TAIL DOCKING

v tec E 27610a

The relationship of tail length to tail tip injuries focused on working dogs of the Spaniel and European hunt point retriever (HPR) gundog breeds in Scotland.

A survey covering the period August 2008 to July 2009

Produced by Airlie Bruce Jones

Table of Contents

1 Executive Summary

2 Introduction.

3 Scottish Background

4 New research evidence by John Houlton.

5 Methodology

6 Findings

7 Working dogs with full tails.

8 Ownership

9 How injury affects work.

10 The effect of tail injuries on the working dog.

11 Conclusions

12 Recommendations

References and Appendices
Appendix 1 Injuries and costs
Appendix 2 Cause of injury
Appendix 3 Tail statistics
Appendix 4 Defra/RVC study
Appendix 5 BioSS summary

1 Executive Summary v20510

1.1. The Scottish Government banned tail docking for all dogs in 2007. Before then, tail shortening was a commonly performed veterinary procedure and there was little evidence of the injuries that working dogs, of the traditionally docked gundog breeds, could suffer if they worked with full tails.

1.2. Consultation with the Royal Veterinary College in March 2007 on the remit from DEFRA for their survey of tail injury in dogs of all breeds suggested that it was not directed towards the identification of the specific problems which had been created for Scottish working dogs.

1.3. Consequently, the remit of this Scottish based survey was to discover what, if any, tail injuries may have occurred to working gundogs from August 2008 to July 2009, when dogs born after the docking ban started to work with full tails. The survey focused on gathering information which could be statistically analysed to identify the tail length at which working dogs appear to be protected from tail tip injuries and establish what the effects were on young dogs starting a working life with a full undocked tail.

1.4. Biomathematics and Statistics Scotland (BioSS) advised on the protocols used in carrying out the survey and produced a full statistical analysis of the results. The full details of their analysis are in **Appendix 5**.

1.5. Labradors, Retrievers and Collies, when working, are rarely affected by tail injuries because of the way these dogs use their tails. However, about 40% of working gundogs are hunters, not retrievers or sheep herders, and come from the Spaniel and European hunt point retrieve (HPR) breeds. These dogs use their tails continuously when hunting and have normally had their tails shortened in the past**.** The survey concentrated on the working members of these breeds as they are the ones that were assumed to be most affected by the Scottish tail docking ban.

.

1.6. Responses were received from the owners of over 450 working dogs of all breeds. The other working breed dogs, Labradors, Retrievers, Collies and Terriers were noted but not included in the analysis.

1.7. BioSS analysed the returns from 156 owners covering 319 working Spaniels and HPR dogs, with particular focus on returns from individuals who owned two or more dogs, some of which were injured and some not, on the basis that this was potentially the most statistically valid and unbiased sub-group of dogs.

o There were 287 Spaniels that worked in the survey period. Those that did not were discounted. 57 Spaniels had full tails and 230 Spaniels had had tails shortened as puppies. There were also 21 HPRs.

Full tailed dogs

o 57 of the Spaniels, 20.5% of all the surveyed dogs, were not docked and had full tails of between 8”/20cms and 20”/50cms in length. 46 (80.7%) of these dogs suffered tail-tip injuries. Spaniels from the sub-group of those owning three or more dogs had a statistically similar experience of tail tip injuries.

o 44 dogs with injured tails had repeated injuries with 19 of them never healing properly.

o 24 dogs (48%) of the injured full tailed Spaniels subsequently had their tails shortened to a safe length by partial amputation to resolve a healing problem during the survey period.

o 36 of the tail injured dogs were treated by vets, and 24 of these required surgery

(referred to above). Owners treated 22 dogs with veterinary medication and 8 dogs had injuries which reoccurred so often that they had to stop working - and in 4 cases - be permanently re-homed. A further group of 6/8 owners whose dogs were injured during the survey period are awaiting a veterinary decision to operate and shorten the damaged tails of their dogs.

- 78% of young dogs with tails over 10"/25cms were injured during their first season of work.

Dogs with shortened tails.

- The spaniels that had had their tails shortened as puppies and had a tail lengths at maturity of between 6"/15cms and 10"/25cms, (referred to as long docks), 12 dogs (9.2%) subsequently received an injured tail and 2 had partial amputations to cure the problem.

- **Of the spaniels that had had their tails shortened as puppies to under 6"/15cms (short docks), none suffered an injured tail**.

1.8. When analysed according to the stringent conditions defined by BioSS, the study has identified strong statistically significant evidence that working dogs belonging to the Springer and Cocker spaniel breeds have a higher risk of injury associated with longer tails. A similar effect was observed for HPR dogs, but that effect was not formally statistically significant. *****

1.9. No other risk factors were found to be statistically significant in explaining injury, though of course this does not mean that other, unrecorded, factors were not operational. The results do suggest, however, that longer tails are an important predispositional risk, either alone or in interaction with other risk factors.

1.10. In Cocker and Springer Spaniels Length of Tail was found to be the only statistically significant explanatory variable ($p<0.001$), where increased length equated to increased risk.

1.11. This effect can be quantified as saying that the odds of a Cocker Spaniel in this population having an injury increase by a factor of 2.4 for every extra inch of tail length; the odds of a Springer Spaniel in this population having an injury increase by a factor of 13 for every extra inch of tail length.

1.12. The survey shows that there has been a documented increase in tail injuries for young working dogs with full tails since the tail docking ban. In most cases these dogs suffer multiple injuries, requiring extended treatment and resulting in reduced time working. Reoccurring injuries mean that a partial tail amputation becomes a necessity for those dogs that are required to carry out regular work.*

1.13. This report recommends:

A. Scottish Government to amend the Prohibited Procedures on Protected Animals (Exemptions) (Scotland) Regulations 2007 to allow the prophylactic tail shortening of working dogs under tightly specified circumstances. (Vets should be allowed to make the decision to shorten the tails of working dog puppies at 3 days old when they know that the puppies are likely to go to working homes.)

B. Tail lengths of spaniel puppies should be reduced so that the adult tail length is less than 8" (20cms) to avoid the probability of a future tail tip injury and consequential need for an amputation later in life. Similar recommendations could be made for HPRs.

* The size of these effects cannot be used to make statements about the risk of injury in the more general non working dog population. All the statistics quoted apply to the surveyed group of Spaniels working during the season 2008 - 2009.

2. Introduction

The Spaniels and the European Hunt Point Retrievers (HPRs) are gundog breeds selectively bred over centuries to find by scent, hunt out and retrieve game or quarry, alive or dead. In the 21st Century these inherent skills and the sheer dogged enthusiasm for hunting are recognised as being of immense value for seeking out victims of accidents, drugs, explosives in military, police and rescue services as well as deer control, rabbit clearance and recreational shooting. These dogs work their tails vigorously all the time that they are hunting**.**

The 2007 Animal Welfare Legislation banning the tail docking of all puppies for prophylactic reasons in April 2007, with no exceptions for any breeds of working dogs, has forced the latest generation of Scottish born working Spaniels and HPRs to start work with “Full tails”. Ref 1

Certain working dog breeds such as Collies, Labradors and Retrievers are rarely affected by tail injuries because of the way these animals use their tails. A BASC survey of Gundogs found that **Spaniels and European hunt point retriever (HPR) breeds** are at least 40% of the working gundogs**.** Ref 2.
The survey is therefore directed at the working members of these breeds as they, along with many types of working terrier, are the ones which in the past have always had their tails shortened as puppies and are the most vulnerable to the effects of the tail docking ban because of the way they use them.

The full tail lengths of mature Spaniel and HPR breeds are normally in the range of from 9 to 20 inches long. They have a very thin and whip like end tip with only a light covering of fine hair which for many dogs gives no effective protection.

Unfortunately when training, exercising and working in the countryside and woodland their tails are continuously bashed against vegetation, bushes, gorse, scrub, bracken, undergrowth and brushwood. 95% of the dogs in this survey live, exercise and work off the lead in rural situations.

As a result their tail tips suffer abrasive injuries and cuts from contact with undergrowth and other hard objects encountered when working. The abrasions this causes in time split, bleed and the tail becomes traumatised.

Vulnerable Full tail in places like this and what is underneath the hair

During the last century when these breeds of working dogs have always been docked, as a prophylactic measure, there is no credible evidence of tail injuries occurring to these breeds**.** Ref 3

3. The Scottish Situation

In April 2007 the Scottish Government introduced a total ban on tail docking and included all breeds of working dogs. Up until then it had been a near uniform practice in rural Scotland for vets to shorten the tails of working Spaniel and HPR puppies, within 5 days of birth, in order to protect them from injuries which could be incurred when carrying out their normal working activities. **Ref 4**

As owners considered tail shortening essential for Spaniel, HPR and terrier puppies which were going to work prior to the ban, there was little or no evidence at that time as to what tail injuries might be incurred if dogs were worked with a full tail. Government advisers were unable to consider whether any working gundog breeds, which were traditionally docked as puppies, were being docked for sound practical reasons. There was a lack of relevant evidence to justify granting a prophylactic exemption.

“Prophylactic”, in connection with dogs’ tails, is defined by the Royal College of Veterinary Surgeons (RCVS) as “undertaken for the necessary protection of the given dog from risks to that dog of disease or of injury which are likely to arise in the future from the retention of the entire tail. The test of likelihood is whether or not such outcome will probably arise in the case of that dog if it is not docked.”

The Scottish Government decision seems to have been based upon the advice of the RCVS who claimed that any exemption is a technical loophole which others, with traditional or purely cosmetic justifications, would be able to use. It was not denied that specific working dog breeds could become vulnerable if their tails were not docked, but as they were nearly all docked there was no proof of this available. The 100% ban would, however, make Scotland a test area.

An exemption for specified working breeds in England with specific criteria to be met and specified exclusions from dog showing activities for docked dogs was made. This exemption was introduced based on informed contributions from working dog owners, users, Police, Customs, Military and Rescue Organisations. This was not accepted as valid for Scotland. Ref 5

4. Recent Research during 2007 to 2009

In March 2008 John Houlton of Davies Veterinary Specialists reported on his survey of the types and causes of injuries to working dogs carried out over 2 years on 1312 dogs.
This included 409 docked Spaniels and only 3.7% of these suffered any tail injury.
There were however a further 22 Spaniels (5.1of all Spaniels) that had Full tails and 27% of these had tail injuries.
“Using Fishers exact test on these undocked dogs, a highly significant statistical association was found between undocked dogs and tail injuries in both Springer and Cocker Spaniels breeds”.

This clearly indicated that Cocker and Springer Spaniels, if left undocked as pups and used for work, were much more vulnerable to tail injuries than the other gundog breeds - 11 times more vulnerable in this survey.
The Houlton survey noted that 53% of the injuries were managed by the owners and not treated by veterinarians. Ref 6

The Royal Veterinary College/University of Bristol is currently undertaking a general case-control survey based on cluster sampling through veterinary practices. Anecdotally, however, this study is apparently collecting data equally in a 2 by 3 structure across Urban/Rural and Scotland/England/Wales from all dogs, where only a subset of animals are likely to be at higher risk of tail injury. After a visit to the Royal Veterinary College and discussions with the researchers on the protocols to be used on their survey of all dog breeds it was not clear whether their survey would have sufficient power to find the type of effect indicated by anecdotal evidence which was to be expected from within the narrow specialised field of Scottish working dogs. See Appendix 4

5. Methodology

The 2008/2009 survey was focused on owners who actually worked their dogs during 2008 and 2009. The survey form and protocols were drawn up under the guidance of BioSS (Animal Health and Welfare - Biomathematics & Statistics Scotland) and with much considered assistance from veterinary advisors. Ref 7
The full details are contained in the BioSS statistical report in Appendix 5.

The working dog owners were informed of the study via a number of rural organisations, via shoot managers and word of mouth**.** Ref 8. People who had heard about the tail docking petition, carried out earlier, asked their membership associations what was happening and were given information about the survey at country fairs.

This study has used a questionnaire survey form which has been completed by the owners of working **Cocker Spaniels, Springer Spaniels and European hunt point retrievers** (HPRs) covering the year from August 2008 to July 2009.

The importance of getting accurate information about all their dogs' tail lengths as well as the details of the work they carried out was emphasised in writing, in the survey form and verbally.

The dog owners were asked to return the forms for every one of their working dogs of the Spaniel and HPR breeds that had worked in that season. They were also asked to report what other working dogs they used. They returned an information count on their other working breeds, which included Labradors English Pointers Retrievers Collies and Terriers. These other working dogs were noted, counted in the total but excluded from any detailed analysis.

The survey document was in 19 sections. The first 10 covering in detail each dogs breeding age and confirmation, measurements of shoulder height and tail, location of living, exercise and work, days worked, type of sites and working conditions. The next 9 sections were only required if the dog received an injury. It covered the causes if known, the treatment, subsequent recuperation history and veterinary involvement.

Responses were received from over 160 dog workers with an average of 2.8 dogs each of all breeds. Over 450 dogs in total. Respondents' ownership varied from single dogs up to 10 dogs. Ref 10.

Owners who failed initially to fill in a form for every one of the Spaniel or HPR dogs in their use or ownership were contacted individually to complete forms for all of them to make sure that the sample was not selective and that all their dogs were available for analysis. The number of their other working breed dogs was counted only.
7 records were discarded because although the dogs had worked a lifetime without tail injury they were now retired and had not worked during the survey period. 5 were discarded because although still owned they were unable to work due to recurrent tail injury. All dogs of some owners that were uninjured but gave no tail length information were also excluded.

Table 1
Dogs belonging to 156 owners included in BioSS statistical analysis at data lock all of which worked in 2008/2009 season. Ref 9

Springer Spaniels	176
Cocker Spaniels	111
Total Spaniels Used for Analysis	287
HPRs	21
Other (missing sheet, info discounted.)	12
Total dogs surveyed	**320**
Other breed dogs owned and worked but not analysed.	95
Total	**415**

To avoid any confusion between different dog breeds the main analysis has been carried out on the Springer and Cocker Spaniel breeds.
The statistics for the Hunt Point Retrievers were considered separately but they show similar trends but on a much smaller survey group.

Statistical analyses by BioSS have been carried out using Genstat 12th edition, using various linear regression, generalised linear modelling, linear mixed modelling and generalised linear mixed modelling approaches as appropriate to the data.

6. Findings

The BioSS statistical analysis has concentrated on the Spaniel breeds because of the higher numbers available for these breeds. The number of HPRs was to low to provide significantly statistical evidence although the results were similar.

Spaniels with Full tails.
There were 57 Cockers and Springer Spaniels with undocked full tails between 8" and 20" long.
Of these 46 dogs (80.7%) had a tail injury.
During the survey period 24 (52%) of the 46 full tailed injured Spaniels had a partial amputation to finally cure the problem. A minimum of 8 more injured Spaniels owners' were expecting their dogs to have an operation due to the repeated reoccurrence of the injury and the dog's continued discomfort.
Only 11 of the 57 Spaniels with full tails were as yet uninjured. These dogs tails ranged from 9" to 12 " and were at the shorter end of the full tail lengths recorded.

Long docks. Tail docking terms see Ref 10
There were 137 Cocker and Springer Spaniels which were docked as puppies with mature tails between 6" and 10"long (long docks). 12 dogs (9%), which had been docked at these lengths, subsequently received a tail injury.
2 of these dogs had an amputation to resolve the problem, 5 have recurring problems and 2 have stopped working completely and the remainder were able to work on a reduced or occasional basis.

Short docks.
NO dogs with mature tails under 6"(short docks) were injured.

Table 2. Dogs in the BioSS analysis that worked in 2008/2009

Spaniels – Cockers and Springers	Total No of dogs	No of injured dogs	% of injured dogs	No of dogs requiring Amputation	% of injured dogs requiring amputation
Full Tails	57	46	81%	24	52%
Long Dock as pups 8 to under 10"	40	6	15%	2	33%
Long Dock as pups 6- under 8"	97	6	6%	0	0%
Short Docks as pups under 6"	92	0	0%	0	0%

For full data see Appendix 1.

Discussion

The tail length measurements indicated that **in our sample group of docked dogs** with tails between 6" and under 8" long about 6% might receive a tail injury whereas those with tails of 8 to 10" long the chances of injury increased to 15%.
But up to **81% of all Spaniels with full tails** did receive a tail injury.

The Houlton Survey (Ref 6**)** recorded 410 docked Spaniels which had 15 tail injuries amounting to 3.6%.
In this survey (2008/09) there are a total of 229 docked Spaniels and 12 dogs (5.2%) had a tail injury – a reasonably comparable proportion.

Further analysis looking at the Cocker Spaniels separately from the Springer Spaniels found that 16 out of the 21 of the full tailed Cocker Spaniels 76% dogs were injured. Cockers appeared to be slightly less vulnerable than the Springer Spaniels. 86% of the full tailed Springer spaniels were injured.

The BioSS statistical analysis in Appendix 1 suggests that for this group of surveyed dogs " ***the odds of a cocker spaniel having an injury increase by a factor of 2.4 for every extra inch of tail length and the odds of a springer spaniel having an injury increase by a factor of 13 for every extra inch of tail length."*** Ref 11

As there was no obvious difference between the work carried out by Cocker and Springer Spaniels the lower injury rate for Cockers is likely to be accounted for by the fact that as smaller dogs they appear to have proportionately shorter tails. The average measurements of shoulder heights of the surveyed dogs were as follows.
Cocker Spaniels Shoulder height - 15.6
Springers Spaniels Shoulder height - 17"
BioSS analysis however found no statistically significant evidence that shoulder height alone was a risk factor.

On examination of the full survey statistics BioSS analysis included "*Breed, Height to Shoulder, Animal off lead, Rural environment, and Sex of animal and all exhibited no statistically significant evidence of being a risk factor (although it should be noted that only 14 responses were from non-rural animals, giving a negligible power to detect differences between rural and non-rural animals)".*

"However a detailed examination of the dogs age, whether the animal was less than 3 years old and the number of days worked were also studied and associated with tail length."

"When analysing the effect of age and tail length there was little difference in the tail length distributions in different years. However in the dog group aged 2y.o. and 1y.o. there were tail length distributions which were steadily shifting towards longer median tail length values in younger animals". See Appendix 5

"Focusing only on younger animals, in which age classes there was a wide and relatively balanced range of tail length, fitting a model incorporating both age and tail length showed that little of the variability was explained by the age (p=0.16) but much was explained by tail length (p<0.001)." Ref 12

The following sections expand on these points.

7. Working full tailed dogs

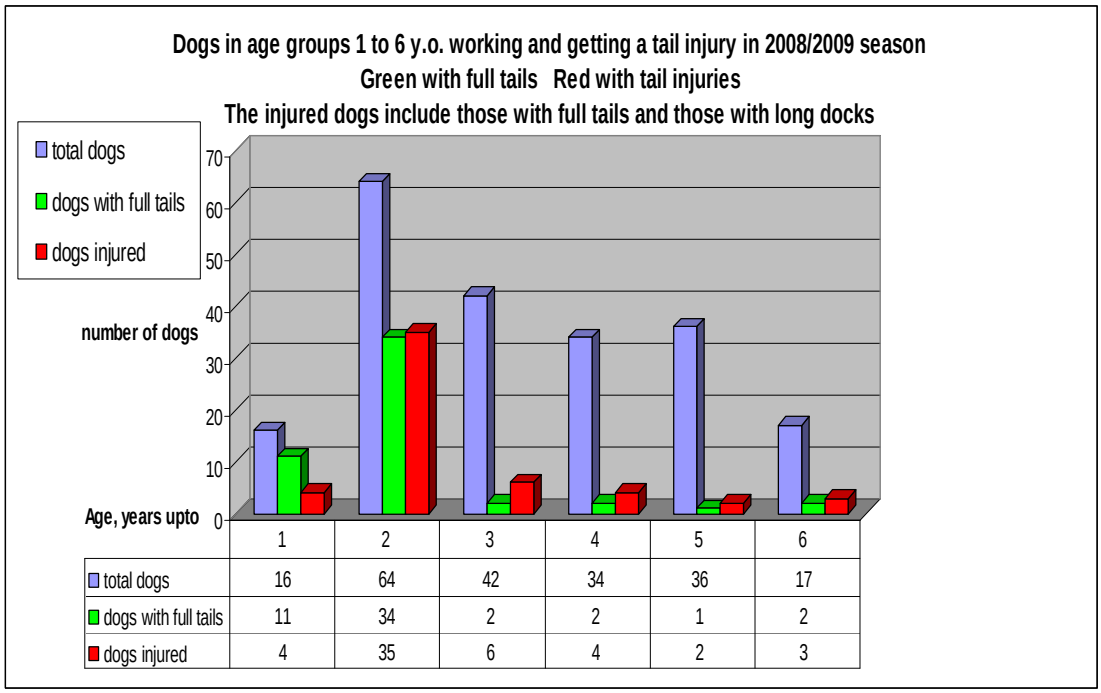
After the tail docking ban in April 2007 the 2008/2009 was the first shooting season that young dogs, born in Scotland, could start work. This explains the sharp increase in young dogs with full tails aged between 1 and 2 years old which have appeared in the survey.

44 full tailed dogs 2 years old and under began work in the 2008/2009 shooting season. Unfortunately, of these, 34 (77.3%) subsequently suffered a tail injury. 16 of the dogs with tail injuries have since required a partial tail amputation which experienced vets appear to consider to be the only effective long term remedy for reoccurring tail tip injuries. 5 are awaiting amputations and 7 have stopped working. The remainder are recording ongoing problems.
33 other dogs, all docked and born before the ban or imported from outside Scotland started work during the season. 4 (12%) with Long tails of 7", 8.5", 9.5", and 10" were injured.

In the 3 years prior to the ban on prophylactic tail docking, this survey records that 112 young dogs entered work. Only 5 (4.5%) of these 112 dogs had full tails. All 5 full tailed dogs were subsequently injured.
It is interesting to note that in John Houston's Survey of general gundog injuries there were also only 5% of the Spaniels with full tails. This is not surprising as the laws were the same on either side of the national borders.

The rise in numbers of full tailed dogs
The next chart illustrates the sharp rise in young dogs with full tails between 1 and 2 years old born after the ban and entering work for the first time in 2008.
The chart also shows the high number of tail tip injuries in 2008/2009 received by dogs working with undocked full tails and the relatively lower proportion of injuries experienced by older dogs that had had their tails shortened as puppies. Older dogs with tail injuries that have not had a partial tail amputation have injuries which reoccur annually.

Chart 3 This chart illustrates the sharp increase in full tailed dogs born after the docking ban and the increase in tail injuries which they incurred in their first working season. The older dogs whose tails were first injured in earlier years, but had not had a tail shortening amputation, also reported their injuries reoccuring in the 208/2009 season.



	1	2	3	4	5	6
total dogs	16	64	42	34	36	17
dogs with full tails	11	34	2	2	1	2
dogs injured	4	35	6	4	2	3

The chart also shows that young full tailed Spaniels under 1 year old working on training activities, are already reporting injury. 36.4% are affected and from this evidence further injuries can be expected in the season 2009/2010.

8 Ownership and multiple dog owners

Working dog owners who responded to the survey reported that they owned between 1 and 10 dogs.

61 respondents had 3 or more dogs and had occupations for which their dogs were an essential requirement.
Such occupations were gamekeepers, wildlife rangers, vermin controllers, police, forestry and deer stalkers as well as people who regularly engaged in dog work on a part time basis or in their retirement. Some recorded up to 150 days and more of work for their dogs during the year.
The group however averaged 55 days worked per dog

91 dog owners who responded had 1 or 2 dogs.
These were regular part time helpers or participants in shooting sports, with full time employment elsewhere. These people worked their dogs regularly throughout the game shooting season some also recording up to 150 days and more of work. Out of season most of these dogs were treated as companion dogs and working pets.
These dogs worked on average 28 days per dog.

Although the first group worked on average 55 days per year and the second 28 days per year the proportion of tail injured dogs was similar at 23% and 25.3% respectively.

When assessed by age, which of course includes several years of work, exposure for older dogs the likelihood of injury does not appear to increase significantly. However dogs of 3 years and over in the survey were rarely without an injury if they have a full tail.

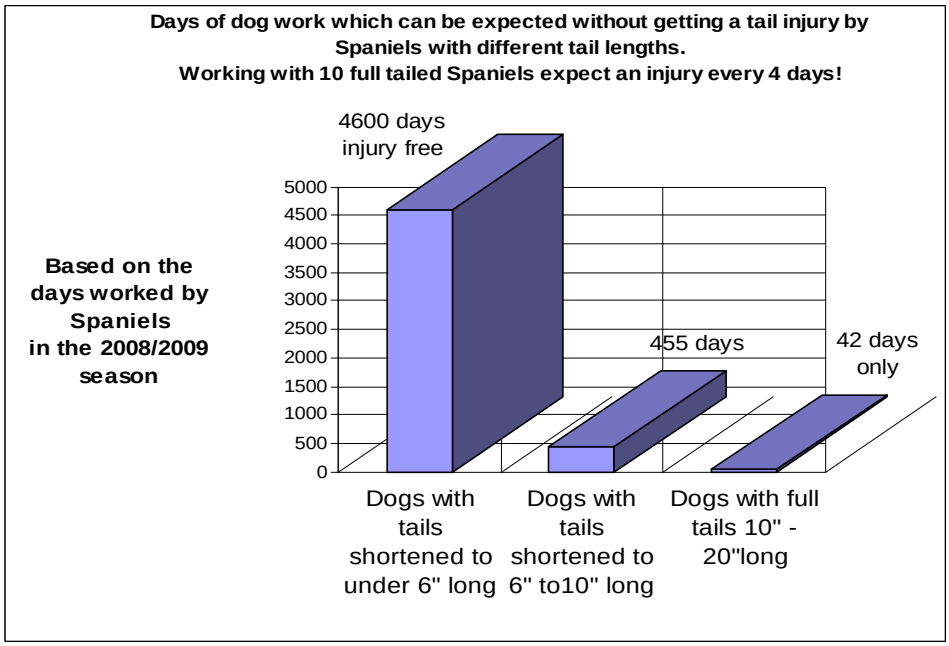
In their statistical analysis Bioss identified and assessed "***a sub group of 29 owners with 3 or more dogs, which consisted of 101 records, some, but not all of which have a history of injury. This was then compared to the whole survey group. The estimated values were qualitatively similar in each case, Length of tail is a risk factor, statistically significantly so, for the Spaniel breeds***."

9. How injury affects work

In the survey
295 Spaniels recorded 13373 days of work.
93 Short tailed spaniels carried out 4825 days work without injury.
142 Long docked Spaniels carried out 6464 days of work suffering 13 injuries. The 61 full tailed Spaniels worked 2046 days and suffered 50 injuries.

"Examining the explanatory variables Days Worked and Length of Tail", **BioSS analysis found that *"animals with longer tails tended to have worked for fewer days than those with shorter tails".***

Chart 4 This chart shows the practical effect of tail tip injuries on the work capacity of the whole group of dogs covered by the survey. Note this chart includes additional dogs recorded after data lock.



Clearly most of the dogs with full tails, which received a tail injury, could not work the same number of days as the docked ones. An injured tail requires a significant period of zero work activity to try to allow the wound to heal.

The kind of work the dogs carried out and an indication of what they were doing when the injury occurred are recorded in Appendix 2

10. The effect of tail injuries on the working dog.

In practise many full tailed Spaniels do not seem to be able to work consistently for 20 to 50 days without damaging their tail. They then need to stop work to recover which can take from 2 to 16 weeks in some cases. Often the dog tail can heal only to experience the injury returning again during the next few days work.

The usual sequel to a tail tip injury is the extended period of healing time and what seems to be inevitable reoccurrences until the veterinary surgeon agrees to carry out a remedial partial amputation operation**.**

In the survey 44 dogs were found to have recurrent injuries. These were mostly abrasions which developed, over time into swellings and cuts. 12 of these have had injuries which “never healed properly” and more than half of them have already had a partial tail amputation during the year, with a further 8, at least awaiting, a vet’s agreement to amputate. 3 dogs had required multiple operations due to complications.

The dogs with injured tails can only continue doing their job under an occasional light work regime. This allowed some people to “manage” the situation where the dog work requirement is not intensive.

Owners have rapidly become aware that, for a dog to work several days a week, the permanent cure for a tail tip injury is a partial amputation to remove the vulnerable tail end. 8 dogs, however, had to stop working on a permanent basis, some were given away but had to be replaced.

Table 5 Injuries suffered by all the surveyed dogs.

Number. of dogs suffering tail injuries	**58**	
Type of injuries received		
Abrasions and cuts	**51**	**88%**
Breaks	**6**	**10%**
Re-occurring	**44**	**76%**
Never healing properly	**17**	**30.2%**
Amputations	**26**	**44.8%**
Average healing weeks	**6.5**	

In this survey 36 (62 %) of the injured dogs were treated by vets.
The owners of the other tail injured dogs opted to administer treatment themselves until the injury either healed or developed to a stage that the vet could agree to operate.

What the vet needs to see to justify carrying out a remedial operation

11. Conclusion

The statistical model identifies length of tail as a risk factor for injury.

The study has identified strong statistical evidence that working dogs belonging to the Springer and Cocker spaniel breeds have a higher risk of injury associated with longer tails. For both spaniel breeds the effect is highly statistically significant ($p<0.001$ in both cases).

It is also a risk factor for HPR (Hunt Point Retrieve) animals, but there were insufficient dogs recorded to provide a statistically significant result ($p=0.18$).

The results from the full survey analysis and the restricted analysis of the subgroup of multiple dog owners which are potentially less subject to bias are qualitatively identical, This, BioSS says, provides additional confidence in the robustness of the conclusions.

Tails on Spaniels and HPRs are very vulnerable if more than 8" (20cms) long.
Tails under 6" (15cms) are very unlikely to have an injury.

Full undocked tails of Spaniels and HPRs are in the acute danger zone. The fragile end of a full tail is quite obviously at a many times greater risk of receiving the progressive damage and healing problems which respondents have recorded and is now common amongst people trying to work with full tailed dogs. The risk is worst for the longer tailed Springer Spaniels where Bioss quantified the risk of injury as an additional factor of 13 for every inch of longer tail length. *

12. Recommendation

A. Scottish Government to amend the Prohibited Procedures on Protected Animals (Exemptions) (Scotland) Regulations 2007 to allow the prophylactic tail shortening of working dogs under tightly specified circumstances. Vets should be allowed to make the decision to shorten the tails of working dog puppies at 3 days old when they know that the puppies are likely to go to working homes.

B. Tail lengths of spaniel puppies should be reduced so that the adult tail length is less than 8" (20cms) to avoid the probability of a future tail tip injury and consequential need for an amputation later in life.

C. Similar recommendations could be made for HPRs.

D. This will be a real improvement in animal welfare for a small and clearly identifiable group of working dog breeds and allow continuity of local Scottish working dog blood lines.

* The size of these effects cannot be used to make statements about the risk of injury in the more general non working dog population.

All the statistics quoted apply to the surveyed group of Spaniels working during the season 2008 - 2009.

References

Ref 1
"Prophylactic docking", in connection with dogs' tails, has been legally defined for the Royal College of Veterinary Surgeons as "undertaken for the necessary protection of the given dog from risks to that dog of disease or of injury which is likely to arise in the future from the retention of the entire tail.
The test of likelihood is whether or not such outcome will probably arise in the case of that dog if it is not docked."
See also RCVS r. Tail-docking (dogs) at RCVS.org.uk June2007

Ref 2
BASC study of working dog breeds owned by members.

Ref 3
No credible evidence. The reason given repeatedly by the anti tail docking lobby for the support of a general ban on tail docking of dogs.

Ref 4
Scottish Regulations Animal Health and Welfare (Scotland) Act 2006 asp 11 Part 2 Animal Welfare Section 20 Mutilations. Sub section 5(b) and (c) give the route to exceptions by regulation. Also sub section 3.

Ref 5
English Act the exemption for working dogs - Animal Welfare Act 2006 Chapter 45 Sections 5 Mutilation and 6 Docking of dogs tails paras 1-16. Statutory Instrument 2007 No1120. The Docking of Working Dogs Tails(England) Regulations 2007. in force from 6th April 2007

Ref 6
A survey of gundog lameness and injuries in Great Britain in shooting seasons 2005/2006 and 2006/2007. JEF Houlton Davies Veterinary Specialists, Higham Gobian Hertfordshire UK Accepted March 19 2008
Veterinary and Comparative Orthopaedics & Traumatology 3/2008

Ref 7
BioSS - Animal Health and Welfare - Biomathematics & Statistics Scotland
The orginisation is a charity which is one of the main Research Providers for strategic research in environmental, agricultural and biological science funded by the Scottish Governments's Rural and Environment Research and analysis Directorate.

Ref 8
The following rural organisations aided the survey work.
BASC Scotland - British Association for Shooting and Conservation (Scotland)
SCA – Scottish Countryside Alliance
SGA - Scottish Gamekeepers Association.
NOBS - National Organisation for Beaters and Pickers Up.

Ref 9
"Data lock (and hence the subsequent statistical analysis by BioSS) was carried out on the dogs whose details had been confirmed by September 2009."
Additional dogs whose details were confirmed later and worked during the 2008 /2009 season were added to the totals but these merely confirmed the earlier findings and the BioSS statistical analysis. Their returned information is included in the tables and charts unless otherwise stated.

Ref 10
Tail docking shortening terms and measuements.

A **Full tail** is one which has been allowed to grow and mature to its full length.

A "L**ong dock"** is a term used in this survey for the tail of those dogs docked as puppies whose mature tails are between 6 and 10 inches (15- 25cms)long. It is favoured by people who want a long tail on their dog. About 10% of these dogs may get a tail tip injury when working. Prior to the ban in Scotland these were the main source of occasional tail injuries in Scotland.

A "S**hort dock"** is the mature dog's tail, which is less than 6 inches (15cms) long, which appears from this survey to be immune to injury. It is the length favoured by people who use dogs for regular work which involves the dog hunting through cover.

Measurements
Imperial measure suits the people in this survey who have had to measure their dogs' tails which is not easy as dogs hate their tails being touched.
Measure to the nearest inch is accurate enough to show the difference between Short docks, Long docks and Full tails.

Ref 11*
The size of these effects cannot be used to make statements about the risk of injury in the more general non working dog population. All the statistics quoted apply to the surveyed group of Spaniels working during the season 2008 - 2009.

Ref 12
The statistical significance of $p<0.001$
There is a probability, "p", of only 1 chance in 1000 that the findings or conclusions reached are incorrect.
There is a 0.1% chance that the conclusion is incorrect or a 99.9% chance that it is correct.

Appendix 1

This table shows how the severity of the tail tip injuries has been assessed.

Table H Tail Injury Treatment	Injury Grade	No of dogs	
Tail injury, normally recurring but managed by the owner without veterinary intervention. Some injuries being managed by light work or early retiral.	1&2	22	38%
Tail injuries requiring one or more veterinary consultations including any treatment stopping short of removal of any tail vertebrae (amputation)	3	12	21%
Tail injury requiring one or more consultations with a veterinary surgeon. Single surgical procedure involving the removal of one or more tail vertebrae, required to achieve healing.	4	18	27%
Tail injury requiring two or more consultations with a veterinary surgeon. More than one surgical procedure involving removal of one or more tail vertebrae required to achieve healing or at least one unsuccessful surgical procedure leading to euthanasia of the dog on medical grounds advised by the veterinary surgeon or economic grounds as decided by the owner	5&6	8	14%
		58	100%

Grade 1and 2 injuries were treated by the owners, in some cases over several years. The owners were usually unwilling to put their dogs through an amputation operation either for financial reasons or because they were actually able to reduce the incidence of injury by reduced working activity. Because of the reoccurring nature of the injuries 5 of these dogs were given away but had to be replaced. The remainder are candidates for amputation if their recurring injuries are to be permanently cured.

Grade 3 injuries are all candidates for an amputation later in life, early retiral, or to be given away.

Grade 4 included those dogs which were injured and are required to work several days each week. They had to have an amputation as soon as possible as there appeared to be no practical alternative.
All these dogs resumed full time work when the hair had regrown and a natural protective furry cushion was in place at the end of the shortened tail. This could take up to 3 months or more.

Grade5/6 injury dogs have had to have multiple operations. These appear to have been caused by infection getting into the tail wound. The tails have been left long after the first amputation which allowed infection to enter due to the dog or the surgical collar rim being able to connect with the injured area. In one case there was also insufficient unaffected skin retained to cover the bone properly.

Indicative costs of tail injury to working dog owners.

30 respondents gave indicative estimates of the costs of their dog's injuries.
These totalled £13,942
26 people provided the costs of amputations. These ranged from £750 to £1500 for complicated treatment involving repeated veterinary visits and multiple remedial amputations.
For the majority a normal amputation treatment without complications costs from £200 to £350. Only 4 of these cost under £200.
1 respondant included the cost of a replacement dog after experiencing repeated injuries with costs estimated at £2000.

Appendix 2
Causes of injury.

52 dogs that were injured were analysed for what their normal working activities were, where they carried them out and what their owners thought their dogs were doing when the injury was caused.

Normal working activities.

Training	17.1%
Hunting which includes beating, picking up, shooting over dogs, gamekeeping.	77.2%
Other activities which includes dog trials, wild fowling, vermin control, deer stalking, police work	5.6%

The type of working site conditions in which injured dogs worked

Moorland	14.1%
Forestry gorse and Bracken	23.7%
Low ground, in game crops and stubbles	22.8%
Low ground woods	24.5%
Walking up	10.8%
Buildings and built environment.	4.1%

Note. Most dogs worked in more than one of these cond

Activity at time of injury	
Hunting - Beating	40.7%
Hunting- Picking up	26.0%
Pointing	1.3%
Hunting in exercise	14.7%
Training	4.7%
Kennels and buildings	11.3%
Vehicles	1.3%

Hunting is clearly the major activity involved with injury.

Appendix 3

This table shows all the Spaniels whose owners responded to the survey. Those which were discounted for various reasons ie retired, insufficient details, unable to work, excluded by data lock etc are shown as a reduction in numbers at the bottom.

Spaniels	Total No of dogs	No of Un-injured dogs	% of Un-injured dogs	No of Injured dogs	% of Injured Dogs	No of Dogs requiring amputation	% of **Injured** Dogs Requiring amputation.
Full Tails unknown original length	20	0	0.0%	20	100%	17	85%
Full Tails 10 -20”	38	10	26.3%	28	73.7%	7	25.0%
Full Tails 8-10”	3	1	33.3%	2	66.6%	0	0.0%
Full Tails Totals	**61**	**11**	**18.0%**	**50**	**82.0%**	**24**	**48.0%**
Long Docks unknown original length	1	0	0.0%	1	100%	1	100%
Long Dock as pups 8 to 10”	41	35	85.4%	6	14.6%	1	16.7%
Long Dock as pups 6-under 8”	98	92	93.9%	6	6.1%	0	0%
Short Docks as pups under 6”	95	95	100.0 %	0	0 (0%)	0	0%
Totals Docked Dogs	**234**	**222**	**94.9%**	**13**	**5.6%**	**2**	**15.4%**
Tail info missing	2	2	0.0%	0	0.0%	0	0.0%
Total Spaniels	**298**	**235**	**78.2%**	**63**	**21.1%**	**26**	
Discounted by BioSS	**11**	**6**		**5**		**0**	
Analysed by BioSS	**287**	**229**	**79.7%**	**58**	**20.2%**	**26**	**44.8%**

Appendix 4

Defra/RVC survey

The Royal Veterinary College/University of Bristol is currently undertaking a general case-control survey based on cluster sampling through veterinary practices. Anecdotally, however, this study is apparently collecting data equally in a 2 by 3 structure across Urban/Rural and Scotland/England/Wales from all dogs, where only a subset of animals are likely to be at higher risk of tail injury. It is not clear whether the exercise will have sufficient power to find the type of effect indicated by anecdotal evidence from the Scottish field.

BioSS comment that ideally the focus of a study of Scottish working dogs would, however, be different to that of the RVC study, since it would preferably focus on rural working dogs. This is what the 2008/2009 Survey has done.

RVC research team was asked in March 2008 if they would carry out a study based on actual working dogs but after consideration they declined at that time.

RVC Tail injury study – data collection protocol

1) 10 veterinary practices will initially be sampled per country – England, Scotland and Wales (30 practices in total)
2) Within each country, 5 practices located in urban areas and 5 practices located in rural areas will be selected
3) These practices will be contacted and asked to participate
4) All dogs that have been seen or treated for a tail injury within the last 12 months will be selected and a random sample of dogs that have been seen in the last 12 months but not for a tail injury
5) For these selected dogs, a questionnaire will be sent to each of their owners
6) Therefore data will be collected from both the veterinary practice and the owner
7) By, this it is hoped we will obtain approximately 250 to 300 cases of tail injuries and approximately 1200 dogs without injuries, spread evenly between the 3 countries.
8) If possible we will try to increase our sample size and therefore more veterinary practices will be randomly selected, dependent on funding and time.

BioSS - Animal Health and Welfare - Biomathematics & Statistics Scotland

1 The full statistical calculation report covering 102 pages of analysis is available if required but not reproduced here.
2 The report Summary, Discussions and Conclusions are reproduced in full below in Appendix 5.

Appendix 5

Working Dog Injury Survey Analysis

Iain McKendrick
Biomathematics & Statistics Scotland
16/4/2010 Sponsor: Airlie Bruce-Jones

Executive Summary

Following detailed discussions on the design of this survey in order both to maximise power and to minimise bias, BioSS recommended that this study should

- focus on spaniels as being a relatively common group of dogs likely to be at relatively high risk, hence giving the highest power of detecting a hazard given the relatively sparse resources available;
- explicitly define 'tail injury' as having required medical treatment;
- utilise the collaborators' existing database of names and addresses, while attempting to sample further individuals at game fairs and such-like events;
- treat the sampled mean prevalences of injury as worst-case scenarios, which cannot be quoted as being relevant to the wider population of dogs;
- have a particular focus on collecting and completing datasets from owners with multiple dogs, some, but not all of which have a history of injury;
- also be analysed with the data restricted to the above sub-sample;
- be marketed and designed as a survey of risk factors in tail injury, even though tail length was the factor which was driving the exercise;
- explicitly try to encourage accurate reporting of all terms;
- collect information from a recent, short, well-defined period of time;
- try to collect information about the length of tail prior to injury, while noting that any bias arising from a failure to achieve this will be conservative in its effect.

Having reviewed the survey as conducted against the above recommendations, I have concluded that although the study probably will be subject to a number of biases and sources of excess variability, these are, with one exception, all likely to be conservative in their effect. The exception is recruitment bias, as it is impossible to be sure that the surveyed animals were drawn at random from the population about which inference is to be drawn. Recruitment bias could result from a number of different effects likely to be at work, operating in opposing directions. However, since these are all likely to be operational at the owner stratum of variability, it is believed that an analysis of data within owners, restricted to owners with multiple dogs, some but not all of which have been subject to injury, will provide relatively unbiased estimates of the risk factors. The latter analysis is also subjected to a stringent interpretation of the demand that data should be collected from a recent, short, well-defined period of time.

When analysed in this way, the study has identified strong statistical evidence that working dogs belonging to the springer and cocker breeds have a higher risk of injury associated with longer tails. A qualitatively similar effect was estimated for HPR (Hunt Point Retrieve) animals, but there was no statistical evidence that this was genuine.

No other risk factors were found to be statistically significant in explaining injury, though of course this does not mean that other, unrecorded, factors were not operational. The results do suggest, however, that longer tails are an important predispositional risk, either alone or in interaction with other risk factors.

Introduction

BioSS was approached for advice on collecting information relating to tail injuries in working dogs. Anecdotal evidence suggested that spaniels (and perhaps other working dogs) were proving more prone to tail injury subsequent to the ban on tail docking in Scotland. It was desired to collect information which would be submitted to the Scottish Government or the Scottish Parliament as a spur to further action. Any survey would be carried out on a voluntary basis, with relatively little resource. BioSS's view was that we would only undertake to work on this project if the collaborators accepted that the statistical robustness of the exercise was of the highest priority. As a safeguard against publication bias, we asked the collaborators to commit to publicising the conclusions from any statistical analysis, regardless of whether these conclusions confirmed or contradicted their hypotheses. We believe that, within the logistical constraints defined by their relative lack of resources and lack of official status, the collaborators have taken pains to live up to the high statistical standards set by BioSS, and have succeeded to an extent which has allowed a valid statistical analysis to proceed.

Other Sources of Data and Focus of Study

The Royal Veterinary College/University of Bristol is currently undertaking a general case-control survey based on cluster sampling through veterinary practices. Anecdotally, however, this study is apparently collecting data equally in a 2 by 3 structure across Urban/Rural and Scotland/England/Wales from all dogs, where only a subset of animals are likely to be at higher risk of tail injury. It is not clear whether the exercise will have sufficient power to find the type of effect indicated by anecdotal evidence from the Scottish field.

An English vet has recently published a paper reporting the results from his survey of gundog lameness and injuries in Great Britain (Houlton, 2008). The statistical analysis is no more than adequate, but the reported data do suggest that spaniels might be at a higher risk of tail injury than other breeds.

Accordingly, it was recommended that any study should

- focus on spaniels as being a relatively common group of dogs likely to be at relatively high risk, hence giving the highest power of detecting a hazard given the relatively sparse resources available.

Although the organisers of the study chose also to collect information about other breeds of dog, this should not have, in any way, invalidated their collection of spaniel data.

A study investigating issues relating to tail injury in animals requires a robust and defendable definition of injury. To avoid subjective assessments of injury, medical treatment was a useful criterion for this. It was decided not to specify that 'medical treatment' had to have been carried out by a veterinary surgeon, as such a constraint would have been overly restrictive and likely therefore to reduce the prevalence of injury to overly low levels.

Accordingly, it was recommended that any study should

- explicitly define 'tail injury' as having required medical treatment.

Possible Strategies

The ideal design for a study would be similar to that carried out by the RVC: a case-control study which matched injured animals (as they were recruited) with other animals matched on relevant properties except for docking status. This would only be possible through the involvement of veterinary practices. It would be both statistically wise and logistically necessary to utilise many veterinary practices in the study, to allow for between-practice variability and to collect sufficient numbers of animals. The focus of the study would, however, be different to that of the RVC study, since it would preferably focus on rural working dogs. A study of this size and complexity is, however, beyond the resources and logistical capacity of even the most enthusiastic volunteers.

The only alternative which is, potentially, within the capacity of a voluntary study is to survey the experiences of dog owners, collecting information about injuries accruing to their animals, while collecting data about possible risk factors. The advantage of this approach is that it might allow collection of information about a wider range of risk factors. The drawbacks are that the power to detect statistically significant effects per animal is less than in a case control study, since the focus of the study is more diffuse. There are also serious issues relating to the quality of the data collected. Retrospective data provided on a voluntary basis by owners (as opposed to veterinarians) may be subject to recruitment bias, deliberate bias, recollection bias and a higher level of variability. Nevertheless, since this is the only viable approach, it is necessary to consider how these effects can be minimised, and their likely effects assessed.

Recruitment Bias

The target population is the population of working dogs whose activities put them at potential risk of tail injury. There was no viable mechanism to explicitly define a sampling frame for the study. The collaborators had proposed contacting possible respondents via various interest groups, but in discussion it was concluded that this approach would give rise to a sample with unacceptably non-random statistical properties. If it were possible to involve a large group of veterinary practices, one option would have been for the vet to pass the questionnaires on to owners who they knew owned working dogs. However such a two-stage process would have been likely to give rise to a very low response rate. The collaborators have made contact with a large number of people with working dogs while collecting signatures for a petition, which might reasonable be characterised as a representative sample of the population of working dog owners who are concerned about the causes of tail injuries. They have frequently been contacted via personal contact at game fairs and such-like events, and indeed the participants at such events are likely to include disproportionate numbers of owners of animals in the at-risk group. Individuals contacted or re-contacted via game shows may be likely to own animals in the at-risk population, but there may be issues relating to bias in the sample. This is clearly not a sample whose *past* experiences can be used to compare incidences of injury in animals with different lengths of tail, since recruitment may well have been influenced by these past events, but it is a sample which could credibly provide data to explore whether there is any relationship between an animal's tail length and risk of injury in the *current* and *future* seasons, provided that we are confident that other sources of bias which might be present in this sample can be controlled. In fact, if recruitment is positively correlated with past injury, which in turn is positively correlated with a high potential risk of injury, then this is a set of animals within the wider at-risk group which would provide a statistically more powerful sample to detect any relationship of injury with tail-length. The corollary is, however, that the actual observed mean prevalence of injuries is unlikely to be representative even of the wider at-risk group of animals, and these figures should be discounted.

Retrospectively reviewing the properties of the study, it appears that virtually all respondents were previously unknown to the organisers (reportedly, all but 5 respondents, approximately 97% of the sample). They were predominantly not people who had previously been surveyed or were on a list of contacts. The majority had heard about the survey from membership associations, their employers or by word-of-mouth. The concerns expressed in the previous paragraph, as identified at the survey design stage, have therefore turned out to be much less of an issue. However, there are other issues relating to the recruitment of this new group which do require further discussion.

After considering potential sources of bias in the sample, it was concluded that owners with injured animals were more likely to respond than those whose animals had no injuries; that some owners with animals with longer tails were potentially more likely to report a lack of injury (since if they were positively engaged with the policy, and hence had animals with longer tails, they might be thought likely to be pleased to report that no injury had ensued); and that some owners with animals with longer tails were potentially more likely to report injury (since if they were negatively engaged with the policy, and hence had animals with longer tails than they wished, they might be thought likely to be keen to report when injury had ensued). These subgroups of owners are unlikely to be balanced between the shorter tail and longer tailed groups of dogs, so the size of any bias effect will be different for shorter tailed and longer tailed animals.

Summarising the effects in a table, we see the following pattern (italics: tail effects; bold: injury effects).

	Shorter Tail	*Longer Tail*
No injury	**0 baseline propensity to respond** **+** *higher propensity to report amongst those positive about current policy, probably less marked in this group*	**0 baseline propensity to respond** **++** *higher propensity to report amongst those positive about current policy, probably more marked in this group*
Injury	**+ more likely to respond** *++ higher propensity to report amongst those negative about current policy, probably more marked in this group*	**+ more likely to respond** *+ higher propensity to report amongst those negative about current policy, probably less marked in this group*

What we do not know is the relative size of the injury and tail effects. However if we sum the effects on a qualitative basis, the following summary of effects would result.

	Shorter Tail	**Longer Tail**
No injury	+	++
Injury	**+**++	**++**

The biases in these data are likely to lead to an underestimation of risk associated with longer tails. Hence for the purposes discussed these biases are likely to have a conservative effect, when attempting to identify tail length as a risk factor.

There are uncontrolled sources of bias present in the data. However, it is reasonable to regard these as operating through the decision of the owner to contribute data about his or her dogs to the survey. If efforts are made to ensure that all contributing owners report information about all their dogs, and the analysis is restricted to data only from owners with multiple dogs, some of whom have reported injuries and some who do not, then, since much of the variability in the data will also occur at the owner stratum, it would be anticipated that most of any estimated tail length effect will be estimated at the within-owner stratum, and hence will not be subject to these biases. The organisers took great pains to chase up owners with incomplete information about multiple dogs, and it has therefore been possible to fit a mixed effects model to a restricted dataset, as indicated here. Although the sampled population is now a population of owners with multiple dogs, whose animals are prone to some level of injury, it does not seem likely that this will cause any additional problems in our interpretation of any results (although again it ensures that mean prevalence figures will be meaningless in this context).

Accordingly, it was recommended that any study should

- utilise the collaborators' existing database of names and addresses, while attempting to sample further individuals at game fairs and such-like events;
- treat the observed mean prevalences of injury as worst-case scenarios.

  However, it is impossible to quantify what biases may be present in the sample. General bias arising from the owners' propensity to volunteer information may be conservative in its effect, but the data could also exhibit a more severe bias caused by the recruitment of owners known to the organisers because of the existence of previous injuries. Retrospective assessment of the dataset suggests, however, that this latter effect will be negligible.

Nevertheless it was recommended that any study should

- have a particular focus on collecting and completing datasets from owners with multiple dogs, some, but not all of which have a history of injury;

- also be analysed with the data restricted to the above sub-sample.

Deliberate Bias

Given the emotive nature of the issues involved, it is possible that respondents might deliberately distort their responses or suppress relevant pieces of information in order to deliberately distort the conclusions of any study in line with their personal opinions. It was concluded that any study which **explicitly** aimed to study the effects of tail docking would be at highest risk of such biases, and in such a case it would be impossible even to infer in what direction such biases might be operating. It was felt that a stated focus on investigation of the risk of tail injury in working dogs, in which tail length was recorded as one amongst several covariates, would provide the best basis for collection of minimally biased data. In addition, the organisers ensured that the questionnaire began with the following rubric:
"PLEASE answer EVERY question in this document for ALL your dogs even if your dogs have experienced NO tail injury. Your accurate information about your working dogs is essential for establishing both the causes of tail injuries and how to avoid them to give to the Scottish Government."
which, by linking the (rational) need for accurate information to the uniformly desirable (emotive) outcome of avoiding tail injuries, will hopefully have encouraged respondents to report as accurately as they are able.

Accordingly, it was recommended that any study should
- be marketed and designed as a survey of risk factors in tail injury, even though tail length was the factor which was driving the exercise;
- explicitly try to encourage accurate reporting of all terms.

Recollection Bias

The only strategy which could reduce recollection bias would be to collect information from a recent, relatively short period of time. However, this would inevitably reduce the numbers of injuries reported in the survey, with a commensurate reduction in the power of the study. However, we might assume that an animal's injury is a sufficiently serious event that conscientious owners would correctly remember the details over a moderate period of time. That this is so may have been confirmed by the numbers of owners who have carefully provided different sets of information for different animals which they own. It was felt that an accurate count of numbers of injuries over a longer period of time would be unlikely to be accurate, and that an appropriate strategy was therefore to aim to collect information about recent injuries during the 2008/09 season; in order to validate these data, respondents reporting an animal as injured were asked to give a date for the **initial** injury occurrence. The following table summarises the responses to this request:

Type of Response	**Number**
2008/09 Season	46
Late 2007	6
First injury much earlier than 2008/09	6
Missing	5

Hence, from the 63 records of injury, 46 (73%) were clearly within the specified sampling frame, 6 (10%) fell just outside the frame, 6 (10%) were repeat injuries, occurring within the 2008/09 season, although possibly recurrences of earlier injuries, and 5 (8%) provided no information. Effectively, 17% of the sample cannot be validated as occurring in the specified season, since the associated data is either missing or details an earlier injury. The properties of the rest of the data suggest that compliance with the questionnaire has been good, with the bulk of the data arising from the 2008/09 season. Even the injuries from the 2007 period are relatively recent. Therefore it was proposed to analyse all the data, regardless of the status of the date field, in the initial analysis, but to restrict the analysis of the multiple dogs dataset (as specified earlier in this report) only to animals with date of injury restricted to the 2008/09 period. This is a very restrictive assumption, since it seems likely that the bulk of the data are

probably well defined. As it happened, this latter restriction only led to the removal of 6 animals/2 owners from the latter analysis.

There is, however, a serious problem in formulating the study as retrospective in this way: once an injury has occurred, and docking has occurred, the owner will no longer be able to measure and report the original length of tail. This problem is inherent in any retrospective study.

Ideally, the survey would have operated on a two-stage basis, with owners being asked to complete an initial form detailing their animals, including information about the length of tail. Later, at the end of the season, they would have been asked to return a further questionnaire, detailing injuries and relevant between animal within year covariates (such as number of days worked). The advantages of this approach would have been to reduce the risk of bias (since the tail and injury information was being collected on different occasions) while giving better quality data, at the cost of greater expense and a potentially much lower response rate, and lower incidence of injury (since this data set would relate to only 1 year). This approach was, however, logistically unfeasible for what was a purely voluntary activity on the part of the organisers.

I suspect that it has proved impossible in a one-off survey of this type to collect tail length data which perfectly describes the length of tail before injury. However, the effect of such errors will have been to attenuate the relationship between injury and tail length, leading to reduced statistical power and a conservative bias in this study's attempt to establish length as a risk factor. This loss of power is purely a matter of concern to the organisers, and should not impact on our interpretation of any identified risk factors.

Accordingly, it was recommended that any study should

- collect information from a recent, short, well-defined period of time;
- try to collect information about the length of tail prior to injury, while noting that any bias arising from a failure to achieve this will be conservative in its effect.

In the event, it was found that compliance with date recording was good, but that as part of a conservative analysis strategy it was concluded that

- the 'multiple dogs' analysis should also be restricted to records reported as first occurring in the 2008/09 season.

Higher Level of Variability

Where the dependence of the data on owners' recollection of past facts causes a higher level of variability in the recorded data than was actually the case, it is difficult to imagine a realistic scenario when this would lead to a factor being incorrectly identified as a statistically significant risk factor. However, it might easily reduce the apparent effect of a (genuine) risk factor to a degree such that we record a false negative. In so far as these would then be conservative results, and the organisers are interested in collecting evidence for the **existence** of a risk factor, then this loss of power is purely a matter of concern to the organisers, and should not impact on our interpretation of any identified risk factors. As usual, in studies of this type, a failure to find any particular effect should not be taken as evidence of the non-existence of that effect.

Validity of Study

It is concluded that although the study as carried out is subject to a number of biases and sources of excess variability, these are, with one exception, all likely to be conservative in their effect. The exception is bias arising from recruitment bias, where there are a number of different effects likely to be at work, operating in opposing directions. However, since these are all operational at the owner stratum of variability, it is anticipated that an analysis of data restricted to owners with multiple dogs, some but not all of which have been subject to injury, will provide unbiased estimates of the risk factors. These results can then be compared with those arising from the complete dataset.

Statistical Analysis

Statistical analyses were carried out using Genstat 12th edition, using various linear regression, generalised linear modelling, linear mixed modelling and generalised linear mixed modelling approaches as appropriate to the data.

Results

Summary information about the data set and the evidence behind the following results are given in the Tables and Figures at the end of this report.

Analysis of the complete dataset indicated that, when examining each risk factor separately:

- Age of animal, number of days worked, whether the animal was less than 3 years old and tail length were all statistically significant risk factors.
- Breed, Height to Shoulder, Animal off lead, Rural environment, and Sex of animal all exhibited no statistically significant evidence of being a risk factor (although it should be noted that only 14 responses were from non-rural animals, giving a negligible power to detect differences between rural and non-rural animals).
- A detailed examination of the statistically significant variables and factors showed that the apparent associations of risk of injury with Age, Number of days worked and whether the animal was less than 3 years old were all also associated with tail length and that tail length was a better explanatory variable.
- For all three breeds, the statistical model identifies length of tail as a risk factor for injury. For HPR (Hunt Point Retrieve) animals, this effect is not statistically significant ($p=0.18$), but for both spaniel breeds the effect is highly statistically significant ($p<0.001$ in both cases).

Analysis of the dataset when restricted to only date validated responses from owners with multiple dogs, some but not all of which have exhibited injuries showed:

- For all three breeds, the statistical model identifies length of tail as a risk factor for injury. For HPR, this effect is not statistically significant ($p=0.50$), but for both spaniel breeds the effect is statistically significant ($p=0.004$ for cockers and $p=0.01$ for springers).
- This effect can be quantified as saying that the odds of a cocker spaniel in this population having an injury increase by a factor of 2.4 for every extra inch of tail length; the odds of a springer spaniel in this population having an injury increase by a factor of 13 for every extra inch of tail length; and the odds of a HPR in this population having an injury increase by a factor of 1.3 for every extra inch of tail length. Note that the size of these effects cannot be used to make statements about the risk of injury in the more general dog population.

The results from the full and restricted analyses are qualitatively identical, providing additional confidence in the robustness of the conclusions. On balance, however, the results from the restricted analysis are to be preferred, since these are potentially less subject to bias.

Conclusions

The study has identified strong statistically significant evidence that working dogs belonging to the springer and cocker breeds have a higher risk of injury associated with longer tails. A similar effect was observed for HPR animals, but that effect was not formally statistically significant.

No other risk factors were found to be statistically significant in explaining injury, though of course this does not mean that other, unrecorded, factors were not operational. The results do suggest, however, that longer tails are an important predispositional risk, either alone or in interaction with other risk factors.

Summary of Analysis

The full dataset consisted of 319 records from 156 owners.

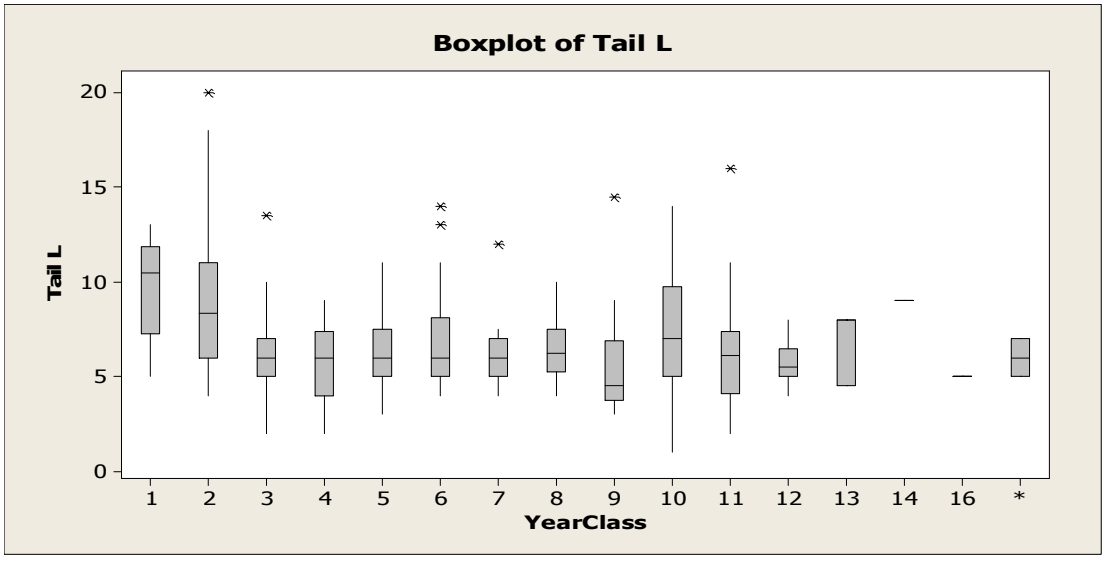
Fitting univariate models relating the different explanatory variables to the absence/present of injury response variable, fitting generalised linear mixed models, with a binomial response and a logit link function, with dispersion fixed at 1 (since the data are Bernoulli in form), the following results were seen.

Explanatory Variable	**Estimated Effect(s) (+ve= increased risk; -ve= reduced risk)**	**Standard Error(s) of Effect(s)**	**p-value Associated with Effect(s)**
Age	-0.17	0.049	<0.001
Breed	0.54 (Springers v Cockers) -0.12 (HPR v Cockers)	0.69 0.32	0.18
Days Worked	-0.0095	0.0044	0.03
Animal Aged Less Than 3	1.69	0.30	<0.001
Animal Off Lead	0.25	1.12	0.82
Rural Area	1.26	1.06	0.23
Sex	0.065 (Male v Female)	0.29	0.82
Tail Length	0.76	0.10	<0.001

The 'Height to Shoulder' variable could only be modelled appropriately when in interaction with Breed. With an overall p-value of 0.18, there was no evidence that Height to Shoulder was a statistically significant risk factor for any of the breeds of dog.

Of these variables, Age, Days Worked, Less3 and Tail Length were worthy of further investigation. The effect of Breed as an interacting factor was also explored.

There were relationships between each of these explanatory variables. For example, there were more springers and cockers with longer tails in the younger age groups, reflecting the change in legislation in recent years, as illustrated by the following boxplot:



Across older animals there was little difference in the tail length distributions in different years. However, animals in Year classes 2 and 1 had distributions which were steadily shifting towards higher median values in younger animals. Focusing only on younger animals, in which age classes there was a wide and relatively balanced range of tail length, fitting a model incorporating both age and tail length showed that little of the variability was explained by the age (p=0.16) but much was explained by tail length (p<0.001).

Examining the explanatory variables Days Worked and Length of Tail, it was found that animals with longer tails tended to have worked for fewer days than those with shorter tails.