



The aim of the animal welfare science update is to keep you informed of developments in animal welfare science relating to the work of the RSPCA. The update provides summaries of the most relevant scientific papers and reports received by the RSPCA Australia office in the past quarter. Email [science@rspca.org.au](mailto:science@rspca.org.au) to subscribe.



## Why animal welfare matters

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RSPCA Australia  
Animal Welfare Seminar  
1 May 2015

**RSPCA** 

### Dog socialisation questionnaire



THE UNIVERSITY OF  
MELBOURNE

Do you own a dog? Is it between 1-3 years old? Did you get it as a puppy before it was 10 weeks old? If so Melbourne University wants to hear from you! Researchers are conducting a world first study exploring the influence of socialisation on dog behaviour in Australia to try and prevent future dogs ending up in pounds. To participate in the survey visit: [www.dogbehaviourstudy.com](http://www.dogbehaviourstudy.com)



### Non-human primates in research

The NHMRC has advised that public consultation on the draft *Principles and guidelines for the care and use of non-human primates for scientific purposes* is now open.

Information is available via the public consultation portal on NHMRC's website at <https://consultations.nhmrc.gov.au>. Public consultation will close on **Friday 8 May 2015**.

## ANIMALS USED FOR SPORT, ENTERTAINMENT, RECREATION AND WORK

### **A critical analysis of the British horseracing authority's review of the use of the whip in horseracing**

Bidda Jones, Jed Goodfellow, James Yeates and Paul McGreevy

Animals 5(1):138-150

There is increasing controversy about the use of the whip as a performance aid in Thoroughbred horseracing and its impact on horse welfare. This paper offers a critical analysis of the British Horseracing Authority's (BHA) 2011 Report 'Responsible Regulation: A Review of the Use of the Whip in Horseracing'. It examines the BHA's process of consultation and use of science and public opinion research through the application of current scientific literature and legal analysis. This analysis suggests that the BHA's findings on the welfare impact and justification for whip use are insufficiently defended by the report. These findings indicate that the report is an inadequate basis from which to draw any definitive conclusions on the impact of whips on racehorse welfare. Further review is needed, undertaken by an independent scientific body, to advance this debate.

### **Gastrointestinal changes in horses moved from pasture to stabled environment**

In the UK, most domestic horses will have access to pasture but will also be stabled for some time, meaning that they experience management changes when moving from one system to the other. Simple colonic obstruction and distension (SCOD) is one of the common causes of colic (abdominal pain) in horses which may in some cases, if the obstruction cannot be cleared, be fatal. Risk factors for the development of SCOD are a recent change in the amount of exercise the horse performs, increased time stabled, and a recent change in feeding concentrates. These factors may all have an impact on a horse when they are moved from pasture grazing to a stabled environment. This study was performed to assess the actual impacts that a change in management can have on the intestinal function of a horse.

The study which was performed in Leicestershire in the UK and examined the effects of moving 7 horses from 24 hour/day at pasture with no controlled exercise to the new management regime of controlled stabling with light exercise. The authors aimed to assess the effects that change in management has on; 1) the amount of water that the horses drank, the faecal output, faecal water content, 2) the motility of the

large intestine (assessed using ultrasonography) and 3) the duration and size of any changes in gastrointestinal function in the following 14 days resulting from the change in management.

It was found that the water intake of the horses was significantly increased following movement to the new management system, as was faecal dry matter content, but total faecal output was significantly decreased on all 14 days post-stabling. Intestinal motility was decreased in all regions of the large colon on day 2 post-stabling and in the left colon only on day 4. The study showed that significant changes in large intestinal motility patterns occur due to a slowing and drying of the food in the gut during a transition to a stabled management regime, particularly during the first 5 days, suggesting that this may increase the risk of horses developing SCOD during this time.

Williams S, Horner J, Orton E *et al* (2015) Water intake, faecal output and intestinal motility in horses moved from pasture to a stabled management regime with controlled exercise. *Equine Veterinary Journal* **47**:96-100.

## Apparatus use in popular equestrian disciplines in Australia

Horses and ponies are used in a variety of sporting disciplines, and are commonly trained using the process of negative reinforcement (NR). NR is a training process that rewards an animal for a behaviour by the removal or avoidance of an aversive stimulus. Reliance on NR is common in traditional horse training, (i.e., riders use pressure to create discomfort such that the horse seeks relief from that pressure. Horse training equipment such as bits, spurs, and whips allows NR, to communicate with the horse. They apply aversive pressure to the horse until the appropriate response is obtained, which leads to the removal of the stimulus. However horses can readily habituate to pressure and over time, exhibit a lessened response, which may result in the rider using harsher equipment to obtain the same original response. Almost any piece of equipment can be used abusively. Some of the equipment used on horses to create a change in behaviour, such as severe bits, may compromise the welfare of the horse.

Welfare concerns can occur in any equestrian discipline, and this study aimed to examine use of bits, nosebands, whips and spurs in different equestrian disciplines in Australia, with the aim of determining where welfare concerns may lie. 1101 responses were obtained to an online questionnaire. Respondents were asked to indicate their use of bits, bridles, spurs

and whips, and provide demographic information concerning their riding history, their horse and chosen riding discipline.

The results showed that dressage riders are more likely to use a noseband and whip, but not use bitless bridles, which may reflect the competition rules that are in force influencing the use of the types of bridles used in this discipline. The use of nosebands was also higher in this discipline, compared to the others, which may reflect the use of nosebands such as 'crank' nosebands which are used to keep the horse's mouth closed during competition. Western riders were more likely to use a curb bit and spurs, but did not often use nosebands or whips. It was also found, overall, that the respondents that used strong bits were also more likely to use whips and/or spurs. The study showed that the sporting discipline affects the choice of gear that is used on a horse's head and adds to the growing debate around the mandatory use of certain apparatus, especially severe bits, in certain equestrian sports.

Hill E, McGreevy PD, Caspar G *et al* (2015) Apparatus use in popular equestrian disciplines in Australia. *Journal of Veterinary Behavior* **10**:147-152.



## COMPANION ANIMALS

### Evaluation of hip scores in four breeds of dog in New Zealand Veterinary Association (NZVA) Hip Dysplasia Scheme

Canine hip dysplasia (CHD) is one of the most common orthopaedic diseases in dogs. CHD is a developmental condition, primarily affecting medium to large sized dogs where the dogs develop joint instability, pain, osteoarthritis and lameness/stiffness. The inheritance of CHD is considered to be multifactorial, meaning that its incidence is influenced by genetics and environmental effects. Due to the complexity in how this disorder is inherited, there is a lack of current genetic tests which are available for clinical use. In the mid-1980s, the NZVA, in co-operation with the New Zealand Kennel Club introduced a 'Hip Scheme' whereby hip score records were held on a national database in order to maintain records that, it was hoped, would provide data to help reduce the prevalence of hereditary CHD using selective breeding. The aim of this study was to develop a within-breed evaluation system to estimate heritability and the genetic trends for this trait in four breeds of dog under the NZVA CHD scheme.

Records maintained for the four most common breeds in the NZVA database, the German Shepherd, the Labrador Retriever, Golden Retriever and Rottweiler breeds were examined between 1990 and 2011, with a total of 2983 NZVA hip score records from a pedigree of 3172 animals. It was found that despite moderate heritability of the NZVA total hip score, there has not been substantial improvement of this trait for the four breeds analysed. There was no genetic change in the Golden Retriever, Labrador Retriever and Rottweiler breeds over the study period, suggesting random selection or very low selection intensity for

better hip conformation. While the German Shepherd breed showed a genetic trend towards better hip conformation, the magnitude of genetic change was not substantial.

The authors suggest that greater improvements in reducing the prevalence of CHD genetic may be possible if screening for CHD was a compulsory requirement for the registration of pedigree breeding dogs, greater selection pressure was applied, and if selection of breeding animals was made on the basis of each individuals genetic superiority compared to counterparts (Estimated Breeding Value – EBV), rather than the NZVA total hip score alone.

Soo M, Sneddon NW, Lopez-Villalobos N *et al* (2015) Genetic evaluation of the total hip score of four populous breeds of dog, as recorded by the New Zealand Veterinary Association Hip Dysplasia Scheme (1991-2011) *New Zealand Veterinary Journal* **63** (2):79-85.



### Prevalence and risk factors for mast cell tumours in dogs

Mast cell tumour is the most common skin tumour type in dogs, accounting for 7-21% of all skin tumours diagnosed. It is thought that there are likely to be many factors that contribute to the development of mast cell tumours, and genetics may play a role in predisposing dogs to its development. To date, little is known about the frequency of mast cell tumours in the general population of dogs and in particular dog breeds. This study aimed to increase knowledge about mast cell skin tumours in dogs by estimating the prevalence and risk factors for development. This was performed using a large sample of dogs which were contained on the VetCompass database in the UK, a database containing medical records of 168,686 dogs from 94 UK veterinary practices collected between 2007 and 2013.

Use of specific words and search terms on the database identified 453 of the dogs as having developed mast cell tumours, indicating a prevalence of 0.27% of dogs having this disorder in the population. Analysis of these 453 dogs showed that the highest breed prevalence was for the Boxer, the Golden Retriever and the Weimaraner and older, heavier dogs. Boxers, Pugs and Staffordshire Bull Terriers were at increased risk for developing mast cell tumours when compared with crossbred dogs. German Shepherds, West Highland White Terriers, Border Collies and Cocker Spaniels showed a lower chance of developing these tumours. There was no difference in the development of these tumours between male and female dogs.

This study highlights a clinically significant prevalence of MCT and identifies specific breed types with a predisposition to MCT, potentially aiding veterinarian and owner awareness and facilitating diagnosis.

Shoop SJW, Marlow S, Church DB *et al* (2015) Prevalence and risk factors for mast cell tumours in dogs in England. *Canine Genetics and Epidemiology* **2**:1.

## Effect of gentling on behaviour, immunity and respiratory disease in shelter cats

A relationship between the occurrence of negative life events and resulting increased susceptibility to disease is well established in humans. In cats also, a stressful event, such as entering a shelter, can increase their chances of developing diseases including upper respiratory disease (URD), due to a decrease in the production of antibodies from the mucus membranes, in particular, immunoglobulin A (IgA). Recent attitudes in veterinary medicine emphasise the importance of addressing negative emotional states in animals as they may compromise health.

This study was performed at the Vancouver Branch of the British Columbia Society for the Prevention of Cruelty to Animals and examined the effect that gentling (gentle stroking of the head or neck area of the cat together with gentle vocalisation) of cats in a shelter would have on their anxiety, their levels of IgA and incidence of URD. 139 cats that had been assessed as being anxious upon entry to an animal shelter were placed in either a gentling (four times daily for ten minutes over ten days) (n=70) or a control group (presence of a human experimenter for the same time periods, but no gentling performed) (n=69) and the cats mood rated for the following ten days as anxious, frustrated or content. Cats that were observed to react aggressively to the gentling were gentled with the use of an extended tool. Daily saliva swabs were taken in order to assess levels of IgA.

It was found that gentled cats were less likely to show anxious or frustrated moods than control cats, and had increased levels of IgA. IgA levels were also found to be higher in those cats in the gentled group that responded positively to the gentling, rather than negatively. Control cats were 2.4 times more likely



than gentled cats to develop upper respiratory disease over time. The study indicates that interventions, such as gentling, for cats entering animal shelters should be employed in order to reduce anxiety and to reduce the likelihood of cats developing clinical signs of upper respiratory disease over time.

Gourkow N, Hamon SC, Phillips CJC (2014) Effect of gentle stroking and vocalisation on behaviour, mucosal immunity and upper respiratory disease in anxious shelter cats. *Preventative Veterinary Medicine* **117**:266-275.

## Behavioural and psychological characteristics of abuse in dogs



The abuse of animals, including dogs, is a problem throughout the world, but, to date has received little attention as an area of research. At the present time, the clinical criteria determining abuse and neglect in animals has not been described. This study aimed to explore the behavioural and psychological characteristics of dogs in America that had been abused, to determine if they were different to those of dogs that had not been abused.

An online survey was used to find respondents that were the new caregivers of dogs that they stated had been abused by previous owners. 149 of the dogs that had been described by caregivers on the survey were chosen to be analysed further by a panel of five experts and, following consideration, 69 dogs met the criteria to continue in the study and it was considered that there was sufficient evidence to support the claim that they had definitely received abuse. The caregivers of these dogs were then asked to fill in a questionnaire describing the reactions of their dog to a number of specific situations using scales from 0-4 to indicate the intensity of the reactions. The survey also requested demographic information about the new caregiver.

When compared with a convenience sample of 5239 control dogs, it was found that the abused dogs showed higher levels of aggression and fear directed behaviour towards unfamiliar humans and dogs, excitability, hyperactivity, attachment and attention-seeking behaviours, persistent barking, and strange or repetitive behaviours than did the control dogs.

Describing the behavioural and psychological characteristics of abused dogs can aid in distinguishing the risk factors, which can help in the development of preventative and therapeutic programmes for animals that are at risk of abuse.

McMillan FD, Duffy DL, Zawistowski SL *et al* (2015) Behavioral and psychological characteristics of canine victims of abuse. *Journal of Applied Animal Welfare Science* **18**:92-111.

## FARM ANIMALS

### Assessing alternatives for surgical castration of pigs

Male pigs are castrated to reduce unwanted aggressive and sexual behaviour and to prevent the occurrence of boar taint, a strong unpleasant taste in the meat of the pig when cooked and eaten. However, surgical castration is a painful procedure for the piglets and in many countries, including the European Union, alternatives are being sought. There are two main categories of alternatives: 1) those that reduce the discomfort of castration using anaesthesia or analgesia and 2) those that leave the male piglets entire but use management strategies to reduce boar taint or immunocastrate the piglets. Before alternatives such as these can be implemented, it is important that they are feasible in practice. This study aims to assess the effects of the different alternatives by examining mortality, performance, carcass traits and boar taint in pigs subjected to 1) application of analgesia (Metacam) 15 minutes prior to castration, 2) CO<sub>2</sub> anaesthesia during castration, 3) raising entire male pigs, 4) raising pigs that have been vaccinated with Improvac to cause immunocastration, 5) a control group of castrated male pigs.

This study, performed in Belgium, consisted of two trials: 1) an experimental farm trial with 18 pigs/treatment and 2) a field trial on 20 farms with approximately 120 male pigs/farm per treatment

(with all treatments performed on each farm). It was found that neither castration, nor the administration of analgesia or anaesthesia had an effect on the daily weight gain of the piglets in farrowing crates ( $p>0.05$ ) and piglet mortality was not affected by the administration of analgesia or anaesthesia ( $p>0.05$ ) when compared to the other treatments. No significant differences were found for daily weight gain ( $p>0.05$ ) or slaughter age ( $P>0.05$ ) between treatments. Immunocastrates and entire males had a better feed-to-gain ratio ( $P<0.05$ ) compared to the other treatments and the carcass weights of the immunocastrates were significantly lower than the other treatments ( $P<0.05$ ). The prevalence of boar taint varied from 0% to 14% across farms and this variability may influence the choices that farmers make when deciding on the best practical and profitable alternative to surgical castration of piglets on their own farm.

Aluwé M, Tuytens FAM, Millet S (2015) Field experience with surgical castration with anaesthesia, analgesia, immunocastration and production of entire male pigs: performance, carcass traits and boar taint prevalence. *Animal* **9**(3):500-508.

### Use of human epilation technology for wool removal in Merino sheep

Merino sheep have been selectively bred for wool production. This breeding has resulted in a long growth phase of the wool and sheep that need to be shorn frequently around the face, pizzle and breech to enable them to maintain normal vision, help stop grass seeds being caught around the eyes, and to prevent build-up of excreta in the wool. These sheep are usually shorn around 10-12 times over their lifetime, contributing significantly to the cost of wool production. A large number of methods to permanently remove the wool from the breech area have been developed including topical application of noxious chemicals to the skin, freezing, radiation and injection of biological agents. These different techniques can be classified either as techniques that remove the skin and scar, or those that kill the wool follicles.

Human laser treatment is used to remove hair by use of red and near-red wavelengths, which penetrate into the skin follicles, to cause a reduction in hair growth. This study examined the effect of human laser treatment on 14 Merino sheep in Armidale, Australia. Two laser units (Sharplan alexandrite 755 nm laser and Lumenis LightSheer @800 nm diode laser) were used in the trial, and tested at energies between 10 and 100 J/cm<sup>2</sup> and at pulse widths from 2 to 400ms. The wool was firstly clipped from the flank, breech, pizzle and around the eyes of the sheep, and the skin sites treated with up to 15 cycles of laser irradiation. The behaviour of the sheep and skin

temperature was monitored during and immediately after the treatment, and the skin and wool responses were observed for 3 months following treatment.



It was found that scabs formed on the treated areas and remained for >6 weeks. When these scabs shed, scarring was seen at sites receiving multiple treatment cycles, and normal wool growth was observed in unscarred skin. The sheep appeared to tolerate the application of the laser treatment well, but there was no evidence of permanent inhibition of wool growth using this method. The authors suggest that the absence of melanin (which is the primary target which enables the laser energy to be absorbed in human hair) in the wool of the sheep may have contributed to the lack of effect.

Colditz IG, Cox T, Small AH (2015) Trial of human epilation technology for permanent wool removal in Merino sheep. *Australian Veterinary Journal* **93**:31-35.

## Behavioural traits at mixing and long-term social stability in group-housed pigs

When livestock species that adopt social systems are mixed, they develop dominance hierarchies, the formation of which often involves aggressive contests between group members. This aggression between individuals may be associated with high levels of stress and injury, especially in pigs. The aggression interactions during group formation in commercial pigs can have effects on their welfare and a negative effect on production, growth, reproduction, and carcase quality. Physical aggression between pigs may also cause skin lesions, with more lesions being found with pigs that spend more time in aggressive interactions. Methods of reducing aggression in pigs have been studied for the last three decades, but to date, no socially acceptable, low cost, high impact solution has been found.

This study investigated if there may be a phenotypic (the physical or behavioural attributes of an animal) link between aggression at mixing and increased long-term group stability, as indicated by reduced skin lesions. 1166 pigs on a commercial farm in Ransta, Sweden, were used and were separated into groups of 15 pigs (3 pigs mixed from 5 different litters, resulting in 78 groups of pigs). Aggressive behavioural traits were recorded for 24 hours after mixing of these groups, and the number of skin lesions (on the front, middle and posterior of the pigs) were counted 24 hours and three weeks after mixing of the groups.

It was found that, when studying the group of pigs as a whole, aggressive behavioural traits in pigs were positively correlated with skin lesions on the front of the pigs, and negatively with lesions on the central part of the pig's body. When examining individual pigs, most behavioural traits of aggressiveness correlated with the skin lesions counted after 24 hours, but the opposite associations were seen after three weeks. The study suggests that increased aggression of pigs at mixing may aid the formation of a stable hierarchy after three weeks. Selection of pigs for reduced aggression in a commercial environment may actually result in increased chronic aggression. Mixing pigs to increase the amount of acute aggression may therefore have a beneficial long-term reduction on the amount of aggression the pigs show in groups and thus benefit the long-term welfare of the group.

Desire S, Turner SP, D'Eath RB *et al* (in press) Analysis of the phenotypic link between behavioural traits at mixing and increased long-term social stability in group-housed pigs. *Applied Animal Behaviour Science*.

## Scientific assessment of animal welfare

This paper describes three science-based frameworks that have had an influence on animal welfare assessments and illustrates how two of these frameworks have been applied to improving the welfare of group-housed sows. The authors discuss the three science-based frameworks for assessing animal welfare: 1) biological functioning (which is based on the rationale that difficult or inadequate adaption will cause welfare problems for the animals), 2) affective state (which emphasises that the welfare of an animal is based on its capacity for affective experiences, i.e. the welfare state of an animal is likely to be negative when the affects experienced are unpleasant and vice versa) and 3) natural living (based on the view that the welfare of animals is improved when they can express their normal or natural behaviour). The biological functioning and affective state frameworks were initially seen as competing, but a more recent

unified approach considering the dynamic interactions between the two is considered to be fundamental to improving animal welfare.

The authors of this paper describe the value of the biological functioning and affective frameworks in understanding the welfare of animals. They use group-housed sows as an example and describe how the frameworks can be used to identify welfare issues, modify management practices and hence increase the well-being of these animals. The paper highlights the challenges and potential opportunities for improving sow management through well-focused research and a multidisciplinary assessment of animal welfare.

Hemsworth PH, Mellor DJ, Cronin GM *et al* (2015) Scientific assessment of animal welfare. *New Zealand Veterinary Journal* **63**(1):24-30.

## Promoting the welfare of farmed fish

The farming of fish for human consumption is a rapidly growing industry, currently providing more than 50% of the fish we eat. Fish have many similarities to other intensively farmed animals, such as chickens and pigs, but they also have some traits in which they are unique, which means that there are specific challenges in meeting requirements to ensure that their welfare is maintained. Similarly to other vertebrates, they have behavioural traits that enable them to find and capture food, avoid predators, fight, mate and in some cases take care of their young. However, fish are suited to an aquatic environment, and have a long separate evolutionary history, and so have special features that are different to those of land-based animals and mean that there are differences in how their welfare is defined and assessed.

This paper examines welfare in fish and discusses the concept of whether fish are conscious, sentient and can suffer and if so, the authors argue that it is vital that we maintain their welfare to minimise their suffering. The paper discusses the different methods that are available to identify and assess good and bad welfare in fish using assessment of their physical health, their physiology, behaviour and genetic factors, and those that can be used to assess welfare specifically during fish farming. Some aspects of fish farming that have the potential to have a negative effect on the welfare of the fish are discussed and ways in which these can be minimised. As fish farming is likely to continue to increase as an industry, it is anticipated that changes will be made to how this type of farming is performed in the near future, with larger numbers of fish and a wider range of species farmed. It is important that the farming conditions that optimise welfare are established for each species throughout their lives.

Huntingford FA, Kadri S (2014) Defining, assessing and promoting the welfare of farming. *Scientific and Technical Review International Office of Epizootics* **33**(1):233-244.



## Invasive piglet husbandry procedures: alleviation and alternatives

Piglets on commercial pig farms are often subjected to several invasive procedures within the first week of life, including iron administration (to supplement the iron in the piglet's body and prevent deficiency), needle teeth clipping (to avoid these sharp teeth being used and hence to reduce facial injuries in other piglets and lesions to the udder of the sow), tail docking (to stop pigs having their tails bitten by group mates, which can lead to significant injury) and castration (to reduce aggressive and sexual behaviours between pigs and prevent boar taint, which is a strong unpleasant taste and smell that may be apparent in the meat of mature male pigs). These procedures are performed to prevent potential health and welfare problems and to increase meat quality, but they can also cause behavioural and physiological changes that are indicative of pain and potentially have long-term negative consequences. As a result, some countries have banned or placed restrictions on a number of these procedures.



The New Zealand pork production industry is small compared to other countries, and here, castration of pigs is not performed as the pigs are slaughtered at a lower body weight before they reach sexual maturity. However, iron administration, teeth clipping and tail docking are all performed. This paper examines these husbandry procedures, the various methods by which they are performed and the implications that they have on the welfare of the pigs. The author then discusses ways in which pain could be alleviated during the performance of these procedures by using anaesthetic or alternative strategies which cause less pain to the animal.

The author concludes that there is sufficient scientific evidence to suggest that all the above practices, with the exception of iron administration, cause short-term physiological and behavioural changes indicative of pain in pigs, however the long-term welfare implications of these practices, such as chronic pain caused by neuroma formation, risk of infection and mortality rates, are not yet clear. Given that teeth clipping, tail docking and castration are invasive procedures that cause pain, there is a need to develop either effective pain mitigation strategies or find alternatives to these practices in the pork industry.

Sutherland MA (2015) Welfare implications of invasive piglet husbandry procedures, methods of alleviation and alternatives: a review. *New Zealand Veterinary Journal* **63**:52-57.

## Use of straw increases nest building in loose housing farrowing systems

Despite being domesticated in modern times, sows are still genetically programmed to perform nest-building behaviour close to farrowing. In nature, the nest is vital for the survival of the piglets, and the sow is still highly motivated to perform this behaviour, even in today's modern farrowing environment. Prolonged farrowing (more than 4 or 5 hours) is associated with an increase of stillborn piglets and a higher probability that the sow will develop problems following birth. However, worldwide, the majority of commercial sows are housed in farrowing crates, which do not allow the performance of nesting behaviour. In the European Union, it is mandatory that sows must be provided with sufficient nesting material, unless this is not feasible for the slurry system used in the establishment, however, what is a 'sufficient' quantity of material is not defined.

This Swedish study aimed to examine the effects of the provision of a large amount of straw (15-20kg) given to sows in loose housing systems 2 days before farrowing, compared to the provision of small daily amounts (0.5-1 kg) on: 1) the total time that the sow spends performing nest-building behaviours within 18 hours before birth and 1 hour following birth 2) the point in time when the sows have performed 50% of her total nest building prior to birth and 3) the duration of farrowing and the number of stillborn piglets.

Four commercial farms were used in this study, and on each farm, 20-34 loose-housed sows were studied over two lactations and the behaviour of the sows was recorded. It was found that, compared to controls, the sows provided with the 15-20kg of straw given 2 days prior to farrowing, triggered the sows to start nest building earlier and increased the amount of time that they spent nest building in the 18h prior to farrowing by 19%. Sows given large amounts of straw also performed less nesting behaviour during the first hour after birth. There was no significant effect of treatment on the duration of farrowing, but a strong negative association was found between time spent nest building before farrowing and the duration of farrowing, regardless of treatment.

This study shows that the strategic application of large amounts of straw is beneficial for farrowing sows and the design and development of housing and slurry systems that can accommodate large amounts of straw is important to improve the welfare of farrowing sows in future.

Westin R, Hultgren J, Algers B (in press) Strategic use of straw increases nest building in loose housed farrowing sows. *Applied Animal Behaviour Science*.

## WILD ANIMALS

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### Welfare impacts of kill-trapping European moles

European moles are widely thought of as pests both in Britain and wider Europe. Perceived problems with moles include the tunnel systems that they create and associated molehills (soil heaps) that they produce. Prior to 2007, strychnine was the most common form of mole control amongst farmers, but was withdrawn from use in 2006. In 2007, the use of kill-traps became the most common form of mole control, and their use was widely considered to be humane. Two main types of mole spring trap are used today: the scissor (pincer) trap and the Duffus (half barrel) trap. Both of these traps are designed to catch moles around the body when a trigger plate or wire is pushed, releasing a

mechanism which crushes the mole. Under the 1954 UK Pests Act, spring traps require welfare approval, and are required to render the trapped animal irreversibly unconscious within 5 minutes in  $\geq 80\%$  of 12 tests, but mole traps are exempt from this approval process as a result of the opinions of the Committee on Cruelty to Wild Animals in 1958, which still stand today.

This study sourced 50 mole carcasses trapped by 28 individual trappers between November 2008 and August 2009 in Southern England using scissor or Duffus traps. It was found that the large majority of

moles that were trapped were males, as captures peaked during the peak in male breeding activity. It was found that the primary cause of death for all but one mole was acute haemorrhage. No moles died as a result of damage to the skull or upper cervical vertebrae, which would be more likely to cause immediate unconsciousness. Some moles may have died from lack of oxygen as a result of pressure on the neck, and it is likely that a number of moles became unconscious prior to death, but the amount of time until they reached unconsciousness was not possible to determine.

As the available mole traps in Britain vary in quality and performance, they are likely to have varying effects on the trapped moles and further research is required to ensure that all the traps that are available meet the requirements as set by the International Humane Trapping Standards to ensure that moles are killed humanely.

Baker SE, Shaw, RF, Atkinson RPD *et al* (2015) Potential welfare impacts of kill-trapping European moles (*Talpa europaea*) using scissor traps and Duffus traps: a post mortem examination study. *Animal Welfare* **24**:1-14.

## Using the Five Domains model for assessing animal welfare during vertebrate pest control

Vertebrate pest control is undertaken for a range of reasons which include the reduction of economic losses and minimisation of disease transmission. In New Zealand, pest control is particularly important due to the unique native fauna and the ongoing population decreases of these animals due to competition and predation from introduced animal species. As a result, in this country, pest control will continue to occur in the foreseeable future.



Animal welfare is an important consideration when developing, implementing and evaluating ethical vertebrate pest control programs as many pest control activities have the potential to have a negative impact on the welfare of target and non-target species.

This paper describes the Five Domains model, which has been used in New Zealand since 2008, for assessing welfare impacts, and discusses the advantages and limitations of this model. The model uses four physical or functional domains (nutrition, environment, health and behaviour) and one mental domain (mental state) to determine an animal's overall animal welfare status. Compromise in one or all of the four physical domains will have a negative impact on the fifth mental state domain, which gives an indication of what an animal is experiencing. The model has a number of advantages for pest animal welfare assessment over less structured or formal approaches which include the ability to 1) identify a wide range of impacts associated with a variety of pest control tools, 2) incorporate new information easily, 3) highlight additional information needed for a more accurate assessment and 4) produce relative rankings of pest control tools in terms of their welfare impacts. In addition, as the model separates the physical and mental impacts it encourages a more comprehensive consideration of negative mental experiences than has occurred in the past.

The authors describe the limitations of the model and conclude that the model advances the ability to evaluate the impacts on animal welfare of vertebrate pest control methods provided that these limitations are borne in mind.

Beausoleil NJ, Mellor DJ (2015) Advantages and limitations of the Five Domains model for assessing welfare impacts associated with vertebrate pest control. *New Zealand Veterinary Journal* **63**(1):37-43.

## The use of GPS technology to determine social relationships in elephants

Sociality in animals can provide a number of benefits such as protection, help with raising young and longevity and as long as the benefits are greater than the costs to the animals, they are inclined to develop social relationships. Elephants are social animals and, in the wild, female populations are made up of flexible fission-fusion societies that have a hierarchical structure. Females stay with the natal group upon maturity and so their relationships will remain stable, whereas male elephants are likely to leave the group upon maturity. Social relationships are commonly measured using one of two techniques 1) through behavioural observation, observing aggressive and affiliative interactions between individuals and 2) by documenting patterns of association and which animals associate more frequently with other individuals. Both of these techniques have disadvantages due to aspects such as observer fatigue and the inability to see subtle interactions and estimate how close animals are to each other from a distance.



This study examined if the use of global positioning system (GPS) technology could be used as a tool to determine the social structure of animals by comparing the social structure already known in elephants in an African elephant herd to that determined by the GPS system.

This study used eight African elephants housed at the San Diego Safari Park in California which were deemed old enough to be trained and hence allow safe application of the GPS collars. Positive reinforcement techniques were used over several months in order to fit the GPS devices and data was collected from the devices over nine 24-hour periods. The average distances between individuals were then calculated for different times of day, as well as for the entire 24 hours. Behavioural data was collected on both positive and negative interactions between elephants as were scores for sociality. Staff who were responsible for caring for the animals and who interacted with them frequently were questioned about their social structure and hierarchy.

Significant correlations were found between the data provided by the GPS and the social relationships reported by staff, and the GPS collars had little to no impact on the behaviour of the elephants as long as adequate training was provided. This suggests that the GPS technology can be used as a tool in determining social relationships between animals. The knowledge gained from understanding social structures of group of animals can be used in their daily management and in potentially stressful situations such as transporting animals or moving them between exhibits. The use of this technology could also be applied more broadly and used in animal behaviour research, zoological planning and ecological management.

Hacker CE, Horback KM, Miller LJ (2015) GPS technology as a proxy tool for determining relationships in social animals: An example with African elephants. *Applied Animal Behaviour Science* **163**:175-182.

## HUMANE KILLING

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### Effect of stocking rate during carbon dioxide euthanasia of young pigs

Exposure to carbon dioxide (CO<sub>2</sub>) can be used for euthanasia of young pigs and as a method of pre-slaughter stunning for adult pigs. Prolonged exposure to a concentration of 80-90% CO<sub>2</sub> in air is regarded by the American Veterinary Medical Association (AVMA) as an acceptable form of euthanasia for pigs, although animal reactions to this process are known to vary widely within the industry, and are dependent on the individual procedures used. Gas euthanasia methods are commonly used to kill large groups of animals, however carbon dioxide gas does not provide an instant loss of consciousness and is believed to cause discomfort to the animal prior to death. It has been suggested that the density and positioning of pigs during gassing may also influence air flow, and crowding or piling of the animals in the chamber could cause injury and create variable micro environments that prevent consistent gas exposure. Alternatively, it has been suggested that euthanasia of young pigs in small groups may provide a calming effect for these social animals. This study aimed to determine whether the chamber stocking rate affects animal welfare and the efficiency of killing during carbon dioxide euthanasia of young pigs.

This study was performed in Iowa, America, and used crossbred pigs (390 neonatal and 270 weaned) which were designated for euthanasia at farms. The pigs were randomly assigned to group sizes of 1, 2, 4 or 6 pigs and gas euthanasia of each group was performed using an Euthanex® AgPro chamber. The chamber air was gradually displaced with carbon dioxide gas over 5 minutes to establish a concentration of approximately 80% CO<sub>2</sub>, and then the pigs left for another 5 minutes in the chamber.

It was found that higher stocking rates were associated with higher CO<sub>2</sub> concentrations after gradual fill for both age groups. While there was no evidence of an effect of stocking rate on loss of posture or last movement in neonatal pigs, the grouped-weaned pigs were faster to succumb to the CO<sub>2</sub> gas than solitary pigs. The study provided no evidence that isolation during gas euthanasia would benefit animal welfare and the authors recommend that, when humanely killing animals in groups, animals of similar size and health status are grouped in the chamber whenever possible to reduce or avoid injury.

Fielder KJ, Parsons RL, Sadler LJ *et al* (2014) Effects of stocking rate on measures of efficacy and welfare during carbon dioxide gas euthanasia of young pigs. *Animal Welfare* **23**:309-321.

### Scientific comment on the welfare of ruminants slaughtered without stunning

It has long been acknowledged that slaughter of cattle, sheep and goats by neck incision is likely to cause pain in the period following incision and prior to insensibility. This review paper provides an overview of the evidence on the welfare of ruminants slaughtered without being previously stunned.

The authors discuss the likelihood of the animals experiencing pain following neck cut as a result of the severing of major blood vessels and damage to surrounding nerves and connective tissue leading to the transmission of impulses to the brain. How animal pain is determined by human researchers is discussed and the physiological and behavioural indicators that can be used to determine if an animal is experiencing

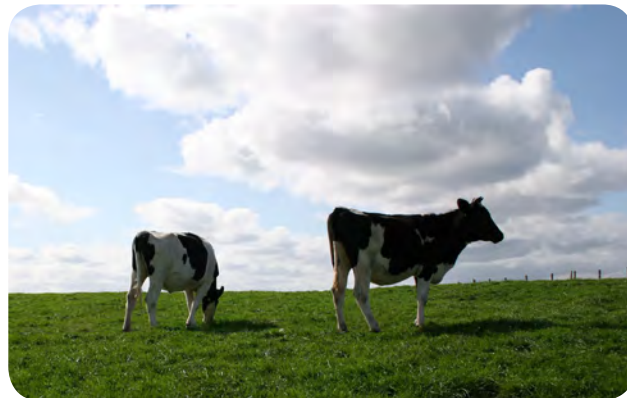
pain are listed. The available evidence all supports the capacity for animals to perceive pain in a very similar way to humans and, as a result, international scientific opinion has long been that slaughter by neck incision of conscious animals would cause significant pain before the onset of insensibility.

The review then discusses the evidence surrounding the amount of time that the animal will perceive pain after the neck incision as this is instrumental in determining the total amount of pain that the animal experiences. The authors conclude that sheep may remain conscious for at least 2-8 seconds following neck cut, but they may be conscious for 8-20 seconds in duration. Cattle may remain conscious for as long

as 85 seconds, and the longest recorded duration based on electroencephalographic (EEG) studies is 168 seconds.

The findings outlined in the review indicate that the slaughter of cattle, sheep and goats by ventral neck incision without prior stunning is likely to cause pain, and this poses a threat to welfare.

Johnson CB, Mellor DJ, Hemsworth PH *et al* (2015) A scientific comment on the welfare of domesticated ruminants slaughtered without stunning. *New Zealand Veterinary Journal* **63**(1):58-65



## Induction with isoflurane or carbon dioxide to perform humane euthanasia of mice

Laboratory rodents are commonly euthanased via exposure to gradually increasing concentrations of isoflurane or CO<sub>2</sub> gas. However, both rats and mice find CO<sub>2</sub> gas aversive and will not tolerate exposure at concentrations sufficient to cause insensibility (complete loss of sensation). Isoflurane is less aversive to rodents than CO<sub>2</sub> and is used during the process to first induce insensibility, and then, once the animal has reached insensibility, the isoflurane is turned off and immediately switched to a high flow rate of CO<sub>2</sub> for more rapid killing than with isoflurane alone. It is important that mice are insensible when this switch is made, as CO<sub>2</sub> levels of over 3% are aversive to mice and concentrations over 10% cause fear responses. Currently, no measures exist for users to reliably know when loss of complete sensibility occurs in rodents being euthanased with this method, and so, to increase the available knowledge in this area, this study aimed to evaluate three progressive measures of insensibility.

13 male mice were used in this experiment performed in Vancouver, Canada and were randomly assigned to: 1) 5% isoflurane using 2L/min oxygen as the carrier gas, followed by CO<sub>2</sub> (n=7) or 2) 20% gradual fill CO<sub>2</sub> (n=6) treatments. Mice were then individually placed in a gas chamber and a human hand inserted into the chamber. The appropriate gas was introduced into the chamber and the experimenter kept their hand motionless on the cage floor until the mouse became recumbent, and then moved their hand towards the mouse. A response was recorded if the mouse exhibited leg paddling and forward and lateral movement in response to the hand, and this was recorded as an 'escape response'. If no response was elicited, the mouse was placed on its back to test for

the second indicator of insensibility, loss of the righting reflex. If leg paddling occurred when placed on its back, this was recorded as a 'purposeful movement'. Once the mouse was unable to self-right (unable to re-establish an upright position), the time of loss of the pedal withdrawal reflex was recorded at the time of the third consecutive toe pinch with no response (toe pinches were 10s apart) and the treatment gas was turned off and the CO<sub>2</sub> gas at 60% was introduced until last breath.

All isoflurane treatment mice showed an escape response, purposeful movement and a pedal withdrawal response in comparison to only two, zero and one CO<sub>2</sub> mice respectively, therefore, even after recumbency and the loss of the righting reflex, mice showed indications of sensibility, suggesting that these are not reliable indicators. On average, the interval between the onset of recumbency and loss of the pedal withdrawal reflex was 40 seconds for isoflurane versus 16 seconds for the CO<sub>2</sub> method. The authors recommend that users wait a minimum of 79 seconds after recumbency before switching to a high rate of CO<sub>2</sub> and if using the gradual-fill CO<sub>2</sub> method, users should wait a minimum of 49 seconds before increasing the flow rate of CO<sub>2</sub>.

Moody CM, Makowska IJ and Weary DM (2015) Testing three measures of mouse insensibility following induction with isoflurane or carbon dioxide gas for a more humane euthanasia. *Applied Animal Behaviour Science* **163**:183-187.

## Microwave energy as a humane stunning technique for cattle

The humane slaughter of animals implies that they experience minimal pain and distress before death. In Western countries, animals are required to be stunned prior to slaughter in order to induce insensibility (where the animal cannot experience feelings or sensations and hence no pain). Some stunning techniques are reversible and the animal is able to recover if allowed (e.g. head only electrical stun), whereas others are irreversible (e.g. penetrating captive bolt stun). However, stunning techniques can lead to variable results, which has the potential to have a negative impact on the welfare of animals, hence there is a global search for alternative techniques. Previous studies in humans and animals have shown that the use of electroencephalographic (EEG) data can indicate the occurrence of pain and of insensibility. This study examined the effectiveness of applying different settings of microwave energy delivery, power and duration for inducing insensibility on anaesthetised cows, as indicated by seizure-like EEG readings.

This study was performed on nine cows in Melbourne, Australia and the researchers applied different settings of microwave energy to anaesthetised cattle. The EEG responses were recorded via electrodes attached to the head of the cattle and the electrocardiology (ECG) responses (i.e. the responses of the heart) were recorded via electrodes attached to the body of the cattle. It was found that microwave application induced EEG changes in all of the nine cows, and induced seizure-like readings that are associated with insensibility. The EEG seizure-like changes were found to be observed as soon as 3 seconds following the end of a 10-second microwave application.

The results confirm that microwave energy is a relatively quick stunning process when compared with other procedures such as electrical stunning, for which applications of 15 seconds are required. EEG suppression was found to last between 37-162 seconds and applying high power increased the duration of insensibility. It was also found that there was a sudden decrease in heart rate as evidenced by the ECG readings following microwave application. This study suggests that the use of microwave energy may be appropriate for performing humane stunning and the authors suggest further research be performed to assess if this technique may be appropriate for use in a commercial setting.

Rault JL, Hemsworth PH, Cakebread PL *et al* (2014) Evaluation of microwave energy as a humane stunning technique based on electroencephalography (EEG) of anaesthetised cattle. *Animal Welfare* **23**:391-400.



## A review of the indicators used to assess unconsciousness in livestock after stunning

Much of the livestock that is killed at commercial abattoirs will be stunned prior to killing. As animals become unconscious when stunned, and are considered then not to experience pain, it is important to determine exactly when an animal is unconscious after stunning before killing. This paper discusses the different ways in which unconsciousness after stunning is assessed, depending on the species of animal and method of stunning. Assessing unconsciousness using an electroencephalogram (EEG), which records electrical impulses from the brain, is suggested to be the most objective, and therefore accurate, means of assessing unconsciousness, but the use of EEG is generally restricted to experimental set-ups.

This paper explores unconsciousness, what it means and how it can be achieved in a commercial slaughter environment, and the wide range of behavioural and physical indicators that can be used to identify if an animal is unconscious. The authors suggest that the indicators that animals are unconscious vary in reliability between stunning methods. When physically stunning an animal (e.g. by captive bolt gun) the most important indicators to be examined are posture, righting reflex, rhythmic breathing and the corneal reflex (the blink reflex stimulated by touching the white of the eye) and these should all be absent if the animal is unconscious. Spinal reflexes should not be used for this type of stunning, as they can occur vigorously after stunning. For stunning methods that

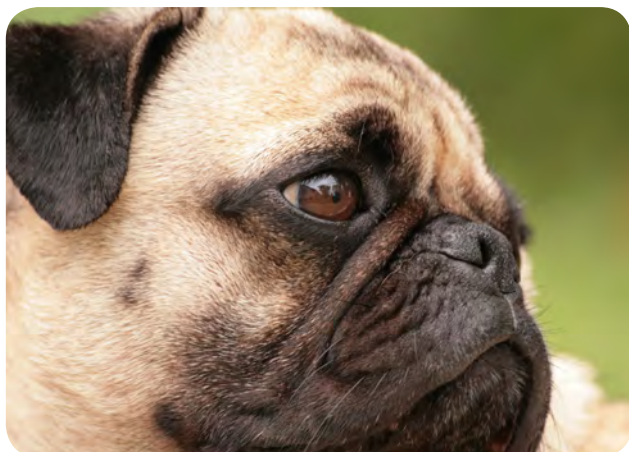
do not physically destroy the brain (e.g. electrical and gas stunning) the most important indicators of unconsciousness are posture, righting reflex, natural blinking response, rhythmic breathing, vocalisations and focused eye movement and these should all be absent if an animal is unconscious. The authors emphasise that, under commercial conditions, none of the indicators above should be used alone to indicate unconsciousness, and multiple indicators should be used and time given for the animal to die following exsanguination (draining of the blood, usually from the neck) before beginning procedures such as scalding or skinning.

The use of EEG recordings, although considered the most objective way to assess unconsciousness, are difficult to use under commercial slaughtering conditions, and the authors suggest that effort is made to resolve the difficulties. This will allow the use of EEG recordings in combination with other indicators, to be used to indicate unconsciousness under commercial conditions and to lead to improvements in stunning methods and hence animal welfare at the slaughter plant.

Verhoeven MTW, Gerritzen MA, Hellebrekers LJ *et al* (2015) Indicators used in livestock to assess unconsciousness after stunning: a review. *Animal* **9**(2): 320-330.

## MISCELLANEOUS

### Breathlessness as a significant animal welfare issue



Breathlessness has been studied extensively in humans and has been reported to be very unpleasant and distressing. This paper provides an account of the neural and physiological mechanisms around the conscious awareness of breathlessness and draws attention to the negative impact that breathlessness can have on the welfare of animals and the range of situations in which they may experience breathlessness.

The authors firstly define the concept of breathlessness and how the respiratory system is controlled in the body. At least three different qualities of breathlessness are currently recognised which are

respiratory effort (the conscious awareness of the respiratory muscle force required to achieve necessary ventilation and air intake), air hunger (the urge to breathe such as that experienced at the end of a long breath hold) and chest tightness (caused by tightening of smooth muscle in the lungs). Breathlessness may occur in animals due to a variety of reasons. Annually many millions of mammals are deliberately drowned or asphyxiated for the purposes of pest control, harvesting of fur, or to euthanase unwanted individuals. Breathlessness can also be seen in brachycephalic dogs and, due to the lack of oxygen entering the lungs as a result of their flat face, exercise may cause fainting in severely affected animals. In animals with any condition that impairs

ventilation, breathlessness may also be caused by yarding, mustering, riding, racing or driving, with the associated sense of unpleasantness.

The paper concludes that air hunger is the most unpleasant sensation of the three qualities and has the greatest potential to compromise animal welfare. The authors encourage those involved in evaluations of animal welfare to consider breathlessness when determining the overall welfare of the animal.

Beausoleil NJ, Mellor DJ (2015) Introducing breathlessness as a significant animal welfare issue. *New Zealand Veterinary Journal* **63**(1):44-51.

## Fish intelligence, sentience and ethics

Fish are used as a food source, utilised in experimental research and are kept as pets. However, despite the fact that humans interact with fish on many levels, they have not attracted much public concern as to their welfare. This may be for a number of reasons, but perhaps, primarily, because there is a widely held societal view that they are not intelligent or conscious. Mounting evidence does, however, suggest that fish are far more intelligent than we give them credit for.

The author of this paper attempts to bridge the gap between public perception of fish cognition and the scientific reality and reviews the available scientific evidence around fish. The paper shows, from the evidence presented on cognition and sensory perception, that fish have very good memories and live in complex social communities where they are able to recognise individuals, and themselves, and are able to learn from, and cooperate with, each other. They build complex structures in their aquatic environment and are capable of tool use. In many cases, their primary senses such as their visual, olfactory and auditory senses, are just as good, and in some cases, better than that of humans. If their behaviour is compared to primates, there is very little difference, with only the exception of their ability to imitate and they also have a brain structure that is more similar to other vertebrates than was previously believed.

The author concludes that the cognitive complexity of fish is on a level with other vertebrates, and as other vertebrate animals are considered to be sentient, then surely fish must be too. As this is the case, fish should be brought into our 'moral circle' and provided with the same protection as would be given to any other vertebrate.

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