, P.A., (2010) Regional anaesthesia and analgesia in the neonate. *Best Practice Research in Clinical Anaesthesiology* **24(3)**: 309-321

MALMSTRÖM, H., VILÀ, C., GILBERT, M.T.P., STORÅ, J., WILLERSLEV, E., HOLMLUND, G. & GÖTHERSTRÖM, A. (2008) Barking up the wrong tree: Modern northern European dogs fail to explain their origin. *BMC Evolutionary Biology* **8(1)**: 71

MARCHANT FORDE, J.N., CHENG, H., LAY JR, D.C., PAJOR, E.A., & MARCHANT-FORDE, R.M. (2009) The Effects of Tail Docking Method on Piglets' Behavioral

Responses to a Formalin Pain Test. International Society of Applied Ethology. Proceedings, abstract only

MCVEY, C. (1998) Pain in the very preterm baby: ‘suffer little children?’. *Pediatric Rehabilitation* **2:** 47-55

MELZACK, R., ISRAEL, R., LACROIX, R. & SCHULTZ, G. (1997) Phantom limbs in people with congenital limb deficiency or amputation in early childhood. *Brain* **120**: 1603–1620

MILLS, D.S. (EDITOR-IN-CHIEF), MARCHANT-FORDE, J.N., MCGREEVY P.D., MORTON D.B., NICOL, C.J., PHILLIPS C.J.C., SANDOE, P. & SWAISGOOD R.R. (2010) In: The Encyclopaedia of applied Animal Behaviour and Welfare, CAB International, 1st edition, pp 181 – 184

MOLONY, V., KENT, J.E. & ROBERTSON, I.S. (1993) Behavioural responses of lambs of three ages in the first three hours after three methods of castration and tail docking. *Research in Veterinary Science* **55(2)**:236-45

MORTON, D. (1992) Docking of dogs: practical and ethical aspects. *Veterinary Record* **131**: 301-306

NICKEL R., SCHUMMER A. & SEIFERLE E. (2000) Lehrbuch der Anatomie der Haustiere, Volume 1 (5. ed.), 3 (2. ed.) and 4 (2. ed.), Paul Parey, Berlin and Hamburg

NIRAJ S. & NIRAJ, G. (2014) Phantom limb pain and its psychologic management: a critical review. *Pain Management and Nursing* **15(1)**: 349-364

NOONAN, G.J., RAND, J.S., PRIEST, J., AINSCOW, J. & BLACKSHAW, J.K. (1994) Behavioural observations of piglets undergoing tail docking, teeth clipping and ear notching. *Applied Animal Behaviour Science* **39:** 203 – 213

NOONAN, G.J., RAND, J.S., BLACKSHAW, J.K. & PRIEST, J. (1996) Behavioural observations of puppies undergoing tail docking. *Applied Animal Behavioural Science* **49**: 335-342

Northern Ireland Assembly, Committee for Agriculture and Rural Development report on the Welfare of Animal Bill: Countryside Alliance Ireland (2010) http://archive.niassembly.gov.uk/record/committees2010/hansard_agriculture.htm (last accessed May 5 2013)

NUTTALL, K. (2006) Non-therapeutic docking of dogs' tails. *Veterinary Record* **158:**211

OSTRANDER, E.A. & WAYNE, R.K. (2005) The canine genome. *Genome research* **15(12)**: 1706-1716

OVODOV, N.D., CROCKFORD, S.J., KUZMIN, Y.V., HIGHAM, T.F.G., HODGINS, G.W.L. & VAN, D.P. (2011) A 33,000-year-old incipient dog from the Altai Mountains of Siberia: Evidence of the earliest domestication disrupted by the last glacial maximum. *PLoS ONE* **6(7)**: e22821

PANG, J.,F., KLUETSCH C., ZOU X.J., ZHANG, A.B., LUO, L.Y., ANGLEBY, H., ARDALAN, A., EKSTRÖM, C., SKÖLLERMO, A., LUNDEBERG, J., MATSUMURA, S., LEITNER, T., ZHANG, Y.P. & SAVOLAINEN, P. (2009) mtDNA data indicate a single origin for dogs south of the Yangtze River, less than 16,300 years ago, from numerous wolves. *Molecular Biology and. Evolution* **26(12)**: 2849 – 2864

PARKER, H.G., KIM, L.V., SUTTER, N.B., CARLSON, S., LORENTZEN, T.D., MALEK, T.B., JOHNSON, G.S., DEFRANCE, H.B., OSTRANDER, E.A. & KRUGLYAK, L. (2004) Genetic Structure of the Purebred Domestic Dog. *Science* **304(5674)**: 1160-1164

PEARCE, J. (2006) Non-therapeutic docking of dogs' tails. *Veterinary Record* **157:** 175-176

PRESCOTT-PRIME, K. (2001) A breeder defends docking dogs' tails. *Australian Veterinary Journal* **79**: 94-95

REYNOLDS, J.P. (2009) Arguments for continuation of ear cropping and tail docking. *Journal of the American Veterinary Medical Association* **234(5)**: 599

SABLIN, M.V. & KHLOPACHEV, G.A. (2002) The earliest ice age dogs: Evidence from Eliseevichi I. *Current anthropology* **43(5)**: 795-799

SAVOLAINEN, P., ZHANG, Y.P., LUO, J., LUNDEBERG, J. & LEITNER, T. (2002) Genetic evidence for an East Asian origin of domestic dogs. *Science* **298**:1610-1613

SCHOEN, K. & SWEET, D.C. (2009) Canine and feline tail amputation. *Laboratory Animal* **38(7)**: 232 – 233

SEAVERS, A. (2000) Docking dispute. *Australian Veterinary Journal* **78**: 599

SHEARIN, A.L. & OSTRANDER, E.A. (2010a) Canine morphology: Hunting for genes and tracking mutations. *PLoS Biology,* **8(3)**: e1000310

SHEARIN, A.L. & OSTRANDER, E.A. (2010b) Leading the way: Canine models of genomics and disease. *DMM Disease Models and Mechanisms* **3**(1-2): 27-34

SIMONSEN, H.B., KLINKEN, L. & BINDSEIL, E. (1991) Histopatholgy of intact and docked pigtails. *British Veterinary Journal* **147**: 407-411

SMITH, W.J. (1984) Mutilations. *Veterinary Record* **115(6)**: 135

SPADY, T.C. & OSTRANDER, E.A. (2008) Canine behavioral genetics: Pointing out the phenotypes and herding up the genes. *Am J Hum Genet* **82(1):** 10-18

SQUIRES, P. (2010) Tail injuries in dogs in Great Britain. *Veterinary Record* **167(6)**: 225

STREJFFERT, G. (1992) Tail injuries of Shorthaired German Pointer dogs born in Sweden 1989. www.cdb.org/countries/Sweden.htm. (Accessed March, 2013)

SUTHERLAND, M. A., BRYER P.J., KREBS, N. & McGLONE, J.J. (2008) Tail docking in pigs: Acute physiological and behavioural responses. *Animal* **2**: 292-297

TADDIO, A., KATZ, J.,ILERSICH, AL. & KOREN, G. (1997) Effect of neonatal circumcision on pain response during subsequent routine vaccination. *Lancet* **349(9052):** 599-603

THE KENNEL CLUB (2013) Kennel Club UK breed information centre http://www.thekennelclub.org.uk/services/public/breed/Default.aspx
and Kennel Club UK Breed watch http://www.thekennelclub.org.uk/services/public/breed (Last accessed December 2013)

TRUT, L.N. (1999) Early canid domestication: The Farm-Fox Experiment: Foxes bred for tamability in a 40-year experiment exhibit remarkable transformations that suggest an interplay between behavioral genetics and development. *American Scientist* **2**:160

VILÀ, C., MALDONADO, J.E., AMORIM, I.R., WAYNE, R.K., SAVOLAINEN, P., LUNDEBERG, J., RICE, J.E., HONEYCUTT, R.L. & CRANDALL, K.A. (1997) Multiple and ancient origins of the domestic dog. *Science* **276 (5319)**: 1687-1689

VONHOLDT, B.M., POLLINGER, J.P., LOHMUELLER, K.E., HAN, E., PARKER, H.G., QUIGNON, P., DEGENHARDT, J.D., BOYKO, A.R., EARL, D.A., AUTON, A., REYNOLDS, A., BRYC, K., BRISBIN, A., KNOWLES, J.C., MOSHER, D.S., SPADY, T.C., ELKAHLOUN, A., GEFFEN, E., PILOT, M., JEDRZEJEWSKI, W., GRECO, C., RANDI, E., BANNASCH, D., WILTON, A., SHEARMAN, J., MUSIANI, M., CARGILL, M., JONES, P.G., QIAN, Z., HUANG, W., DING, Z., ZHANG, Y., BUSTAMANTE, C.D., OSTRANDER, E.A., NOVEMBRE, J., WAYNE, R.K., VONHOLDT, B.M., POLLINGER, J.P., EARL, D.A., KNOWLES, J.C., BOYKO, A.R., PARKER, H., GEFFEN, E., PILOT, M., JEDRZEJEWSKI, W., JEDRZEJEWSKA, B., SIDOROVICH, V., GRECO, C., RANDI, E., MUSIANI, M., KAYS, R., BUSTAMANTE, C.D., OSTRANDER, E.A., NOVEMBRE, J. & WAYNE, R.K. (2011) Genome-wide SNP and haplotype analyses reveal a rich history underlying dog domestication. *Nature* **464(7290)**: 898 – 902

RSPCA Australia (2009) http://kb.rspca.org.au/afile/277/70/
(Last accessed December 2013)

WADA, N., HORI, H. & TOKURIKI, M. (1993) Electromyographic and kinematic studies on tail movements in dogs during treadmill locomotion. *Journal of Morphology* **217:** 105 – 113

WANSBOROUGH, R.K. (1996) Cosmetic tail docking of dogs. *Australian Veterinary Journal* **74**: 59-63

WAYNE, R.K. & VONHOLDT, B.M. (2012) Evolutionary genomics of dog domestication. *Mammalian Genome* **23**: 3-18

WEEKS, S. R., ANDERSON-BARNES, V. C. & TSAO, J. W. (2010) Phantom limb pain: Theories and therapies. *Neurologist* **16(5)**: 277–286

WILSON, E. B. (1927) Probable inference, the law of succession and statistical inference. *Journal of the American Statistical Association* **22:** 209 – 212

WRAY, J.G. (2006) Non-therapeutic docking of dogs' tails.
Veterinary Record **158(7):** 211

Other sources mentioned within the text (last accessed December 2013):

Veterinary Surgeons Act 1966 (Schedule 3 Amendment) Order 1991
http://www.legislation.gov.uk/uksi/1991/1412/contents/made

Animal Welfare Act 2006
http://www.legislation.gov.uk/ukpga/2006/45/contents

Animal Health and Welfare (Scotland) Act 2006
http://www.legislation.gov.uk/asp/2006/11/contents

Animal Health and Welfare Bill 2012 (Ireland)
http://www.agriculture.gov.ie/media/migration/animalhealthwelfare/ImportedRevisedstampeddraft18b0211doc.pdf

Docking and Nicking of Horses Act 1949
http://www.legislation.gov.uk/ukpga/1949/70/pdfs/ukpga_19490070_en.pdf

The Mutilations (Permitted Procedures) (England) Regulation 2007
http://www.legislation.gov.uk/uksi/2007/1100/made/data.pdf

The Mutilations (Permitted Procedures) (Wales) Regulations 2007
http://www.legislation.gov.uk/wsi/2007/1029/schedule/5/made

The Prohibited Procedures on Protected Animals (Exemptions) (Scotland) Regulations 2010) http://www.legislation.gov.uk/ssi/2010/387/contents/made