



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. Click [here](#) to subscribe.

## COMPANION ANIMALS

### Low pitch music tracks may increase dog alertness and vigilance

Auditory enrichment has been proposed for dogs in confined housing such as kennels, shelters and laboratories. Previous studies suggest classical music can have positive behavioural and physiological effects on dogs. However, it is unclear what particular characteristics of music bring about those effects.

This study, conducted at the Clinical Studies Centre of the University of Queensland, compared the behavioural responses of dogs (n=10, 6 females, 4 males, all desexed) to piano/violin music modified for high pitch, low pitch, fast tempo and slow tempo as well as white noise and ambient noise (control). Five of the dogs were former racing greyhounds, the remaining six were from the local pound and some had been housed at the Centre for a considerable time. Over a total of 10 days, all music/noise treatments (each lasting 10 minutes with a 20-minute break in between) were played to all dogs. Dog behaviours were recorded, including standing, walking, lying down and tail movements.

Low-pitch tracks appeared to increase dogs' alertness as indicated by tail movements. Dogs may have been less relaxed and more vigilant during low-pitch tracks because low-pitch sounds are associated with aggressive vocalisations. In a previous study that included the same ten dogs, piano music was found to reduce vocalisations and panting. The authors posit that the results may differ between their previous and current study due to the dogs in this study being habituated or calmer prior to the treatments or because music needs to be played for a longer duration to induce behavioural effects.

Amaya V, Descovich K, Paterson MB et al (2020) [Effects of music pitch and tempo on the behaviour of kennelled dogs](#). *Animals* 11(1), 10. [Author MBA Paterson is from RSPCA Queensland].

### A multi-sectorial approach to animal welfare during the COVID-19 pandemic in Australia

In Australia, the COVID-19 pandemic saw the introduction of physical distancing measures, restrictions on the operation of businesses and limitations placed on travel and gatherings. These changes had the potential to affect many animal related activities and the welfare of animals.

This piece describes the animal welfare risks of the COVID-19 pandemic in Australia. In the red meat industry, COVID-19 affected animal transport and the gathering of people at saleyards. The pork, chicken meat, egg, dairy and wool industries were concerned about feed and labour shortages. Processing delays, over-crowding and mass depopulation of pigs and chickens did not occur in Australia as it did in the USA. Contraction of exports raised concerns about funds for feed and veterinary care in aquaculture. Without income from visitors, there were concerns for the welfare of animals in zoos, aquariums and wildlife parks. Reduced international travel may have limited some avenues for illegal wildlife trade. Travel restrictions within Australia threatened to hamper the efforts of wildlife rescuers. Animal racing and most research continued under modified conditions. Animal shelters and animal welfare inspectors continued their

work after significant adjustments to their operations. The Federal JobKeeper program assisted some sectors to retain animal care staff.

In March 2020, 34 multi-sector organisations including government, non-government and industry representatives, joined together in the COVID-19 Animal Welfare Response Reference Group (COVAWRRG). Key outcomes from COVAWRRG included clarification of interstate animal transport and lobbying for veterinarians to be classified as essential workers. COVID-19 highlighted the importance of emergency preparedness. In preparation for future crises, the authors recommend a national animal welfare risk assessment, clear communication channels, contingency plans, the formation of a crisis response group and support systems for animal care providers.

Baptista J, Blache D, Cox-Witton K et al (2021) [Impact of the COVID-19 pandemic on the welfare of animals in Australia](#). *Frontiers in Veterinary Science* 7, 621843. [Author S Zito is from RSPCA Australia].

### Aversive training methods put companion dog welfare at risk

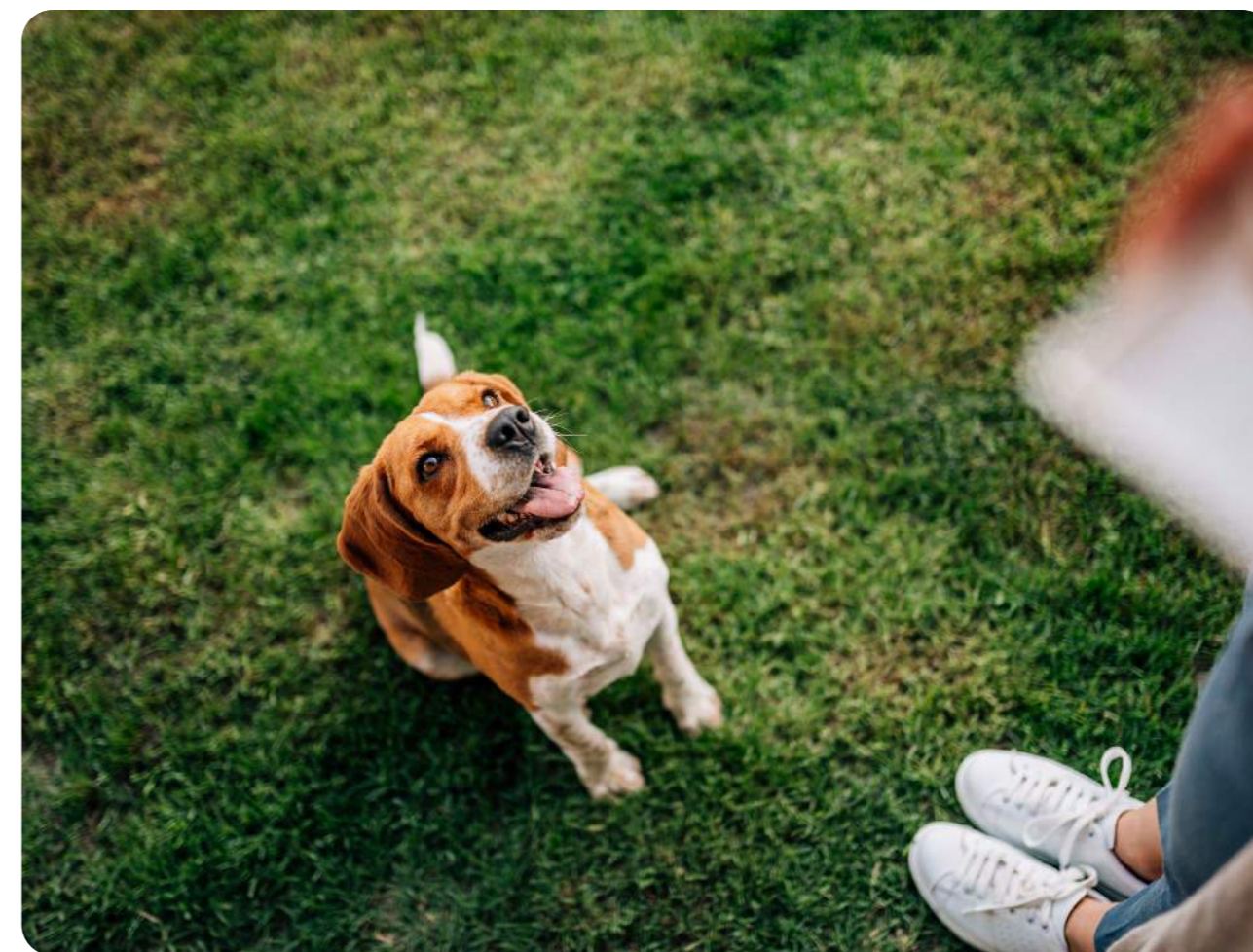
Aversive-based training focuses on punishment and negative reinforcement such as use of shock, pinch and choke collars, leash jerks, physically dominating, striking or yelling at the dog. In contrast, reward-based training focuses on positive reinforcement; for example, giving the dog food treats. There are concerns about poor animal welfare outcomes from aversive-based training compared to reward-based training. However, few studies compare dog welfare during and after different types of training.

This study investigated the effects of different training methods on the welfare of companion dogs. A total of 92 dogs were recruited from 7 training schools in Porto, Portugal. Dogs at 2 schools received 75 to 84% intended aversive training (Group Aversive, n=28 dogs). Dogs at 3 schools received only reward-based training (Group Reward, n=42). Dogs at 2 schools received less than 37% aversive training (Group Mixed, n=22). During and after training, dog behaviour was evaluated including stress-related behaviours (e.g., lip licking, yawning) and overall behavioural state (e.g., tense, low, relaxed, excited). Saliva samples were collected to measure the stress hormone cortisol. In

addition, 73 of the dogs completed a cognitive bias test where latency to reach stimuli is thought to reflect affective state (emotion). Statistical analyses controlled for potential confounders including owner gender, children in household and dog age.

Group Aversive showed more frequent stress behaviours and low and tense behavioural states than Group Reward. Average post-training increase in salivary cortisol was higher in Group Aversive than in Group Reward. In the cognitive bias test, Group Aversive demonstrated longer latencies for all the stimuli suggesting they regarded the food reward as less probable possibly due to a less positive affective state. While this was not a randomised control trial that could establish causality, the study is the first to systematically demonstrate that companion dogs trained with aversive-based methods experience poorer welfare compared to dogs who receive reward-based training.

de Castro ACV, Fuchs D, Morello GM (2020) [Does training method matter? Evidence for the negative impact of aversive-based methods on companion dog welfare](#). *PLOS One* 15(12), e0225023.



### Changes to dogs' daily routines during the first COVID-19 lockdown

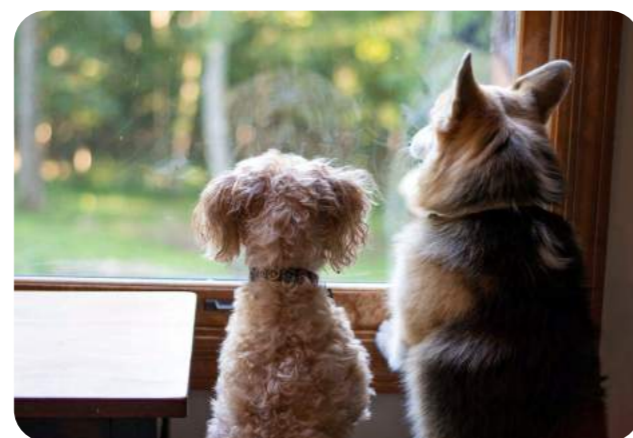
During the initial COVID-19 lockdown in the UK, "stay at home" directives instructed people to only leave their homes for essential reasons including shopping for supplies, medical appointments, caring for the vulnerable and brief exercise. There were concerns about the impact of these restrictions on human and animal welfare.

This study investigated changes in companion dog management during the initial COVID-19 lockdown (March to May 2020) compared to pre-lockdown (February 2020). A total of 6004 dog owners completed a 25-minute online survey about dog walking, enrichment activities and their dogs' interactions with people and other dogs. During the lockdown, the majority (80.3%) of respondents only left their house for essential reasons. The majority reported that their dog's routine had changed 'a little' (56.8%) or 'a lot' (22.9%). There was a significant decrease in the frequency and duration of walks. Dogs were spending more time with human household members. For example, the proportion of dogs left alone for ≥3 hours pre-lockdown was 48.4% versus just 5.4% during lockdown. On an average day during lockdown, over a quarter of dogs did not meet any other dogs compared to 8.6% pre-lockdown.

These findings indicate that many dogs in the UK experienced altered daily routines during lockdown. Respondents willing to fill out a 25-minute online

survey about dog management, were likely to be diligent owners. Nevertheless, the changes identified may be associated with animal welfare risks. Under lockdown, it appeared that dogs may have had fewer opportunities to exercise, socialise with other dogs, explore, rest and choose whether to pursue or avoid social interactions (particularly with humans). If routines return to pre-lockdown, there may be risks of behavioural problems in dogs unaccustomed to being left alone and puppies who have not been socialised. Further research is required to explore the short and long-term effects of lockdown on dog welfare.

Christley RM, Murray JK, Anderson KL et al (2020) [Impact of the first COVID-19 lockdown on management of pet dogs in the UK](#). *Animals* 11(1), 5.



### Routine use of EMLA cream for blood sampling in cats is good practice

Blood sampling is a routine practice that can be stressful and painful for animals. The use of eutectic mixture of local anaesthetics (EMLA) cream, containing 2.5% lidocaine and 2.5% prilocaine, to aid blood sampling has been evaluated 60 minutes post-application in dogs and cats. However, time constraints may have limited the routine use of EMLA cream.

This prospective, blind, controlled clinical trial evaluated the efficacy of EMLA cream in jugular blood sampling of cats, 30-minutes post-application. Eighteen client-owned domestic short-hairs at the Veterinary Teaching Hospital of the University of Teramo, Italy were randomly assigned to receive an application of the placebo (1mL paraffin) or treatment (1mL of EMLA cream), 30-minutes prior to jugular blood sampling. The behaviour of each cat during blood sampling was recorded including struggling, aggression, reaction to restraint, reaction to blood sampling, vocalisations, pupil dilation and ear positions. A stress score was calculated based

on these behaviours. Heart rate, respiration rate and body temperature were also recorded before and after blood sampling. The experienced operator taking the blood sample was asked to describe the procedure as 'easy' or 'difficult'. The operator was not told which cats had received the placebo or treatment.

Cats who received the EMLA treatment demonstrated a lower median stress score (2) compared to the placebo group (6). Blood sampling was classified as 'easy' for 9/18 cats including 1 placebo and 8 in the EMLA group. There was no statistical difference in heart or respiration rates or body temperature. Overall, the authors conclude that routine use of EMLA cream for jugular blood sampling in cats is good practice.

Crisi PE, de Santis F, Giodano MV et al (2021) Evaluation of eutectic lidocaine/prilocaine cream for jugular blood sampling in cats. *Journal of Feline Medicine and Surgery* 23(2):185-189.

### Use of pain relief in cats with chronic kidney disease

Older cats commonly suffer from concurrent chronic kidney disease (CKD) and degenerative joint disease (DJD). Pain-relief in the form of non-steroidal anti-inflammatories (NSAIDs) are often required to improve the quality of life (QoL) of cats with DJD. However, NSAIDs have the potential to affect kidney function so there have been concerns about their use in older cats.

This six-month, prospective, randomised clinical trial investigated the effects of low dose meloxicam on the kidneys of older cats (median age 14 years) with stable CKD. Twenty-one client owned cats, recruited from the Kansas State University Veterinary Health Centre, were semi-randomly allocated to the treatment (n=15) or placebo (n=6), taking into account other factors such as treatment for high blood pressure. Treatment cats received Meloxicam oral suspension 0.02mg/kg/day. Placebo cats received a similar volume of oral starch-based suspension. A variety of blood and urine

markers of kidney function were measured at the beginning and at 1 month, 3 months and 6 months.

No statistically significant decline in kidney function was detected in cats with stable CKD who received low-dose Meloxicam for six months. However, at 6 months, urine protein:creatinine ratio (UPC) was significantly higher in Meloxicam treated compared to placebo cats. Minor increases in UPC are associated with negative outcomes including decreased survival rates. Therefore, the authors conclude that UPC should be monitored in older cats on Meloxicam and this NSAID should be used with caution in older cats with CKD.

KuKanich K, George C, Roush JK et al (2021) Effects of low-dose meloxicam in cats with chronic kidney disease. *Journal of Feline Medicine and Surgery* 23(2):138-148.

### The first large-scale analysis of cat desexing practices in Australia using anonymised medical records

Cats in Australia breed all year round and have high reproductive output. Female cats become fertile as young as 3.5 months and can produce 3 litters per year of up to 6 kittens per litter. To reduce the number of unowned cats and associated animal welfare and biodiversity risks, desexing prior to puberty (at 4 months of age) has been recommended (pre-pubertal desexing [PPD] – called early-age desexing [EAD] in this study). Previous studies have demonstrated that PPD is safe, effective and offers other benefits over traditional desexing (≥6 months of age), such as rapid recovery time and earlier socialisation.

This is the first large-scale analysis of cat desexing practices in Australia using anonymised medical records. Records of 52, 941 cats in the VetCompass Australia (VCA) database were analysed to identify the age at which cats were desexed and predictors such as sex, breed, state, area and socio-economic indices.

In total, 83.6% of cats in the dataset were desexed. While actual desexing rates are likely lower as this dataset only included owned cats taken to veterinary clinics that use VCA, this is one of the highest reported desexing rates in the world. Entire cats were more common in low socio-economic and remote areas, suggesting the need for accessible desexing programs in these areas. Over time, there has been a shift towards desexing cats at an earlier age. PPD was 1.76 times more likely in cats born 2010 to 2017 compared to those born 1995 to 2009. However, PPD was only

carried out on 21.5% of females born 2010 to 2017 suggesting that the majority of female cats will have opportunities to reproduce prior to desexing. The authors recommend measures to promote PPD.

Mazeau L, Wylie C, Boland L et al (2021) A shift towards early-age desexing of cats under veterinary care in Australia. *Scientific Reports* 11, 811.



### Relaxed shelter dogs are less reactive on leash

Dog leash reactivity, such as pulling on the leash, is a common problem behaviour perceived by owners. It is particularly important to understand leash reactivity in shelter dogs as these behaviours can affect adoptability.

This study at the RSPCA Queensland Wacol shelter, investigated whether the standardised behavioural assessment (BA) predicts leash reactivity and the influence of leash reactivity on perceptions of the dog. The study population consisted of 111 shelter dogs (58 males, 53 females, all desexed, mean age 3.74 years). Of these, 43 were strays, 31 were surrendered by their owners, 19 were returned by previous adopters and 18 were from other or unknown sources. All dogs underwent the BA which included the following subtests: socialisation, tolerance, toys, run and freeze, resource guarding, toddler doll, time alone and dog to dog. Seventy-four shelter volunteers walked the dogs on-leash for a total of 370 dog-walker pairs. Human and dog behaviours were analysed during the walks. Leash tension was measured via a customised leash-tension monitor. After each walk, human volunteers were asked to rate their satisfaction with the walk and perceptions of the dog.

Dogs who were more relaxed during the BA were less reactive on the leash, had less tension on the leash and pulled less frequently. Dogs who were more reactive to the toddler doll had higher maximal net leash tension possibly because they were more interested in exploring objects around them. Dogs surrendered by their owners had lower leash tension and returned dogs had lower pulling frequency by handlers. These dogs may have been more familiar with human handling. Volunteers reported lower levels of satisfaction with the walk when dogs displayed 'severe behavioural issues'. Overall, this study suggests that the BA may predict leash reactivity in the shelter but further research is required to establish whether this translates to the home.

Shih H-Y, Paterson MB, Georgiou F et al (2020) [Do canine behavioural assessments and characteristics predict the human-dog interaction when walking on a leash in a shelter setting?](#) *Animals* 1, 26. [Author MBA Paterson is from RSPCA Queensland]

### 'Undesirable behaviours' are a leading cause of death in young dogs

'Undesirable behaviours' (UBs) in dogs, as determined by humans, may include behavioural pathologies (e.g., anxiety), physical issues (e.g., inappropriate urination) or normal canine behaviours (e.g., barking). UB such as escape behaviour, destructiveness and excessive barking can be the manifestation of unmet needs and distress. UBs can represent risks to animal and human welfare.

VetCompass Australia (VCA) records from 2013 to 2018 were interrogated to investigate UB-related deaths of young dogs (≤3 years of age). In this study, UB-related deaths were defined as ≥1 UB(s), another dog exhibiting a UB (e.g., dog attack) or involvement in a road traffic accident (RTA) because RTA can result from UBs such as escape behaviour or poor recall. Dog demographic data and any interventions for UBs were also included in the analyses.

Of the 4,342 records of dogs who had died ≤3 years of age, 1160 (26.7%) were UB-related. The most common UBs included aggression, RTA, dog attack and anxiety. No treatment was specified for the majority (82.8%) of these UB-related deaths. There

was only a six-month delay between the median age of the first report of UB and age at euthanasia, indicating a short window of time for intervention. Interventions included rehoming, training, referral to a behaviourist and pharmaceutical therapy. Overall, cross-bred and desexed dogs had higher odds of UB-related death possibly due to differences in dog keeping practices, owner expectations or owner commitment to care and training. Odds of UB-related death decreased with increasing body weight, possibly because owners perceived higher risks from UB in larger dogs and/or because owners were more tolerant of UB in smaller dogs. While these findings are likely an under-estimation, this study confirms that UBs are one of the most common causes of death in young dogs and there is the need for greater preventative actions and interventions.

Yu Y, Wilson B, Masters S et al (2021) [Mortality resulting from undesirable behaviours in dogs aged three years and under attending primary-care veterinary practices in Australia.](#) *Animals* 11(2), 493.

## FARM ANIMALS

### Laterality as a potential animal welfare indicator in fish

There is growing interest in the welfare of fish. It is now widely acknowledged that fish have the capacity to have positive and negative experiences. There is the need to develop animal welfare indicators to assess the welfare of fish including those kept in aquariums and in aquaculture.

This review examines laterality (handedness) in fish as a potential animal welfare indicator. Laterality, which is both heritable and experience-based, is linked to fish cognition. Changes in laterality are thought to be mediated via neurological and physiological mechanisms. Laterality in fish is mainly assessed using swimming direction in a circular arena or detour test where fish swim toward an obstacle and have to turn left or right. Changes in animal behaviour, such as laterality, may indicate how fish respond to their environment. The authors draw together the literature on how factors such as carbon dioxide (CO<sub>2</sub>) concentrations, pH, light levels and environmental

enrichment alter laterality in fish. For example, increased CO<sub>2</sub> produced lower levels of lateralisation, reduced exploratory behaviour, boldness and learning capacity in temperate fish species. Links between laterality and key fish functions such as swimming, schooling, exploratory behaviour, foraging and cognition are discussed.

This paper concludes that laterality may be a useful animal welfare indicator in fish. However, further research is needed to understand species, sex and individual differences and laterality in aquaculture production contexts. In addition, research on fish emotions remains in its infancy and emotional responses, emotional reactivity and coping styles have yet to be applied in animal welfare assessments of fish.

Berlinghieri F, Panizzon P, Penry-Williams IL et al (2021) [Laterality and fish welfare – a review.](#) *Applied Animal Behaviour Science* 236, 105239.

### Shade alleviates heat stress in beef cattle

Beef cattle are vulnerable to heat stress. When ambient temperature reaches around 25°C, body temperature begins to increase and if animals are unable to maintain normal body temperature, heat stress occurs. Heat stress is associated with poor welfare including discomfort, distress, debility and in severe cases, death. Shade can reduce the risk and alleviate heat stress. However, shade is seldom mandated for beef cattle despite cattle seeking shade when available.

This comprehensive review, with a focus on the US context, analyses literature on heat stress and shade in beef cattle. There is ample evidence that heat stress affects cattle physiology, behaviour, productivity, health and welfare. In severe cases, heat stress has resulted in mass mortalities. Losses from heat stress in the US beef industry are estimated at \$US370 million. The provision of shade can reduce solar load and as a result lead to decreased panting scores, reduced respiration rate and increased feed intake. Shade affects lying, standing, feeding and drinking behaviour though results can be conflicting. As the majority of research focuses on the effects of heat stress on productivity metrics, the authors conducted a meta-analysis of 15 studies comparing feedlot beef cattle with or without shade in summer. They compared production metrics including body weight (BW), dry matter intake (DMI), average daily growth (ADG), hot carcass weight (HCW) and dressing percentage.

This review outlines evidence that shade decreases the risk of and alleviates heat stress with consequent animal welfare and production benefits. Results of the meta-analysis indicated that shade improves production metrics (significantly higher final BW, ADG, HCW and dressing percentage) without an increase in DMI. Further research is recommended to elucidate baseline data on shade provision, industry perceptions, effective shade design, cattle preferences and the impact of shade on the affective state of beef cattle.

Edwards-Callaway LN, Cramer MC, Cadaret CN et al (2021) [Impacts of shade on cattle well-being in the beef supply chain.](#) *Journal of Animal Science* 99(2):1-21.



### Enrichment structure preferences in free-range laying hens

Outdoor range design varies in free-range laying systems. Consequently, there are variations in the number of hens using the range, their distribution and their interaction with the environment. Optimal range design would encourage hens to better utilise the outdoor range. Currently, little is known about specific design elements which encourage hens to use an outdoor range. Optimising outdoor range design requires an understanding of the preferences of free-range laying hens.

This study on a flock of 18,000 hens on a commercial free-range farm in Victoria, is the first to investigate hens' preferences for specific design elements of outdoor range structures. The specific design elements investigated were: orientation (vertical, horizontal or both), shade cloth density (no cloth, 50% density, 90% density) and height of structure (0.5m or 1.5m). Eighteen different structures (9 replicates of height, 6 replicates of each cover density and orientation, controls) were made from wood, pine and dark green shade cloth. Hens had 4 weeks to become accustomed to the structures before camera observations began.

The number of hens within a 1m perimeter of each structure was recorded daily from 1115 to 2000 h for 10 days. In addition, point sampling of the behaviour of five focal hens per frame was recorded for 5 of the 10 days.

Cover density appeared to be the most important design element to hens. Overall, hens preferred structures which were of horizontal orientation with a dense canopy cover (shade cloth with 90% density) and low to the ground (0.5m). This is possibly due to similarity to a dense natural canopy providing the perception of protection from aerial predators. Majority of interactions with the structures were pecks and scratches directed at the shade cloth. These findings inform optimal design of enrichment structures for free-range laying hens.

Larsen H, Rault L-J (2021) Preferences for artificial range enrichment design features in free-range commercial laying hens. *British Poultry Science* 1-9. Epub ahead of print.

### Shade, heatwaves and rangeland sheep behaviour

Heatwaves (3 consecutive days  $\geq 40^{\circ}\text{C}$ ) are becoming more frequent and intense with climate change. Information about how animals respond to heatwaves is critical to manage them in a changing climate.

This study, conducted at the Fowlers Gap Arid Zone Research Station in New South Wales, investigated ewes' shade use, water use and movement activity during heatwaves versus typical conditions. Ewes (n=48) were GPS tracked for three months, December 2017 to March 2018. Habitat surveys from February to March 2018 mapped 106 tree patches across the study area. Body condition and wool length were recorded to see whether these factors affected ewes' shade seeking behaviour.

During heatwaves, ewes face a trade-off between activity (including moving, grazing and drinking) versus staying in the shade. Ewes appeared to balance these competing demands by staying in the shade during the hottest period of the day and changing the timing of and time spent engaged in essential activities. During heatwaves, ewes spent 14.7 times longer in the shade at midday and reduced their movement compared to typical conditions. They also spent significantly more time near water after dawn and before dusk. Ewes spent significantly less time in the shade before and after dawn during heatwave compared to typical conditions possibly because they were grazing during the cooler time of the day. Ewes that spent longer in



the shade had higher body condition possibly because they expended less energy maintaining normal body temperature or due to the effects of heat on feed intake. Shade use was not affected by wool length but all ewes were shorn 6 weeks prior to the study. Overall, the results of this study indicate shade use increases during heatwaves and ewes in the rangelands of arid Australia alter their behaviour and movements in response to these extreme weather events.

Leu ST, Quiring K, Leggett KEA et al (2021) [Consistent behavioural responses to heatwaves provide body condition benefits in rangeland sheep](#). *Applied Animal Behaviour Science* 234, 105204.

### Presence of older piglets improves the welfare of newly weaned piglets

Weaning in commercial production systems is particularly stressful for piglets due to the abrupt separation from their mother, mixing with unfamiliar piglets in a new environment, and changes in feed. These stressors can result in piglets developing abnormal behaviours (e.g. belly nosing and navel sucking) and increased levels of aggression after weaning. Socialisation prior to weaning and providing enrichment has been previously demonstrated to help decrease levels of aggression between piglets. The aim of this study was to assess whether the presence of an older conspecific (older pigs) could also decrease levels of aggression between piglets after weaning.

For the study, 96 piglets (Landrace x Large White) and four castrated 4-month-old male pigs (the older conspecifics) were used. Piglets were born on a commercial farm and, immediately after weaning at 21 days of age, were transported to the University of Sao Paulo, Brazil. The study was conducted in two different blocks with 48 piglets in each block. Piglets were housed in groups of 12 in 8 pens (3 x 4m) with straw. Four pens were housed with an older conspecific

and four pens without. Behavioural measures were recorded in the first block (n=48) for agonistic interactions (aggressive behaviours) through video footage including the type, duration and frequency of the behaviour. In addition, skin lesion scores and vocalisations were recorded for both blocks (n=96) to evaluate piglet welfare and levels of aggression.

The frequency that piglets performed agonistic behaviours was lower in those groups with an older conspecific present. The number of skin lesions and duration of vocalisation in piglets was also found to be lower in those groups with an older conspecific than the control groups. These results indicate that the presences of an older conspecific for piglets after weaning could help improve their welfare and decrease the risk of aggressive behaviours between piglets.

Morrone B, Bernardino T, Tatemoto P et al (2021) [Indication that the presence of older conspecifics reduces agonistic behaviour in piglets at weaning](#). *Applied Animal Behaviour Science* 234, 104201.



### Challenging assumptions that mortality is higher in cage-free egg production

Conventional (battery) cages are associated with poor animal welfare including extreme confinement of birds and the inability for them to express natural behaviours. In contrast, cage-free systems offer animal welfare benefits in allowing laying hens to move freely and express more natural behaviours. However, proponents of conventional cages claim that mortality rates are higher in cage-free systems. Whether mortality rates are indeed higher in cage-free compared to conventional cage systems remains unclear.

This review and meta-analysis is the largest quantitative analysis of laying hen mortality in cage-free versus conventional cage systems. Contemporary data (2000 to 2020) on 176 million hens from 6040 commercial flocks in 16 countries was synthesised. Factors such as flock age, breed, management practices, beak trim status, flock size and lighting conditions were included in the analysis.

Mortality rates were found to be comparable between cage-free and conventional cage systems. The authors highlight that this does not mean the systems have

comparable welfare outcomes considering that their analyses did not account for variations in morbidity, causes of debility or death. Notably, in recent times, as knowledge, practices, experience, and genetics have improved, there has been a significant and progressive decrease in mortality rates in cage-free systems (4-6% decline over the past decade, average decline of 0.35-0.65% per year). Mortality rates in conventional cage systems, on the other hand, appear to have plateaued. While findings may have been limited by the quantity and quality of commercial data, this review and meta-analysis challenges the assumption that mortality rates are higher in cage-free production systems.

Schuck-Paim C, Negro-Calduch E, Alonso WJ (2021) [Laying hen mortality in different indoor housing systems: a meta-analysis of data from commercial farms in 16 countries](#). Scientific Reports 11, 3052.

### Legitimacy of under-cover investigations and whistleblowing

There is growing interest in the welfare of livestock in animal agriculture. Given limited transparency, the general public often only sees the realities of animal agriculture from under-cover investigations and reports from whistleblowers.

This study, conducted in Germany, investigated how the community perceives the legitimacy of different forms of undercover investigations in animal agriculture. Participants (n=292) were selected to reflect a broad cross-section of the community. The majority of participants (94.5%) ate meat. Participants included farmers (5.2%), people who lived near farms (8.3%) and people whose family or friends owned a farm (15.6%) but the majority had no connection to agriculture (70.9%). Participants were shown one of three images. Image 1 showed a pig with a significant leg injury. Image 2 showed many pigs in a pen, suggestive of lack of space. Image 3 showed a snapshot of pigs in a conventional piggery pen. When a participant viewed one of these images, they were also given three descriptors about how the image had been obtained: (i) activist entering without permission through an unlocked door, (ii) activist breaking a lock

to enter and (iii) an employee on the farm took the image during working hours. Participants were asked to respond on a scale from 1 = totally disagree to 5 = totally agree, whether they thought the under-cover investigation was justified, understandable or disproportionate and whether the described action should be punished.

There was broad approval of under-cover investigations and rejection of harsher punishment for whistleblowers. Approval was particularly strong where the investigation uncovered animal cruelty. Approval was less so when property damage was involved. The authors caution generalisation beyond the specific set of images they used but their findings are consistent with similar studies in Australia and the US. Communities perceive under-cover investigations as legitimate and reject gag laws designed to punish whistleblowers.

Schulze M, Risius A, Spiller A (2021) Public perceptions of undercover investigations in livestock farming: An end that justifies the means? *Animal Welfare* 30:39-47.

## ANIMALS IN SPORT, ENTERTAINMENT, PERFORMANCE RECREATION AND WORK

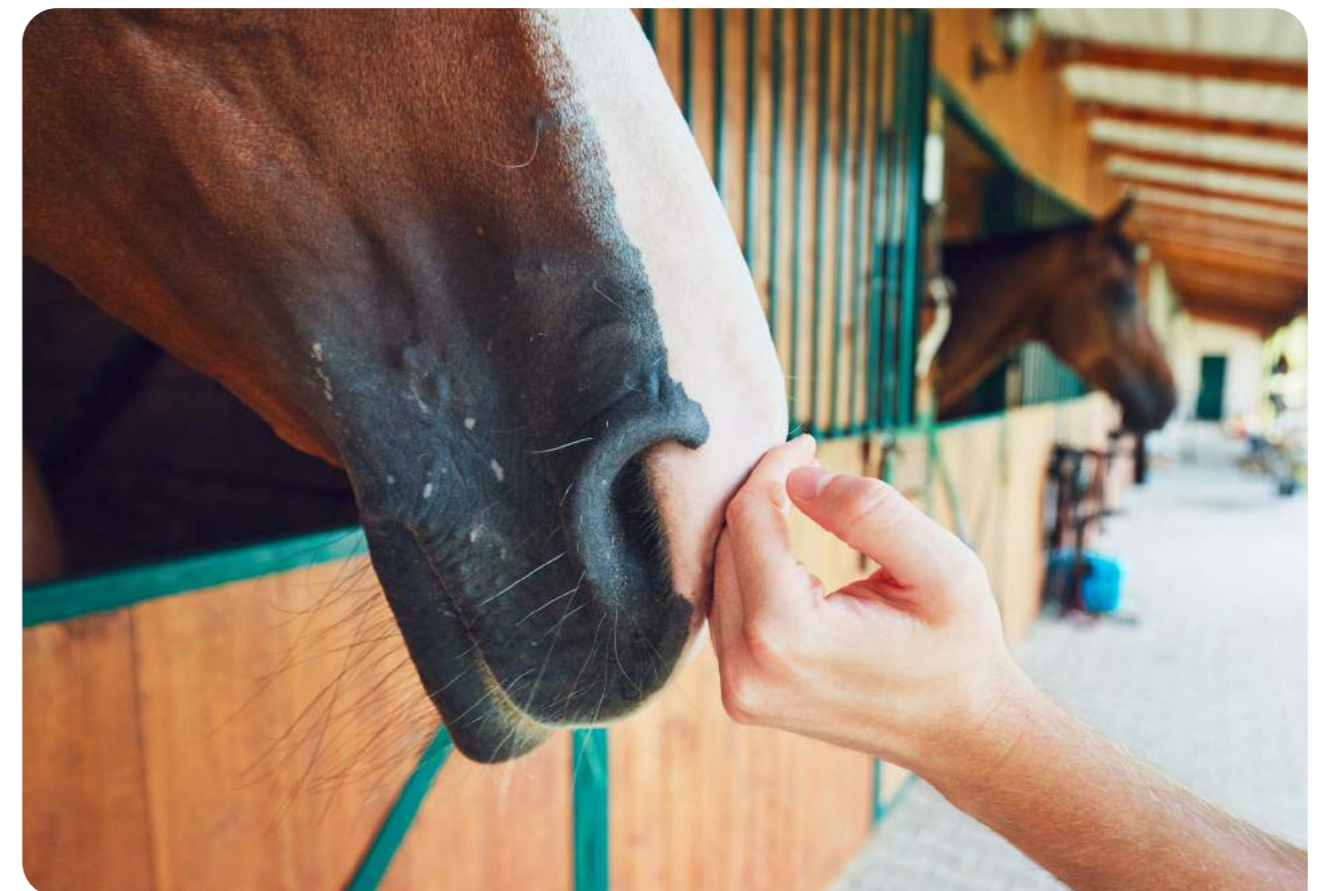
### Correlating cortisol and behaviour with different management in horses

Horses often develop stereotypies (repetitive behaviours) and behavioural pathologies. It is thought that management factors such as confinement and lack of opportunity to completely express natural behaviours may play a role in the development of these behaviours. Overall, it has been suggested that horses expressing stereotypies and behavioural pathologies may be experiencing chronic stress.

This study, conducted across 9 different stables in Italy, aimed to investigate endocrine (hormonal) indicators of stress and management factors that may be associated with stereotypies and behavioural pathologies. Healthy horses (HH) without any behavioural problems (n=14) were compared to horses with behavioural pathologies (BPH). BPH (n=42) were identified by a veterinarian as showing oral or locomotor stereotypies, 'training issues' or 'social problems'. Cortisol and dehydroepiandrosterone (DHEA) were measured in horse hair and blood samples. Information about horse husbandry was collected via a questionnaire.

Plasma:cortisol ratio was significantly higher in BPH compared to HH. While little research has been conducted in non-human animals, an increase in cortisol:DHEA ratio has been associated with chronic stress. BPH spent most of their time confined to stalls, were worked more than four times a week and were not fed fresh alfalfa. In contrast, HH spent more time in a paddock, were mainly worked <3 times/week and were given fresh alfalfa. The findings of this study confirm that stereotypies and behavioural pathologies in horses are likely associated with chronic stress and management factors including lack of control over their environment (such as occurs during work), confinement and a high-energy, low-fibre diet.

Arena I, Marliani G, Sabioni S et al (2021) Assessment of horses' welfare: behavioural, hormonal and husbandry aspects. *Journal of Veterinary Behaviour* 41:82-90.



### Risk assessment for animal-assisted interventions

Animals are increasingly being used in education settings. Despite the popularity of animal-assisted interventions (AAI), such as dogs supporting children in the classroom, there are no unified standards, guidelines or risk assessment tools to protect animal and human participants.

This paper describes Lincoln Education Assistance with Dogs (LEAD), the first risk assessment tool for AAI. Developed in 2015/16, LEAD aims to safeguard the welfare of all involved including animal and human participants. From an animal welfare perspective, LEAD centres around principles of respect and dignity and that animal welfare should not be compromised for the benefit of human participants. LEAD specifies that all dogs involved in AAI should be independently assessed for their suitability. Dog handlers should be competent at interpreting dog body language and detecting when the dog is stressed. Human-dog interactions should be positive and if the dog shows signs of stress, fatigue or withdrawal, the activity should cease. An animal welfare plan should be in place including how the dog will enter and exit the setting, length and intensity of the session, water requirements and toilet and exercise needs. All human participants should receive safety and animal welfare training prior to the activity. LEAD also includes steps to reduce risks of ill-health and injury in animals and humans including good hygiene and preventative care.



LEAD is the first risk assessment tool developed for AAI. It was successfully trialled and implemented during an AAI project which ran from 2015 to 2018. This risk assessment tool can be adapted to other human-animal interactions. The authors encourage educators, practitioners and researchers to use LEAD to create bespoke risk assessments for all types of animal-assisted activities including animal-assisted education and animal-assisted therapy.

Brelsford VL, Dimolareva M, Gee NR et al (2020) [Best practice standards in animal-assisted interventions: how the LEAD risk assessment tool can help](#). *Animals* 10, 974.

### Rodeo horses - learned helplessness or habituation?

There is growing public concern about animal welfare in rodeos. However, there is a general lack of scientific information evaluating the welfare of rodeo animals over time and across different events.

This study assessed the reactivity of horses used for bucking events at a Calgary rodeo 2013 to 2015. The horses (n=116) were generally bred specifically for bucking events and were assigned to riders by random draw. During loading and holding, prior to the event, the behaviour of horses and handlers were continuously monitored via video camera from the opening of the holding pen until the horse entered the loading chute. Handler behaviour included voice/whistle, waving paddle/arms, hitting the animal and swinging the gate onto the animal. Horse behaviour included moving to/fro, kicking, pawing, head tossing, rearing, urinating/defecating and balking. Composite behaviour scores were calculated for humans and horses as an indicator of reactivity/vigour of activity.

Overall, the majority of horses (71.5%) balked during loading and 36.8% of these balked more than once. Balking indicates refusal to move due to distraction and/or fear. The vigour of activity of horses decreased with increasing experience at the rodeo. This could be interpreted as learned helplessness (a state similar to depression where the individual no longer responds to stimuli) or habituation (decreased response due to repeated exposure). The authors conclude that their findings are likely indicative of habituation because the horses still responded to stimuli including human behaviours. However, they also highlight that behavioural observations alone are insufficient to differentiate learned helplessness from habituation.

Goldhawk C, Grandin T, Pajor E (2021) Effect of animal's experience and rodeo procedures on behaviour of bucking horses at a large commercial rodeo in Canada. *Applied Animal Behaviour Science* 234, 105199.

### Horse trainers perceive tongue-ties to be effective despite evidence to the contrary

Tongue-ties (TTs) are bands tying a horse's tongue down. TTs can cause physical and psychological harm and they have been banned by the Fédération Equestre Internationale due to animal welfare concerns.

This pilot study explored the use of TTs by horse trainers. Trainers (n=112), mainly from Australia and New Zealand, were asked whether they use TTs, why, what type, their perception of efficacy, how long TT were left on the horse and whether they noticed any undesirable effects.

Forty-one respondents did not use TT. Most of these said that there was no need (34/44, 82.9%) and 10/44 (24.4%) reported the horse appeared to be in pain. Amongst trainers who used TT, the most common types were stocking (n=34) and elastic (n=32). Racing Australia has banned the use of stocking TTs. On average, TTs were left in place for 24.3 minutes and the most common methods for checking tightness were 'it doesn't slip forward', 'tongue is held in the mouth', 'cannot be removed by the horse' and 'it stops the tongue moving completely'. Checking TT

tightness by 'it stops the tongue moving completely' was associated with increased reporting of physical complications. Trainers (n=37) reported complications including redness, bruising, discolouration and swelling of the tongue. Complications may have been under-reported. The odds of complications increased with duration of TT application. The authors caution against generalising their results across equine industries due to their small sample size. Trainers who used TT perceived them as 'very effective' at 'preventing or reducing airway obstruction' despite endoscopic and treadmill studies indicating TTs do not alter upper airway mechanics and only prevent dorsal displacement of the soft palate (DDSP) in a small number of horses. The authors recommend further research on the effects of TTs on blood vessels, nerves and tissues and risks associated with their use.

Weller D, Franklin S, White P et al (2021) [The reported use of tongue-ties and nosebands in Thoroughbred and Standardbred horse racing – a pilot study](#). *Animals* 11(3), 622.

## ANIMALS IN RESEARCH AND TEACHING

### A call for renewed invitational openness in animal laboratory research

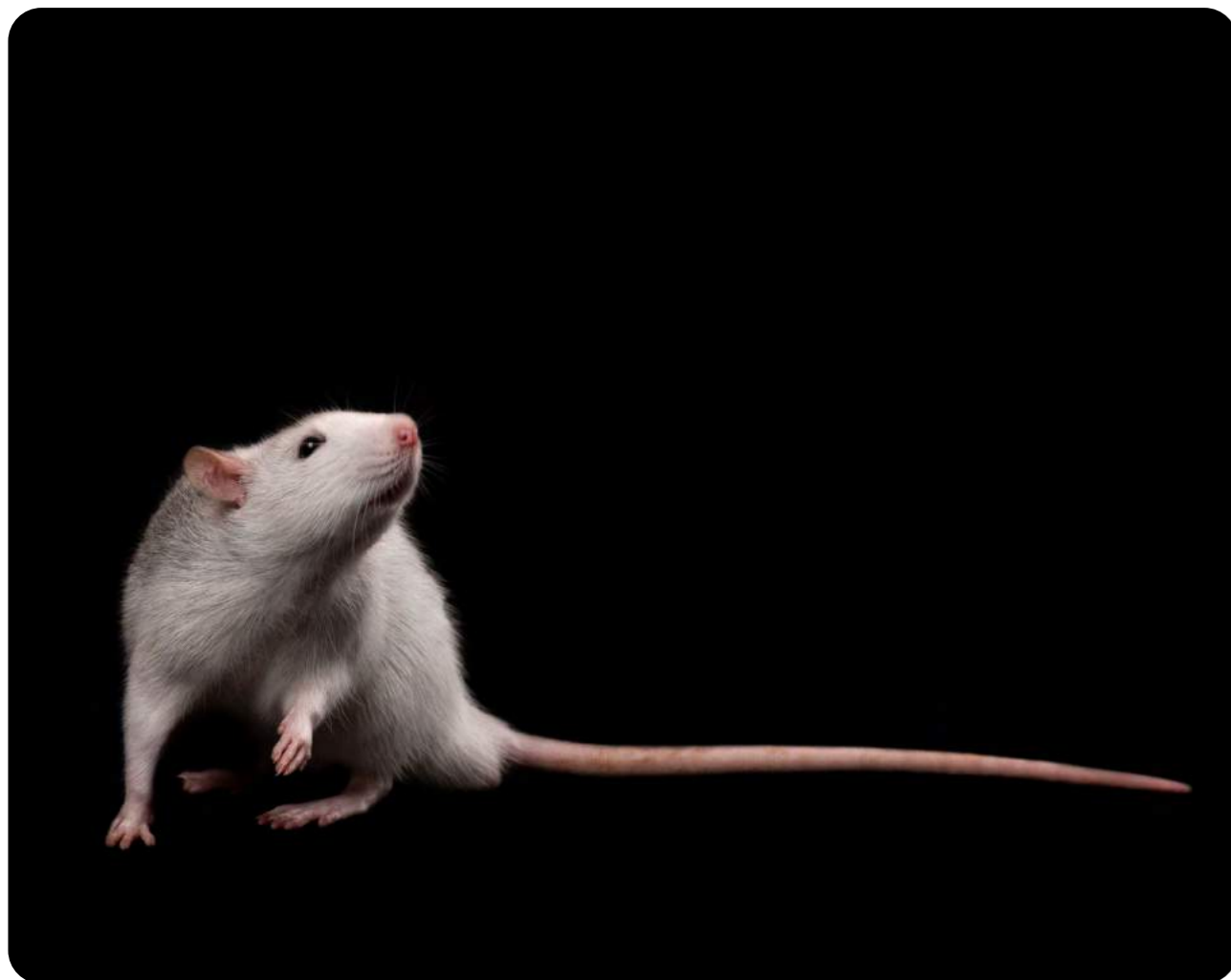
Animals in laboratories can experience discomfort, pain, distress and death. In the past, animal research insiders guarded information for fear that it could be used against them. The status quo facilitated mutual distrust and misinformation. However, over the past decade with initiatives such as the Concordat on Openness in Animal Research (UK), there has been a move towards greater transparency in animal research.

This essay, which focuses on the US context, makes a renewed call for invitational openness in animal laboratory research. Invitational openness is when animal research institutions pro-actively seek questions, comments, visits and the participation of multiple groups (e.g., animal protectionists, activists, the general public). According to the author, a former laboratory animal veterinarian and ethics committee administrator, true openness requires outsiders including activists and the media, to be able to access the information that they identify as important.

Practical steps towards invitational openness include: clear avenues for timely access to current

information including numbers of animals used and severity classifications; using the Animal Research Reporting In Vivo Experiments (ARRIVE) checklist to increase transparency about animal use in scientific publications; including animal welfare advocates on animal ethics committees and inviting their input on the development of standards, guidelines and legislation; regulatory oversight and addressing current legal deficiencies such as defining rats and mice as 'animals' in the US Animal Welfare Act; making available annual performance metrics and non-compliance reports; video tours or live cameras showing the animals being used in research. Many people including industry insiders are uncomfortable about the harm caused to animals in research. A diversity of ideas may improve practices and protocols. The author urges greater collaboration for the benefit of science and the welfare of laboratory animals.

Carbone L (2021) [Open transparent communication about animals in laboratories: dialog for multiple voices and multiple audiences](#). *Animals* 11(2), 368.



### Humane teaching methods for clinical and surgical skills

Animals are often killed for use in life sciences training and education. Some educational institutions, such as all US medical schools, have moved away from animal use. However, harmful animal use still persists in veterinary and medical training programs despite the availability of over 1400 humane teaching methods. The continued use of animals in teaching can be stressful for students and lead to desensitisation to the suffering of sentient beings. One of the barriers to adoption of humane teaching methods is the perception that they are not as effective as harmful animal use.

This review analyses papers published from 1968 to 2020 (n=50) that compare the learning outcomes from harmful animal use versus humane teaching methods. The papers related to education in veterinary medicine, human medicine, animal anatomy, human anatomy, physiology and pharmacology. They compared harmful use of dogs, frogs, rats and pigs to humane alternatives such as models, mannequins, stimulations,

videos, ethically sourced cadavers and supervised clinical practice. Learning outcomes measured included exam results, task performance, skills assessment by employers and perceived usefulness.

The majority of studies (>90%) showed that humane teaching methods had equivalent or superior efficacy compared to harmful animal use. Humane methods were also frequently cheaper, displayed more biological diversity and reduced student and faculty objections. The five studies that reported inferior results from humane teaching methods highlighted the need for effectively designed and realistic teaching methods. Overall, these findings are consistent with previous reviews and confirm there are no valid educational justifications for harmful animal use in teaching.

Zemanova MA, Knight A (2021) [The educational efficacy of humane teaching methods: a systematic review of the evidence](#). *Animals* 11(1), 114.

## WILD ANIMALS

### Management of animals confiscated from the illegal wildlife trade

The illegal wildlife trade represents an international crisis involving harm to millions of animals worldwide. Live animals confiscated from the illegal wildlife trade may be released, held in captivity or killed. However, few countries have formalised plans for the disposal (management) of confiscated animals and there is little information available about their fate.

In this study, interviews were conducted to characterise how confiscated animals are managed in Southeast Asia. The interviewees (n=18) from Thailand, Brunei, Malaysia, Indonesia, Vietnam, the Philippines and Cambodia, were experts in wildlife crime, conservation and confiscated animal management.

Eight limitations to proper disposal of confiscated animals were identified: (1) lack of political will, (2) poor or absent policy, (3) insufficient funding, (4) inadequate capacity, (5) lack of expertise, (6) problematic attitudes and behaviours, (7) exploitation and (8) corruption. Issues included no interest by the country of origin to repatriate animals, animals dying

in captivity due to protracted court proceedings, lack of space and infrastructure, absence of animal care training, poor animal identification due to insufficient taxonomy and genetics expertise, failure to euthanase animals due to cultural beliefs and exploitation of confiscated animals for profit. Interviewees shared accounts of animals suffering in captivity and upon release including thousands of birds of unknown origin dying immediately after being dumped. The authors recommend increased political commitment, strengthened legislation and enforcement, increased funding for legitimate rescue centres, well-resourced and planned release programs, minimum standards of care, new evidentiary standards that do not require animals to be held in captivity and demand reduction. As one interviewee said, a global humanitarian effort is required to provide aid to these displaced animals.

Rivera SN, Knight A, McCulloch SP (2021) [Surviving the wildlife trade in south-east Asia: reforming the 'disposal' of confiscated live animals under CITES](#). *Animals* 11(2), 439.

### Potential animal welfare indicators for zoo housed polar bears

There is increasing concern for the welfare of zoo housed polar bears (*Ursus maritimus*). Captive polar bears live in conditions far removed from wild conditions in terms of space, environmental complexity, social grouping, human presence, climate, diet and water quality. Despite these concerns, no studies are available that specifically investigate the welfare of captive polar bears using multiple variables. There is a need to identify potential animal welfare indicators to assess the welfare of zoo housed polar bears.

This review analysed 46 publications published 1972 to 2020 to identify potential animal welfare indicators for zoo housed polar bears. Few of these publications explicitly aimed to develop welfare indicators. However, they identified potential behavioural (n=21 papers), physical (n= 16) and physiological indicators (n=16).

Animal welfare indicators need to demonstrate content validity (connection of the measure to animal welfare), construct validity (assesses the area it intends to measure) and criterion validity (comparison to an independent gold standard measure). While

findings were constrained by small sample sizes, construct and criterion validity was found for faecal glucocorticoid metabolites and content validity for physical indicators including stool quality, body condition, gait, pedal health, dental health and coat and skin condition. Captive polar bears often develop abnormal behaviours (n=15 papers) including stereotypies (repetitive behaviours) and there is a general consensus that these reflect poor welfare and past or present sub-optimal conditions. In seven of the studies included in this review, stereotypies varied in response to interventions such as 24-hour access to an off-exhibit area, enrichment and fluoxetine (anti-depressant). Overall, the authors recommend further research into stressors to captive polar bears (e.g., thermal stress) and the development of welfare assessment protocols using multiple variables.

Skovlund CR, Kirchner MK, Moos LW et al (2021) [A critical review of animal-based welfare indicators for polar bears \(\*Ursus maritimus\*\) in zoos: identification and evidence of validity](#). *Animal Welfare* 30:1-18.



## HUMANE KILLING

### Captive bolt devices for killing turkeys

On-farm euthanasia may be required where turkeys are sick or injured and will not recover, or in the event of a disease outbreak. Cervical dislocation (manual or mechanical) and captive-bolt are the most common methods used for on-farm euthanasia of turkeys.

This study aimed to determine whether methods used to euthanase turkeys on-farm induce rapid insensibility and death. At facilities near Texas A&M University USA, they tested four non-penetrating captive bolt devices (Zephyr-EXL, Turkey Euthanasia Device, Jarvis pneumatic stunner and experimental crossbow) and three types of cervical dislocation (manual, Koechner Euthanasia Device and broomstick method) on 8 and 12-week-old turkeys (n=1400). Immediately after application of each euthanasia method, the time to insensibility was measured by assessing pupillary light reflex, nictitating membrane reflex and cessation of movement. After death, turkeys euthanased using cervical dislocation (n=600) were x-rayed to assess vertebral separation and crushing.

While factors including operator skill can influence efficacy, captive bolt devices were found to be more humane than cervical dislocation. Cervical dislocation methods resulted in prolonged nictitating membrane and pupillary light reflexes compared to the captive bolt methods. Captive bolt devices brought about immediate insensibility with less time to cessation of movement compared to manual and mechanical cervical dislocation. The experimental cross-bow and Turkey Euthanasia Device had the shortest latency to cessation of movement. The experimental crossbow device was considered to be the most reliable method but wear and maintenance need to be studied further.

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## ARTICLES OF INTEREST

### COMPANION ANIMALS

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