



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.

COMPANION ANIMALS

Frequency and duration of training sessions and long-term memory in dogs

Dogs are a popular household pet and are used for work in areas such as law enforcement. Little research has been performed on how often and for how long a dog should be trained, despite the need for training in many of the relationships that humans have with this species. This study investigated the effect that frequency and duration of training sessions had on how quickly dogs learned, and the long term retention of this knowledge. Laboratory beagles, with the same upbringing and environmental exposures, were subject to training sessions on either a daily, or once to twice weekly basis. They were trained, by means of twelve levels, to go to a basket and stay, using 'positive reinforcement' whereby they were rewarded with treats. The duration of each session was either three continuous sessions, or one training session only. Dogs were judged as to how quickly they acquired knowledge, and how much of this they retained after four weeks.



It was found that the frequency and duration of training sessions affected how quickly dogs learned. Dogs trained once or twice a week learned quicker than daily trained dogs, as did dogs that undertook training sessions that were shorter in duration (one session) rather than three successive training sessions. Dogs that had short sessions once or twice a week acquired skills the quickest, whereas longer duration sessions and daily training resulted in the slowest learning. This may be related to the ability to consolidate previous knowledge and diminishing motivation and concentration with time. Training regime did not affect long-term memory, as all dogs were able to perform the task when retested after four weeks. Therefore breaks in training, do not appear to impair long-term memory of a learned task. The aim of this study was not to provide optimum training schedules, as factors such as the type of task can affect learning. However, these results can be used to optimise training in dogs, since the number of training sessions often is a limiting factor in practical dog training.

Demant, H., Ladewig, J., Balsby, T. *et al.* (2011) The effect of frequency and duration of training sessions on acquisition and long-term memory in dogs, *Applied Animal Behaviour Science*, **133**: 228-234.

Effect of substrate on foraging behaviour in aquarium fish



Fish behaviour, and their capacity to feel pain and suffer, is being increasingly recognised. The type of substrate that is used on the bottom of fish tanks may influence fish welfare and physiology by allowing them to best express their natural behaviour of foraging, the absence of which may cause distress.

In this study, goldfish were examined for the effects that substrate particle size and presence of food amongst substrate had on their foraging behaviour and motivation. Fish were housed individually and given different preference combinations of: very coarse sand (< 1.5 mm), fine gravel (1.5–3 mm), pebbles (10–12 mm) and cobbles (65 mm+), and the presence or absence of food for these different combinations. They were well fed prior to observation, and so it is unlikely that they had any nutritional need to search for food.

Fish displayed foraging behaviour in all substrate types, and even mouthed the tank base when no substrate was provided. Foraging was greatest for substrates with the smallest particle size, perhaps because they could be more easily drawn into the mouth and because benthic invertebrates, their natural food source, are more greatly distributed on smaller particles. Presence of food had little effect on foraging when compared to substrate particle size. Care must be taken when interpreting results of such preference tests as the best choice for the animal may not have been provided.

The study concludes that it may be worthy to assume that fish welfare is compromised in the absence of suitable substrate to facilitate natural foraging behaviour.

Smith, A. & Gray, H. (2011) Goldfish in a tank: the effect of substrate on foraging behaviour in aquarium fish, *Animal Welfare*, **20**: 311-319.

FARM ANIMALS

Review of wallowing in pigs

Currently, most pigs are farmed in intensive systems however there is an increasing trend towards more welfare-friendly and sustainable farming practices. To date, little concern has been given to the importance of wallowing behaviour for pig welfare within modern production systems, which are normally devoid of wallowing facilities

The authors evaluated previously conducted studies concerning pig wallowing behaviour and other welfare parameters in an attempt to describe, for the first time, how different farming designs and wallowing provisions impact on pig behaviour and welfare. They also compared the importance of wallowing for pig welfare to other factors such as dietary provisions, access to straw, and castration of males. Recommendations for ideal wallowing conditions and the benefits that wallowing can provide include helping to regulate body temperature, wound disinfection, protection from ectoparasites, sunburn, heat stroke and predators (through scent masking), as well as social factors such as rest, play and sexual communication are described. These benefits are linked to 'ideal' wallowing conditions and may not be relevant to many farming systems, or where alternative facilities such as scratching, rooting, and cooling methods exist. Additionally, risks associated with wallowing are also described, including the potential for decreased hygiene and increased risk of contagious disease, and increased susceptibility to injury.

The authors found that overall, wallowing, if offered in 'ideal' forms, is important for pig welfare. They acknowledged the existence of stakeholder sensitivities surrounding the implementation of such facilities and suggest this be addressed through further research and a collaborative approach between ethologists, veterinarians, designers, and farmers.



Bracke, M. & Spoolder, H. (2011) Review of wallowing in pigs: implications for animal welfare, *Animal Welfare*, 20: 347-363.

Canopy cover is correlated with reduced feather pecking in laying hens

Increased public concern over the welfare of laying hens has led to the ban of traditional battery cages in the European Union by 2012, in favour of more welfare-friendly housing systems. Non-cage systems have the potential to provide greater welfare, as they allow for more freedom of movement and ability to express natural behaviours such as foraging and dust bathing. However, although abundant outdoor space is provided, hens in free range systems have been found to not use such areas unless canopy cover is present.



Canopy cover offers shade, shelter, and protection from aerial predators. When hens range less, there has been found to be a greater risk of injurious feather pecking (IFP). This is an abnormal behaviour that consists of pulling, plucking, and damaging feathers of fellow hens. It can lead to pain, poor plumage quality, feather loss, skin damage, and greater chance of vent pecking, cannibalism and death. It also makes regulation of body temperature more difficult, which, from a production point of view, can result in greater energy expenditure and thus lower egg return.

The researchers investigated whether the quality of outdoor canopy cover would result in a greater distribution of hens across the range and a subsequent decrease in IFP. Research was conducted through a collaborative project between McDonald's Restaurants UK, and two UK egg-producing companies, The Lakes Free Range Egg Co Ltd and Noble Foods Ltd with the hope of improving the welfare of laying hens within the McDonald's supply chain. 286 laying hen producers were required to plant, if not present already, 5% of the total range area in canopy trees, and record plumage damage scores for each flock at the end of lay. Plumage damage was cross-examined at abattoirs to ensure accuracy of this assessment. Plumage damage was chosen as it is a good indicator of IFP. The level of plumage damage was found to be significantly related to the quality of canopy cover within planted areas, provided that the distance between the house and the nearest cover was relatively close.

Providing a relatively small area of trees with good canopy coverage may be a practical way of reducing plumage damage due to IFP in commercial laying hens and provide environmental benefits such as soil stabilisation, reduced nutrient leaching, and carbon sequestration.

Bright, A., Brass, D., Clachan, J. *et al.* (2011) Canopy cover is correlated with reduced injurious feather pecking in commercial flocks of free-range laying hens, *Animal Welfare*, 20: 329-338.

Effects of mulesing and alternative procedures on lamb behaviour



Flystrike, whereby blowfly larvae infest the skin and fleece of sheep, is an important welfare issue for Australian merinos. A range of permanent preventative measures are currently employed with the aim of reducing the amount of skin folding and moisture and faecal

contamination, particularly around the anogenital region. However many preventative measures also cause pain. The traditional practice of surgical mulesing, whereby skin is removed via cutting without anaesthetic or pain relief, is a contentious welfare issue due to the severity of the wound and the pain inflicted. Other preventative measures currently trialled include selective breeding, anaesthetic and pain relief use during mulesing procedures, chemical tissue destruction, and plastic clips that clamp onto loose skin and cause sloughing when it dies from a subsequent lack of blood supply.

The researchers investigated the short term behavioural effects of mulesing without pain relief, and two other flystrike preventative procedures including placement of a chemical (sodium lauryl sulphate) under the skin, and plastic clip application. Lamb behaviour for the first 120 minutes after procedure application was observed, via digital video recording.

Mulesed lambs spent less time eating, drinking, walking, running and lying, and stood with their head down for longer periods than all other treatments. They also took longer to commence feeding and had a shorter duration of the first lying bout. Lambs treated with chemical spent more time kneeling, and lambs in both the clip and chemical groups spent more time with their head down, than lambs in the control group. However, these observations were much less severe than the mulesed group and it was concluded that the short

term impact of surgical mulesing without pain relief on the behaviour of lambs caused significant behavioural inhibition and reduced welfare.

Edwards, L., Arnold, N., Butler, K. *et al.* (2011) Acute effects of mulesing and alternative procedures to mulesing on lamb behaviour, *Applied Animal Behaviour Science*, 133: 169-174.

Motivation and enrichment use in group-housed sows

The farming of pregnant sows within group housing situations is receiving increasing interest from an animal welfare perspective, as it allows for greater movement and social interaction as opposed to the more commonly used sow gestation stalls. One welfare issue still of concern in both practices is that of low environmental stimulation, which can lead to apathy, impaired mental development, chronic stress, and increased aggression. Access to appropriate environmental stimulation can improve pig welfare by affording the ability to express natural behaviour, increasing exercise and social interaction, providing thermal and flooring comfort, and reducing stereotyped behaviour. However, the effectiveness of such enrichment within group settings may be reduced if individual usage is impacted by their social status.

In this study, the researchers examined differences between dominant and subordinate pregnant sows both in how motivated they were to access enriched group pens, and how much social status affected the use of enrichment facilities. Enrichment was provided through rubber mats, cotton ropes, straw, and compost, with the aim of encouraging natural behaviours such as exploration, rooting and foraging. Motivation for use was based on how determined sows were to enter the enriched pens via the use of an operant panel to which they had been trained. The sows used were in early pregnancy (4–9 days post-breeding), and were formed into newly established groups in which dominance hierarchy was determined via food competition tests.

There was no difference between dominant and subordinate sows' motivation for access to enrichment pens. However, dominant and middle sows were found to spend more time using enrichment facilities whereas subordinate sows were often displaced from participation. Dominant sows were more active and exhibited more aggression within group pens than subordinate sows. Sow social status also affected how enrichment was utilised throughout the day, as subordinate sows appeared to compensate for displacement by operating more in the early morning and non-peak times. Additionally, sows were found to favour rubber matting for resting, which may improve welfare through increasing ease of getting up and down, reduced slipping and fewer injuries.

Regardless of social status, these findings suggest that sows value access to enriched group pens, although social status should be considered when designing enrichments for group housed animals.

Elmore, M., Garner, J., Johnson, A. et al. (2011) Getting around social status: Motivation and enrichment use of dominant and subordinate sows in a group setting, *Applied Animal Behaviour Science*, 133: 154-163.

Preventing piglets from getting crushed

Piglet survival is an important economical and welfare consideration in pig farming. Most piglets and lactating sows are currently housed in farrowing crates that aim to decrease piglet mortality caused by sow crushing when she lies down. However, these crates provide for poor sow welfare due to restricted space, exercise, and environmental enrichment. Recent studies have suggested that piglet mortality rates do not differ between conventional farrowing crates and the more sow-friendly loose farrowing systems, which allow for greater movement and communication for the sow. It seems that the ability of the sow to communicate with her piglets before she lies down, via rooting, pawing, sniffing and nudging of piglets, looking and turning around and descending vertically, may allow piglets more time to move away from 'danger' zones, and provides for greater maternal protectiveness. 'Danger zones' are described as areas within one piglet length of the sow on the side on which she is about to lie down.

This study examined how the incidence of piglet crushing on days one and three after birth was affected by sow and piglet communication (vocalisation and nudging and sniffing of piglets) prior to the sow lying down, as well as piglet condition on piglet location before lying down. Sows and piglets were observed via constant video surveillance and housed in farrowing pens that consisted of 7m² of free space for sows and piglets, and a 1.9 m² creep area for piglets, which was inaccessible to the sow and had floor heating with a wooden triangular roof. Two metal rails in the main area were present to avoid piglet crushing. The number of piglets present in the danger zone and sow area, and the number of piglets clustered together, were counted.

Piglet mortality caused by crushing was 6.4% of live born piglets, the majority of which occurred on day one (93%). There was a greater probability of crushing for lower body weight piglets, although piglets with higher body weights were more likely to be present in the danger zone on day one. Sow pre-lying communication attracted piglets to the sow, increasing piglet clustering, and the proportion of piglets in the danger zone where



they were at risk of crushing. However, piglet crushing was not increased as a result of greater pre-lying communication, piglet location, or time spent in the sow area.

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It seems that the benefits that piglets gain from being close to the sow during the first days after birth, such as sow-piglet bonding, milk, heat, protection and comfort, outweigh the risk of getting crushed, and their preference for this is very high regardless of the comforts provided in the creep areas. It can therefore be considered as a battle against biology to aim at attracting newborn piglets away from the sow.

Melisová, M., Illmann, G., Andersen, I. et al. (In press) Can sow pre-lying communication or good piglet condition prevent piglets from getting crushed? *Applied Animal Behaviour Science*.

Effect of shade in cattle feedlots

Feedlots are a popular way of finishing off beef cattle prior to slaughter. Heat stress is a common and significant issue for cattle housed in these environments, as it decreases welfare and causes production losses. Shade provision can reduce the effects of heat, however to date optimal shade requirements for feedlot cattle have not been determined.

In this study, researchers investigated the effects that

different amounts of shade allocation, in the presence or absence of wind protection, had on the performance, carcass characteristics, and welfare of Black Angus yearling heifer feedlot cattle. Three, 119 day research periods were conducted, in a subtropical, summer environment in which high temperature, humidity and solar radiation was common. Shade was provided via 70% solar block shade cloth, with north-south orientations, and allocated at either 0m², 2.0m², 3.3m² or 4.7m² per animal. Climatic conditions (which were used to determine how much heat cattle experienced), animal behaviour (including panting, posture, feed and water intake, and time spent standing or lying in the sun or shade), and production performance (including the financial return of carcass weight minus the cost of production and shade manufacture), were assessed.



The results demonstrated that shade helped to reduce ground surface temperatures by up to 20oC. Shade improved performance in facilities where wind flow was restricted; otherwise performance was similar for cattle in shaded and unshaded facilities. The provision of shade areas larger than 2.0m² did not offer any greater production benefits, however this size offered less welfare improvements than the larger 3.3 m² and 4.7 m² sizes. Under high heat levels, cattle did not eat as much, and providing shade reduced this effect (i.e. unshaded cattle had a 50% reduction in feed intake compared to shaded cattle that had a 10% reduction). However, when heat abated, unshaded cattle exhibited a compensatory increase in feed intake and subsequent growth. The average amount that cattle gained in a day was lowest for unshaded cattle, and daily weight gained amongst shaded groups was similar regardless of shade size. However, towards the end of their feedlotting time, unshaded cattle exhibited higher weight gains. The biggest response to shade occurred early on in the feedlotting period (first 56 days), even though shade use increased the longer that cattle had been at the facilities. This suggests that shade is of less value once cattle are acclimatised to hot conditions, or when hot conditions subside. When heat is less of an issue, compensation by unshaded cattle offsets the benefits provided by shading. Additionally, production costs and shade material costs must be factored in when

considering the financial benefits of shade allocation. Carcass quality at slaughter was unaffected by whether animals had shade or not.

High heats caused cattle to drink more, and unshaded cattle spent longer at water troughs although shaded cattle drank more in total, perhaps because of their higher feed intake during hot periods. Cattle responded to heat by panting, which was less in shaded groups. They also stood more, and cattle in both shaded and unshaded groups stood more during heat waves. Both standing and panting behaviours may be good indicators of heat stress.

Ultimately, the benefits of shade provision may be most useful in areas with high temperatures and high levels of solar radiation. Access to shade and greater areas of shade reduced but did not eliminate the effects of heat, and therefore other management strategies should be also be utilised to address the issue of heat stress.

Sullivan, M., Cawdell-Smith, A., Mader, T. *et al.* (2011) Effect of shade area on performance and welfare of short-fed feedlot cattle, *Journal of Animal Science*, 89: 2911-2925.

Breeding against harmful social behaviours in pigs and chickens

Harmful behaviours between animals are a common occurrence in modern, intensive farming systems and can decrease welfare and profitability by affecting growth rate and meat quality, increasing risk of infection, and suppressing the immune system. Examples include littermate and maternal aggression, ear biting and belly nosing in pigs, and feather pecking in hens.

Many factors contribute to whether an animal will display adverse behaviours, and their measurement is difficult. Much work has been focused on ways in which husbandry practices and pre and post natal influences may decrease the occurrence of such behaviours, but these are often expensive, labour intensive, or represent welfare risks, such as piglet teeth clipping and layer hen beak trimming. Selective breeding of animals based on genes associated with productivity as well as low harmful behaviour may provide cheaper and more permanent economic and animal welfare benefits.

This paper presents a summary of the progress made in estimating how much an animal's genetics contributes to the expression of harmful social behaviour traits. Additionally, the economic and welfare effects that selection for these behaviour traits may have, as well as some barriers that may prevent such uptake of selection, are examined.

All major harmful social behaviours have been found to be inherited to some degree, although this is often low and therefore has been difficult to measure. One solution for selecting against negative behaviour may be

found through genotyping, or the mapping of genes. It is likely that such traits are influenced by a large number of genes, and combining these genes into one 'value' has proven beneficial in the past for distinguishing traits that are difficult to measure and which are likewise determined by a large number of genes. Selection based on genetic 'values' may allow prediction of behaviour on larger populations, at younger ages, and thus accelerate genetic change. Care must be taken for the unintentional effects that behaviour-related gene selection may have on economically valuable traits. Another, more indirect option is to select animals based on associated social behaviour, thus avoiding the need to map genes. Animals could be selected for

breeding based on how well they affect the economic performance of those around them. Because harmful behaviour has a negative impact on performance of others, this may lead to beneficial changes in social behaviour as a by-product of selection to improve economic traits.

Regardless of the method adopted, it is important that if genetic selection is used to decrease adverse social behaviour, it is not at the price of adequate husbandry and management solutions.

Turner, S. (2011) Breeding against harmful social behaviours in pigs and chickens: State of the art and the way forward, *Applied Animal Behaviour Science*, **134**: 1-9.

ANIMALS USED FOR SPORT, ENTERTAINMENT, RECREATION AND WORK

The Sixth International Equitation Science Conference

The sixth international equitation science conference organized by the International Society for Equitation Science focused on the influence of learning, training, and education on horse welfare and human safety.

Abstracts from the conference are available in the current issue of the *Journal of Veterinary Behavior: Clinical Applications and Research* (2011), **6**(5)

Using positive reinforcement to train horses

Traditionally, many horses have been trained using negative reinforcement (NR). In the past few years, however, the use of positive reinforcement (PR) has become more common. This study evaluated the effectiveness and the possible stressor effect of these 2 training methods. 12 horses showing trailer-loading problems were selected and exposed to trailer-loading. They were randomly assigned to one of the 2 methods. NR involved various degrees of pressure (lead rope pulling, whip tapping). Pressure was removed as soon as the horse complied. PR horses were exposed to clicker training and taught to follow a target into the trailer. Heart rate (HR) and behavior denoting discomfort were recorded at time intervals. Training was completed when the horse could enter the trailer upon a signal, or was terminated after a maximum of 15 sessions.

The results of the study indicated that the horses trained with NR displayed significantly more discomfort behavior per training session than horses trained with PR and that horses in the PR group spent less time per session to complete the training criterion. There was no difference in mean HR (bpm) between the 2 groups during training. The study concludes that the PR group provided the fastest training solution and expressed less stress response. Thus, the PR procedure could provide a preferable training solution when training horses in potentially stressful situations.

Hendriksen, P., Elmgreen, K. & Ladewig, J. (2011) Trailer-loading of horses: Is there a difference between positive and negative reinforcement concerning effectiveness and stress-related signs? *Journal of Veterinary Behavior: Clinical Applications and Research*, **6**(5): 262-266.



Time-out sessions for therapy dogs

Animal-assisted therapy (AAT) involves the use of specially trained animals in clinical situations to assist people physically and psychologically. Study is needed to determine whether such work presents a stress to dogs used in AAT, such as from visual stimulation, crowds, and noises, and whether relief from stress through the form of play provides any benefit.

The researchers in this study investigated whether dogs showed fewer signs of stress after they were given the opportunity for a “quiet-play” time-out session during a working shift. Trained AAT therapy dogs were given time-out sessions during the middle of their working shift (after one hour of work), in the form of play with a toy, petting, or obedience commands. Stress in dogs was assessed based on differences in saliva cortisol levels between when dogs were at home, half way into a work session, and at the end of a work session which was or was not interrupted by a time-out period. This was supported by observations made by the dog handlers and researcher on dogs’ behaviour at the end of a shift.

Time-out sessions did not make a difference to dogs’ stress levels as measured by salivary cortisol concentration. Handler assessment was also consistent with cortisol results and a valid indicator of physiological stress. Dogs had higher cortisol levels after their first hour of work, possibly due to new stimulation. Cortisol levels decreased in several dogs at the end of their shift, whether they had the time-out session or not. This may be because they had become used to the work. Many dogs seemed to view the half-time break in their shift as indicating the end of work, which may mean that when work recommenced after a time-out session, they underwent a similar stress response to that at the start of their work session. More experienced dogs showed less signs of stress compared to less experienced dogs. A high level of performance is expected from therapy dogs, and monitoring body language may enable handlers to intervene through deferred mental stimulation and play when dogs show signs of stress.

King, C., Watters, J. & Mungre, S. (2011) Effect of a time-out session with working animal-assisted therapy dogs, *Journal of Veterinary Behavior: Clinical Applications and Research*, 6(5): 232-238.

Jockeys’ whip hand preferences in Thoroughbred racing

Recent studies have questioned the benefit that whip use provides in improving racing times in horse racing. Additionally, controversy has arisen over the main Australian racing authority’s attempt to moderate the use of whips in the interests of horse welfare. In response, claims have been made that whips provide an important safety mechanism for jockeys, preventing collisions. The authors of this paper tested the assumption whips would be most useful when placed on the side of the horse that is outside of the bends in horses’ natural tendency to steer away from bends. Photographs of horse racing in New South Wales, where racing occurs in a clockwise direction, and in Victoria, where racing is counter clockwise, were examined to determine in which hands jockeys held their whips. Results were compared to Australian data on human hand preference, which indicated males and females are predominantly right-handed, at 85.4% and 87.5% respectively.

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91.5% of Victorian jockeys and 53.5% of New South Wales (NSW) jockeys held the whip in the right hand, which is in line with national preference for right handedness. More than half of NSW jockeys held the whip in the inside hand, even though for steering purposes the left hand would be preferable on a clockwise track. The incomplete reversal in whip placement between counter clockwise and clockwise tracks, suggests that in NSW at least, jockeys' handedness may be more important than steering in determining where to hold the whip. Caution must be taken as whip position in these images may only be relevant to holding, and jockeys may indeed switch hands when actually using the whip.

McGreevy, P. & Oddie, C. (2011) Holding the whip hand - a note on the distribution of jockeys' whip hand preferences in Australian Thoroughbred racing, *Journal of Veterinary Behavior: Clinical Applications and Research*, 6(5): 287-289.

Evaluating learning theory in donkeys

Donkeys have played important roles in human societies, and it is estimated that 95% of donkeys in the world are used for work in developing countries. As yet, little research on their behaviour or learning has been published and this study attempts to address donkey training and psychology. Ten donkeys were trained, half by a 'Halter Training Method', and the other half by the 'Traditional Stick Method', which is often used to guide donkeys when pulling carts. Behaviour tests and heart rate measurements were performed on numerous days. The behaviour

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of donkeys was no different between groups. Heart rate was also largely no different between groups, and there was no difference in driving time or score. Of note is that after ten days of training, those in the stick group needed to be transferred to the halter training method as they were prone to bolting, highlighting the danger that this method may pose.

The study suggests that there were minimal differences between training methods and concludes that donkeys can be trained to pull a cart in a short amount of time without resorting to harsh methods.

McLean, A., Heleski, C., Yokoyama, M. *et al.* (2011) Evaluating learning theory in donkeys (*Equus asinus*) while measuring heart rate variability and behavior when teaching donkeys to work to a cart, *Journal of Veterinary Behavior: Clinical Applications and Research*, 6(5): 293.



WILDLIFE

Enrichment for cheetahs held in captivity



Captive cheetahs are prone to stereotypic behaviours such as pacing, and this may be managed through the provision of enriched environments which aim to

increase the expression of natural behaviours, reduce stereotypical behaviours, and improve animal welfare.

This research tested how the behaviour of captive cheetahs and how they spent their time, changed when fed at unpredictable times, food was spread across the enclosure, and olfactory stimulation was provided (in this case in the form of onyx faeces). These modifications were removed during different periods of the day to prevent habituation and to determine whether their presence at various times also affected cheetah behaviour.

All groups reacted positively to the environmental changes, increasing their exploration and amount of activity, and decreasing pacing behaviours. The enrichment did not cause an increase in abnormal behaviour at any stage. Behaviours were affected by the timing of when enrichment was provided, suggesting that it may be worthwhile to deliver particular

enrichments based around when abnormal behaviour is most common, such as pacing prior to feeding times. Provision of environmental enrichment may help to further promote natural behaviours and reduce stereotypical behaviours such as pacing. Additionally, there was variation in individual responses, suggesting

that it may be worthwhile considering the use of 'tailored' enrichment treatments.

Quirke, T. & O' Riordan, R. (2011) The effect of different types of enrichment on the behaviour of cheetahs (*Acinonyx jubatus*) in captivity, *Applied Animal Behaviour Science*, **133**: 87-94.

MISCELLANEOUS

Pain relief for rainbow trout

The capacity for fish to feel pain and suffer is being increasingly recognised therefore pain relief should be considered for invasive procedures, such as surgery and tagging. At this stage however, there is relatively little information regarding the effectiveness of analgesic drugs or the appropriate dose for fish. This study assessed the efficacy of three different types of pain relief drugs: an opioid (buprenorphine), a non-steroidal anti-inflammatory drug (carprofen) and a local anaesthetic (lidocaine), and their efficacy at three different dose rates. Rainbow trout were given a noxious stimulus via injection of acetic acid under the skin, which has been shown previously to induce behavioural and physiological changes in this species. Video surveillance was used to monitor breathing rate, the time taken to resume feeding, and activity levels. Blood cortisol levels were also used to assess pain responses.

Injection of acid was shown to increase breathing rates, reduce activity levels, and increase the length of time for feeding to resume. These reactions may be useful

to assess response to noxious injurious stimuli in trout in the future. Buprenorphine at all doses had limited impact on the fish's response to a painful stimulus. Carprofen caused fish to resume eating quicker, but activity was reduced more than by noxious treatment alone. This may be related to an unknown adverse side effect of the drug. Lidocaine reduced all of the pain indicators, with the lowest most effective dose being established as 1 mg per fish. There were no significant differences between the plasma cortisol concentrations in any of the buprenorphine treated groups nor the carprofen treated groups compared with the saline and acid groups. However, there was a trend for plasma cortisol to be lower in the lidocaine groups. Lidocaine may be recommended for future use, although further testing is required to gain a better understanding of drug action and their behavioural and physiological effects.

Mettam, J., Oulton, L., McCrohan, C. *et al.* (2011) The efficacy of three types of analgesic drugs in reducing pain in the rainbow trout, *Oncorhynchus mykiss*, *Applied Animal Behaviour Science*, **133**: 265-274.

ARTICLES OF INTEREST

COMPANION ANIMALS

Baguley, J. (2011) An analysis of the demand for and revenue from companion animal veterinary services in Australia between 1996 and 2026 using industry revenue data and household census and pet ownership data and forecasts, *Australian Veterinary Journal*, **89**(9): 352-359.

Finkler, H., Hatna, E. & Terkel, J. (2011) The influence of neighbourhood socio-demographic factors on densities of free-roaming cat populations in an urban ecosystem in Israel, *Wildlife Research*, **38**(3) 235-243.

FARM ANIMALS

Aquaculture

Bosma, R.H. & Verdegem, M.C.J. (2011) Sustainable aquaculture in ponds: Principles, practices and limits, *Livestock Science*, **139**(1-2): 58-68 SI.

Erikson, U. (2011) Assessment of different stunning methods and recovery of farmed Atlantic salmon (*Salmo salar*): isoeugenol, nitrogen and three levels of carbon dioxide,

Animal Welfare, **20**(3): 365-375.

Olesen, I., Myhr, A.I. & Rosendal, G.K. (2011) Sustainable aquaculture: are we getting there? Ethical perspectives on salmon farming, *Journal of Agricultural and Environmental Ethics*, **24**(4): 381-408.

Cattle

de Passillé, A.M., Borderas, F. & Rushen, J. (2011) Cross-sucking by dairy calves may become a habit or reflect characteristics of individual calves more than milk allowance or weaning, *Applied Animal Behaviour Science*, **133**(3-4): 137-143.

Jensen, M.B. (In press) The early behaviour of cow and calf in an individual calving pen, *Applied Animal Behaviour Science*.

Houe, H., Sandøe, P. & Thomsen, P.T. (2011) Welfare assessments based on lifetime health and production data in Danish dairy cows, *Journal of Applied Animal Welfare Science*, **14**(3): 255-264.

Martins, L.T., Goncalves, M.C., Tavares, K.C.S. *et al.* (2011) Castration methods do not affect weight gain and have

diverse impacts on the welfare of water buffalo males, *Livestock Science*, **140**(1-3): 171-176.

Melotti, L., Oostindjer, M., Bolhuis, J.E. *et al.* (2011) Coping personality type and environmental enrichment affect aggression at weaning in pigs, *Applied Animal Behaviour Science*, **133**(3-4): 144-153.

van den Borne, B.H.P., Vernooij, J.C.M., Lupindu, A.M. *et al.* (In press) Relationship between somatic cell count status and subsequent clinical mastitis in Dutch dairy cows, *Preventive Veterinary Medicine*.

Pigs

Bøe, K.E., Cronin, G.M. & Andersen, I.L. (2011) Turning around by pregnant sows, *Applied Animal Behaviour Science*, **133**(3-4): 164-168.

Boogaard, B.K., Boekhorst, L.J.S., Oosting, S.J. *et al.* (2011) Socio-cultural sustainability of pig production: Citizen perceptions in The Netherlands and Denmark, *Livestock Science*, **140**(1-3): 189-200.

de Greef, K.H., Vermeer, H.M., Houwers, H.W.J. *et al.* (2011) Proof of Principle of the Comfort Class concept in pigs. Experimenting in the midst of a stakeholder process on pig welfare, *Livestock Science*, **139**(1-2): 172-185 SI.

Fernández, J., Fàbrega, E., Soler, J. *et al.* (In press) Feeding strategy in group-housed growing pigs of four different breeds, *Applied Animal Behaviour Science*.

Gu, Z., Gao, Y., Lin, B. *et al.* (In press) Impacts of a freedom farrowing pen design on sow behaviours and performance, *Preventive Veterinary Medicine*.

Haugen, J.-E., Brunius, C. & Zamaratskaia, G. (2011) Review of analytical methods to measure boar taint compounds in porcine adipose tissue: The need for harmonised methods, *Meat Science*, **90**(1): 9-19.

Manteuffel, C., Schön, P.C. & Manteuffel, G. (2011) Beyond electronic feeding: The implementation of call feeding for pregnant sows, *Computers and Electronics in Agriculture*, **79**(1): 36-41.

Mullan, S., Edwards, S.A., Butterworth, A. *et al.* (2011) A pilot investigation of possible positive system descriptors in finishing pigs, *Animal Welfare*, **20**(3): 439-449.

Oostindjer, M., Bolhuis, J.E., Mendl, M. *et al.* (2011) Learning how to eat like a pig: effectiveness of mechanisms for vertical social learning in piglets, *Animal Behaviour*, **82**(3): 503-511.

Oostindjer, M., van den Brand, H., Kemp, B. *et al.* (2011) Effects of environmental enrichment and loose housing of lactating sows on piglet behaviour before and after weaning, *Applied Animal Behaviour Science*, **134**(1-2): 31-41.

Statham, P., Green, L. & Mendl, M. (In press) A longitudinal study of the effects of providing straw at different stages of life on tail-biting and other behaviour in commercially housed pigs, *Applied Animal Behaviour Science*.

Swaby, H. & Gregory, N.G. (2011) A note on the frequency of gastric ulcers detected during post-mortem examination at a pig abattoir, *Meat Science*, **90**: 269-271.

Vanheukelom, V., Driessen, B., Maenhout, D. *et al.* (2011) Peat as environmental enrichment for piglets: The effect on behaviour, skin lesions and production results, *Applied Animal Behaviour Science*, **134**(1-2): 42-47.

Poultry

Berrang, M.E., Meinersmann, R.J. & Hofacre, C.L. (2011) Spray washing, absorbent cornstarch powder, and drying time to reduce bacterial numbers on soiled transport cage flooring, *Journal of Applied Poultry Research*, **20**(3): 378-382.

Buchwalder, T. & Fröhlich, E.K. (2011) Assessment of colony nests for laying hens in conjunction with the authorization procedure, *Applied Animal Behaviour Science*, **134**(1-2): 64-71.

Buckley, L.A., Sandilands, V., Tolkamp, B.J. *et al.* Quantifying hungry broiler breeder dietary preferences using a closed economy T-maze task, *Applied Animal Behaviour Science*, **133**(3-4): 216-227.

de Vylder, J., Dewulf, J., van Hoorebeke, S. *et al.* (2011) Horizontal transmission of Salmonella Enteritidis in groups of experimentally infected laying hens housed in different housing systems, *Poultry Science*, **90**(7): 1391-1396.

Dekker, S.E.M., de Boer, I.J.M., Vermeij, I. *et al.* (2011) Ecological and economic evaluation of Dutch egg production systems, *Livestock Science*, **139**(1-2): 109-121 SI.

Elliott, J., Sneddon, J., Lee, J.A. *et al.* (2011) Producers have a positive attitude toward improving lamb survival rates but may be influenced by enterprise factors and perceptions of control, *Livestock Science*, **140**(1-3): 103-110.

Guardia, S., Konsak, B., Combes, S. *et al.* (2011) Effects of stocking density on the growth performance and digestive microbiota of broiler chickens, *Poultry Science*, **90**(9): 1878-1889.

Gupta, A.R. (2011) Ascites syndrome in poultry: a review, *World's Poultry Science Journal*, **67**(03): 457-468.

Kuhne, F., Adler, S. & Sauerbrey, A.F.C. (2011) Redirected behavior in learning tasks: The commercial laying hen (*Gallus gallus domesticus*) as model, *Poultry Science*, **90**(9): 1859-1866.

Lambooy, E., Anil, H., Butler, S.R. *et al.* (2011) Transcranial magnetic stunning of broilers: a preliminary trial to induce unconsciousness, *Animal Welfare*, **20**(3): 407-412.

McInerney, B., Corkery, G., Ayalew, G. *et al.* (2011) A preliminary in vivo study on the potential application of a novel method of e-tracking in the poultry food chain and its potential impact on animal welfare, *Computers and Electronics in Agriculture*, **79**(1): 51-62.

Patwardhan, D. & King, A. (2011) Review: feed withdrawal and non feed withdrawal moult, *World's Poultry Science Journal*, **67**(02): 253-268.

Pickel, T., Scholz, B. & Schrader, L. (In press) Roosting behaviour in laying hens on perches of different temperatures: Trade-offs between thermoregulation, energy budget, vigilance and resting, *Applied Animal Behaviour Science*.

Racicot, M., Venne, D., Durivage, A. *et al.* (2011) Description of 44 biosecurity errors while entering and exiting poultry barns based on video surveillance in Quebec, Canada, *Preventive Veterinary Medicine*, **100**(3-4): 193-199.

Richards, G.J., Nasr, M.A., Brown, S.N. *et al.* (2011) Use of radiography to identify keel bone fractures in laying hens and assess healing in live birds, *Veterinary Record*, **169**(11): 279-283.

Sapkota, A.R., Hulet, R.M., Zhang, G. *et al.* (2011) Lower prevalence of antibiotic-resistant enterococci on U.S. conventional poultry farms that transitioned to organic practices, *Environmental Health Perspectives*, <http://dx.doi.org/10.1289/ehp.1003350>.

Siegel, P.B., Gustin, S.J. & Katanbaf, M.N. (2011) Motor ability and self-selection of an analgesic drug by fast-growing chickens, *Journal of Applied Poultry Research*, **20**(3): 249-252.

Swanson, J.C., Lee, Y., Thompson, P.B. *et al.* (2011) Integration: Valuing stakeholder input in setting priorities for socially sustainable egg production, *Poultry Science*, **90**(9): 2110-2121.

Thompson, P.B., Appleby, M., Busch, L. *et al.* (2011) Values and public acceptability dimensions of sustainable egg production, *Poultry Science*, **90**(9): 2097-2109.

Watts, J.M., Graff, L.J., Strawford, M.L. *et al.* (2011) Heat and moisture production by broilers during simulated cold weather transport, *Poultry Science*, **90**(9): 1890-1899.

Zuowei, S., Yan, L., Yuan, L. *et al.* (2011) Stocking density affects the growth performance of broilers in a sex-dependent fashion, *Poultry Science*, **90**(7): 1406-1415.

Sheep/goats

Andersen, I.L., Tønnesen, H., Estevez, I. *et al.* (In press) The relevance of group size on goats' social dynamics in a production environment, *Applied Animal Behaviour Science*.

Colditz, I.G., Paull, D.R., Hervault, G. *et al.* (2011) Development of a lameness model in sheep for assessing efficacy of analgesics, *Australian Veterinary Journal*, **89**(8): 297-304.

Napolitano, F., De Rosa, G., Girolami, A. *et al.* (2011) Avoidance distance in sheep: Test-retest reliability and relationship with stockmen attitude, *Small Ruminant Research*, **99**(2-3): 81-86.

Plush, K.J., Hebart, M.L., Brien, F.D. *et al.* (In press) The genetics of temperament in Merino sheep and relationships with lamb survival, *Applied Animal Behaviour Science*.

Taylor, D.B., Schneider, D.A., Brown, W.Y. *et al.* (2011) GPS observation of shelter utilisation by Merino ewes, *Animal Production Science*, **51**(8): 724-737.

Ward, S.J., Liste, G. & Tinarwo, A. (2011) Attitudes of UK sheep farmers towards fostering methods: A national survey, *Small Ruminant Research*, **99**(2-3): 87-92.

General

Kupper, F. & De Cock Buning, T. (2011) Deliberating animal values: a pragmatic—pluralistic approach to animal ethics, *Journal of Agricultural and Environmental Ethics*, **24**(5): 431-450.

Verbrugghe, E., Boyen, F., Gaastra, W. *et al.* (In press) The complex interplay between stress and bacterial infections in animals, *Veterinary Microbiology*.

Yeates, J.W. (2011) Is 'a life worth living' a concept worth having? *Animal Welfare*, **20**(3): 397-406.

Yeates, J.W., Röcklinsberg, H. & Gjerris, M. (2011) Is welfare all that matters? A discussion of what should be included in policy-making regarding animals, *Animal Welfare*, **20**(3): 423-432.

ANIMALS USED FOR SPORT, ENTERTAINMENT, RECREATION AND WORK

Hawson, L.A., Oddie, C., McLean, A.N., & McGreevy, P.D. (2011) Is safety valued in the Australian pony market? *Journal of Veterinary Behavior: Clinical Applications and Research*, **6**(5): 254-260.

Hockenhull, J. & Creighton, E. (2011) The use of seven methods of preventing stable-based behaviour problems in UK leisure horses and their relative effectiveness, *Journal of Veterinary Behavior: Clinical Applications and Research*, **6**(5): 254-260.

Ladewig J. (2011) Human safety and horse welfare – two sides of the same coin, *Journal of Veterinary Behavior: Clinical Applications and Research*, **6**(5): 254-260.

Stewart, M., Stratton R.B., Beausoleil N.J., Stafford K.J., Worth, G.M. & Waran, N.K. (2011) Assessment of positive emotions in horses: Implications for welfare and performance, *Journal of Veterinary Behavior: Clinical Applications and Research*, **6**(5): 254-260.

TRANSPORTATION OF ANIMALS

Villarroel, M., Barreiro, P., Kettlewell, P. *et al.* (In press) Time derivatives in air temperature and enthalpy as non-invasive welfare indicators during long distance animal transport, *Biosystems Engineering*.

HUMANE KILLING

Bonner, J. (2011) Stunning before slaughter - not just an issue for livestock, *Veterinary Record*, **169**(6): 140-141.

EVENTS



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