

# **SCIENTIFIC PROGRAMME:**

## **Poster Abstracts**

**Making animal welfare improvements:  
Economic and other incentives and constraints**

UFAW International Animal Welfare Symposium  
Historic Dockyard, Portsmouth UK 28-29<sup>th</sup> June 2011



## **Posters**

### **Key:**

<sup>1</sup> = Session 1 on 28<sup>th</sup> June from 13.00

<sup>2</sup> = Session 2 on 29<sup>th</sup> June from 13.15

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- **Abass Askar K, C Kudi and AJ Moody** (University of Plymouth, UK and Ahmadu Bello University, Nigeria)<sup>2</sup>  
Comparison of two storage methods for the analysis of cholinesterase activities in food animals
- **Abass Askar K, C Kudi and AJ Moody** (University of Plymouth, UK and Ahmadu Bello University, Nigeria)<sup>2</sup>  
Spontaneous reactivation and aging kinetics of liver and muscle of food animals inhibited by dichlorvos and diazinon
- **Albertsen D** (Harley Farms South, UK)<sup>1</sup>  
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- **Ali M, SK Pradhan and J Pritchard** (The Brooke, India and UK)<sup>2</sup>  
Working equine welfare groups in India: The role of common savings and loans in stabilising group membership and improving animal welfare
- **Anneberg I and M Vaarst** (Aarhus University, Denmark)<sup>1</sup>  
Can inspection stimulate farmers to improve animal welfare? An anthropological study
- **Bergstra TJ, H Hogeveen, AGJM Oude Lansink and EN Stassen** (Wageningen University, The Netherlands)<sup>2</sup>  
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- **Boissevain I** (Utrecht University, The Netherlands)<sup>1</sup>  
The impossible position of the animal in civil law; How being an 'object' constrains animal welfare
- **Botreau R and I Veissier** (INRA de Clermont-Ferrand - Theix, France)<sup>2</sup>  
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- **Cameron LJ and PE Rose** (Sparsholt College, UK)<sup>1</sup>  
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- **Dwane AM, SJ More, M Blake and AJ Hanlon** (University College Dublin and Department of Agriculture, Food and Fisheries, Ireland)<sup>2</sup>  
Use of farmer focus groups to evaluate a welfare scheme for suckler beef cattle
- **Forster LM, CM Watthes, C Bessant and SA Corr** (The Royal Veterinary College and University of Nottingham, UK)<sup>1</sup>  
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- **Fukuzawa M, K Kanaoka, T Ema, and O Kai** (Nihon University, Japan)<sup>2</sup>  
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- **Hiby E** (World Society for the Protection of Animals, UK)<sup>1</sup>  
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- **Jukes ND** (InterNICHE, UK)<sup>2</sup>  
Economic considerations for best practice and alternatives in education and training
- **Kerr AJ, S Mullan and DCJ Main** (University of Bristol, UK)<sup>1</sup>  
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### **Making animal welfare improvements: Economic and other incentives and constraints**



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- **Kristensen HH, TB Jensen, N Toft, BL Nielsen, P Sandøe, B Forkman, T Christensen, H Houe and AR Kristensen** (University of Copenhagen, Danish Veterinary and Food Administration, Denmark and INRA, France)<sup>2</sup>  
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- **Liste G, RD Kirkden and DM Broom** (University of Cambridge, UK)<sup>2</sup>  
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- **Manning L** (LJM Associates Ltd, UK)<sup>1</sup>  
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- **Milne CE and LA Paton** (Scottish Agricultural College, UK)<sup>2</sup>  
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## Making animal welfare improvements: Economic and other incentives and constraints



- **Olmos G, N Gregory, F Burden and AQ Alvarado-Arellano** (The Royal Veterinary College and The Donkey Sanctuary, UK and Ciudad Universitaria, Mexico)<sup>1</sup>  
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- **Pohjola JM** (Sparsholt College, UK)<sup>1</sup>  
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- **Quilicini D and I Alpigiani** (Agriconsulting Europe and University of Parma, Italy)<sup>2</sup>  
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- **Ringrose S and CE Milne** (Scottish Agricultural College, UK)<sup>1</sup>  
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- **Rooney NJ** (University of Bristol, UK)<sup>2</sup>  
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- **Rose PE and LJ Cameron** (Sparsholt College, UK)<sup>1</sup>  
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- **Stevenson P** (Compassion in World Farming, UK)<sup>2</sup>  
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- **Still K and AL Bond** (Soil Association, UK)<sup>1</sup>  
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- **Toma L, AW Stott and GJ Gunn** (Scottish Agricultural College, UK)<sup>2</sup>  
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Improving farm animal welfare: Getting the consumer involved
- **Vosough Ahmadi B, M Nath, JJ Hyslop, CA Morgan and AW Stott** (Scottish Agricultural College, UK)<sup>2</sup>  
Economic constraints and incentives of welfare of out-wintering suckler cows
- **Ward SJ, A Tinarwo and G Liste** (Moulton College and the University of Cambridge, UK)<sup>2</sup>  
Use or lose your bottle: The effects of fostering and artificial rearing on lamb meat quality
- **Weeks CA, J Newton, JL McKinstry, M Friel, J Walton, CM Sherwin, S Edge, DCJ Main and CJ Nicol** (University of Bristol and ADAS, UK)<sup>1</sup>

## Making animal welfare improvements: Economic and other incentives and constraints



- Predicting the economic costs and benefits of changes aimed at reducing levels of injurious pecking on free-range layer farms
- **Wepruk JW** (National Farm Animal Care Council, Canada)<sup>2</sup>  
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## Making animal welfare improvements: Economic and other incentives and constraints

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# **ANIMAL WELFARE ON THE DAY OF SLAUGHTER IS NOT JUST AN EXPENSE**

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On the day of slaughter, animals are exposed to a continuing chain of handlings that might be stressful to the animal. However, the slaughter industry is financially pressed and investments needed for increasing animal welfare can be difficult to obtain. The aim of this paper is to demonstrate that increasing animal welfare on the day of slaughter can also be an economic advantage. Handling pigs in groups has been chosen as an example.

When handling pigs in groups the natural behaviour of pigs in a herd combined with their natural curiosity are used to keep the pigs calm during lairage and driving into the stunner. This method has proven to reduce man power in the lairage area at the slaughterhouse and to decrease the amount of blood splashing as well as the drip loss of the meat.

In Denmark, 19 mill pigs were slaughtered in 2009. The drip loss of the loin can be reduced by 0.5 %-point and by 0.7 %-point in the ham when introducing handling in groups. The amount of loins, which needed trimming due to blood splashing, was reduced by 2 %-points. Furthermore, one operator less is needed in the lairage area per stunner handling approx. 750,000 pigs a year. The total gain by introducing handling in groups can be calculated as:

- Reduced drip loss loin: 19 mill pigs \* 5.5 kg loin/pig \* 0.5 % reduced drip loss \* 3.33 Eur/kg = 1,740 TEur
- Reduced drip loss ham: 19 mill pigs \* 15 kg ham/pig \* 0.7 % reduced drip loss \* 3.33 Eur/kg = 6,643 TEur
- Reduced blood splashing: 19 mill pigs \* 5.5 kg loin/pig \* 2 % less trimming \* 0.66 Eur/kg = 1,379 TEur
- Reduced man power: 19 mill pigs / 750,000 pigs/stunner \* 47 TEur/man = 1,191 TEur

This results in an improved economy of a total of 10,954 TEur/year when handling all pigs for slaughter in groups. Installation of 23 new stunners including changing of the stables to lairage pigs in groups would cost approx. 26,667 TEur. The investment would therefore be paid back in approx. 2.25 year.

This calculation clearly demonstrates that animal welfare is not just an expense, but can actually be used to improve the economy of the slaughterhouses. Today, handling in groups is implemented in almost all large slaughterhouses in Denmark.

## **Making animal welfare improvements: Economic and other incentives and constraints**



## NATURAL WEANING AGE IN CATTLE

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Separation induced distress is known to have a negative impact on the health and performance of cattle and especially on calves. Even calves separated from their mothers as late as eight months of age show signs of distress resulting in calling, pacing, reduced feed intake and immune suppression. The mothers equally, call and pace the fence line for several days after removal of their calves.

To address the resulting economic loss HarleyFarmsSouth started phasing out forced weaning in their 600 head AberdeenAngus cow herd in 2005 and have not separated any yearling calves from their mothers since 2009. It was noted that the cows wean their yearlings prior to giving birth to the subsequent calf.

In pursuit of the natural weaning age, a small herd of spring calving cows and their offspring was set aside in 2007. The herd consisted of twelve 2004 born cows (who had lived together within a larger herd since their own forced weaning in November 2004), three of their 2006 born and two of their 2007 born daughters (who were raised within this group). All seventeen cows had a calf in spring 2009. All fifteen 2008 yearlings were also present.

Forty observations took place, seven times a month, between November 2009 and May 2010. The herd was visited at 13:00, the time after the late morning rest period, that had been determined as the most likely to observe suckling. Suckling events were recorded. In support of those, evidence of suckling, such as recently used udders and milky noses, was recorded. Every animal was checked at each visit.

The average weaning age was 285 days, which equals the lactation period of the mother, with 227 days being the youngest and 359 days being the oldest yearling calf weaned. The following dry period averaged 86 days, with 141 days being the longest and 22 days being the shortest. Fifteen cows calved within a month in April 2010. Two cows were barren and did not wean their yearling until the end of the year.

This variation suggests that the time of weaning is determined by the mother, according to her own situation, rather than by the age of the weanling.

2010/11 Data so far shows that the weaning window (86/88 days in average prior to subsequent calving) remained similar, that individual cows did not repeat their time pattern, that calf birth weight appears not to be correlated with the length of the dry period and that the longer lactation for male yearling calves in 2009/10 was not repeated.

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# ECONOMIC CONSTRAINTS AND INCENTIVES OF WELFARE OF OUT-WINTERING SUCKLER COWS

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Following decoupling of the CAP, many Scottish suckler cow farms, which are often situated in disadvantaged areas, are facing financial difficulties. To reduce costs, many farmers are out-wintering extensively managed spring calving suckler cows, which raises concern for trade-offs between profit and animal welfare if out-wintering increases the risk of exposure to hunger or to suffering due to extreme weather events.

To explore these issues the trade-offs between animal welfare indicators and between animal welfare and farm profitability were explored in a decision support framework using a dynamic programming (DP) model. The objective was to identify the main economic constraints and incentives in enhancing the welfare of out-wintered sucker cows. The objective function of the DP is specified to maximise the expected net present value (ENPV) from current cows and all successors by making appropriate replacement decisions. The DP incorporated calving pattern, body condition score (BCS), parity and incidence of involuntary culling (IC). Data were obtained from the experimental out-wintered herd of SAC. Both successful conception by a cow and an incidence of IC were modelled as Bernoulli random variables in a generalised linear model framework, with outcomes from the former empirical model being used to estimate transition probabilities between different calving periods for an animal with a given parity and BCS category.

An example of outcome from the DP model is presented in Figure 1. The results show that the profitability of suckler cow enterprises is sensitive to cull cow price (£/kg) and feed costs, and affects welfare indicators such as mean herdlife. This work has exhibited links between volatile commodity markets and an aspect of animal welfare.

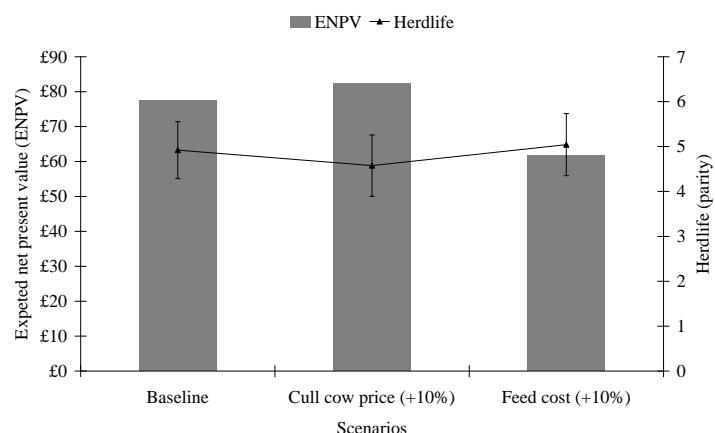


Figure 1. Graphical illustration of the expected net present value (£/cow) under the baseline and two alternative scenarios and the associated mean parity of the herd $\pm$ SE. The alternative scenarios incorporated a 10% increase in cull cow price and a 10% increase in feed costs.

## Making animal welfare improvements: Economic and other incentives and constraints



# WORKING EQUINE WELFARE GROUPS IN INDIA: THE ROLE OF COMMON SAVINGS AND LOANS IN STABILISING GROUP MEMBERSHIP AND IMPROVING ANIMAL WELFARE

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**Introduction and Methods:** The Brooke is a UK charity established in 1934 to improve the welfare of working horses, mules and donkeys in developing countries. Since 2005, Brooke India has been experimenting with the application of accepted good practice from the international development sector, aiming to create collective responsibility within communities for sustainable improvement in the welfare of their working animals. This has resulted in the identification and refinement of a group-based process in which communities use adapted Participatory Rural Appraisal tools to identify positive and negative, mental and physical aspects of equine welfare and their associated risk factors. They assess the welfare of all animals belonging to group members and agree on individual and collective action to improve it. The group monitors progress towards this goal by repeating the participatory welfare assessment at intervals of one to three months and making appropriate changes to their action plans. Many equine welfare groups have incorporated a savings fund into their activities, with each member making a monthly contribution. They regularly lend money from the fund to group members for equine-related and other purposes.

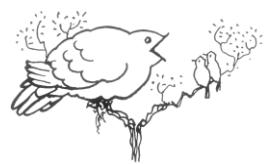
**Results and Discussion:** By June 2010, Brooke India was providing facilitation and technical support to almost 1400 equine welfare groups owning 29,500 working animals. Details of loans taken in 400 village groups in Uttar Pradesh are shown in the table below.

**Table 1: Equine welfare group loans to September 2010, from 400 groups (total 5154 members) in nine districts of Uttar Pradesh, India**

| District (number of village groups) | Members taking loans from common savings fund |    | Average loan per borrowing member |     | Total loans taken |       | Equine-related loans |       | Loans for other purposes |       | % Equine-related loans |
|-------------------------------------|---|----|-----------------------------------|-----|-------------------|-------|----------------------|-------|--------------------------|-------|------------------------|
|                                     | Number  | %  | (Rs)                              | (£) | (Rs)              | (£)   | (Rs)                 | (£)   | (Rs)                     | (£)   |                        |
| Bijnore (61)                        | 389   | 47 | 2113                              | 28  | 821785            | 10957 | 538045               | 7174  | 283740                   | 3783  | 65                     |
| Bulandsahar (52)                    | 148   | 24 | 4286                              | 57  | 634295            | 8457  | 354295               | 4724  | 280000                   | 3733  | 56                     |
| Saharanpur (54)                     | 227   | 29 | 9115                              | 122 | 2069100           | 27588 | 1454500              | 19393 | 614600                   | 8195  | 70                     |
| Ghaziabad (49)                      | 200   | 32 | 3959                              | 53  | 791700            | 10556 | 418800               | 5584  | 372900                   | 4972  | 53                     |
| Baghpat (33)                        | 146   | 34 | 5018                              | 67  | 732640            | 9769  | 311050               | 4147  | 421590                   | 5621  | 42                     |
| Meerut (47)                         | 167   | 31 | 3325                              | 44  | 555210            | 7403  | 208390               | 2779  | 346820                   | 4624  | 38                     |
| Muzaffarnagar (52)                  | 130   | 20 | 5799                              | 77  | 753900            | 10052 | 388700               | 5183  | 365200                   | 4869  | 52                     |
| Aligarh (33)                        | 100   | 23 | 8535                              | 114 | 853500            | 11380 | 340400               | 4539  | 513100                   | 6841  | 40                     |
| Noida (19)                          | 26  | 11 | 10527                             | 140 | 273700            | 3649  | 200000               | 2667  | 73700                    | 983   | 73                     |
| Total or average for                | 1533  | 29 | 5849                              | 78  | 7485830           | 99811 | 4214180              | 56189 | 3271650                  | 43622 | 54                     |
| £1 = Indian Rs.75                   |   |    |                                   |     |                   |       |                      |       |                          |       |                        |

Equine-related loans were made for veterinary treatment, animal feed, cart and equipment repair, buying new animals and repayment of previous loans for buying animals. They enabled owners to provide resources which had previously been financially inaccessible; either through provision of capital or by enabling repayment of high-interest external loans which released family income for other purposes, including equine needs. Administration of contributions and loans bound the group together by reinforcing their internal norms or regulations and by creating peer pressure to take part in meetings and comply with agreed actions. This stabilised group membership and meeting attendance, which in turn encouraged sustained collective action to reduce the risk factors for poor welfare.

## Making animal welfare improvements: Economic and other incentives and constraints



# CAN INSPECTION STIMULATE FARMERS TO IMPROVE ANIMAL WELFARE? AN ANTHROPOLOGICAL STUDY

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In Denmark the Ministry of Justice is responsible for animal welfare legislation including implementation of EU-legislation, and a major effort is put into ensuring certain standards of animal welfare, defined by national as well as EU-legislation.

The overall objective is to ensure the citizens a certain level of animal welfare and to improve animal welfare in general by motivating changes in farms where animal welfare is not complying with the regulations. The way farmers and authorities communicate about animal welfare could have an important influence on how knowledge about animal welfare is passed on inside the production system and also to the consumers. Today control and unannounced inspections from the authorities is part of daily life on Danish livestock farms, and it often leads to conflicts, even though farmers to a certain extend agree on the necessity of inspection.

## Aim of the study

The present study focuses on how farmers communicate about animal welfare, with whom they communicate, and how they react to the controls on animal welfare carried out by the authorities.

## Materials and methods

Methodologically the study includes anthropological fieldwork on four different farms and fieldwork following the inspectors from the authorities on the unannounced inspection among dairy cattle and pig farms. The fieldwork is followed by qualitative interviews with farmers, farm workers, veterinarians, advisers and inspectors. The interviews are analysed phenomenologically and explained using theory about learning and communication.

## Results and conclusions

Result from this study show that stakeholders differ in their knowledge and understanding of animal welfare. The farmers awareness about animal welfare in his daily work might not connect to his knowledge about the law, and the knowledge of the inspectors sometimes seems to diverge significantly from the farmers own daily practise. The result also reveals dilemmas between farmers and authorities in different attitudes to suffering of animals, and it shows that financial problems on the farms influence on the farmers attitude towards inspection and towards animal welfare in a production system under pressure.

This study draws attention to the importance of gaining more knowledge about the farmers' attitude towards animal welfare and the necessity of putting forward suggestions of new learning possibilities.

## Making animal welfare improvements: Economic and other incentives and constraints



## **COMPARISON OF TWO STORAGE METHODS FOR THE ANALYSIS OF CHOLINESTERASE ACTIVITIES IN FOOD ANIMALS**

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Cholinesterases are specialized carboxylic ester hydrolases that catalyse the hydrolysis of choline esters. They are classified into either acetylcholinesterase or butyrylcholinesterase. Determination of cholinesterases in tissues is the appropriate tool for the diagnosis of organophosphorus and carbamate exposures. Cholinesterases were determined by the Ellman method, adapted for a plate reader. The purpose of this study was to investigate the freezing correlations between the acetylcholinesterase and butyrylcholinesterase at -80 °C and -20 °C. A further aim was to establish a foundation for the applicability of cholinesterases in food animal species as biochemical biomarkers for the evaluation of exposure to organophosphorus and carbamate pesticides. Chemical products are prevalent in animals destined for human consumption in world with serious public health implications. Animal handlers are at risk of contamination and can serve as source of contamination to susceptible hosts. Targeted pest control of poisoned animals, concerted veterinary efforts, professional health instruction, active attachment of animal careers and good health care systems are necessary for effective control. In general, a significant inhibition was seen for both acetylcholinesterase and butyrylcholinesterase activities after 6 months at -80 °C and after 3 months at -20 °C. Linear regression of mean acetylcholinesterase and butyrylcholinesterase observed in all individual samples on months of two freezing. Bland and Altman plot of the ratio of two freezing was shown the mean differences between two freezing methods to be 8.8 and SD was 144.7 and -127.6 for upper and lower limits, respectively, for liver, while in muscle 1.5 and SD was 32.5 and -28.9 for upper and lower limits, respectively. In conclusion, we suggest that determination of cholinesterases in animal tissues could be useful for biomonitoring for anticholinesterases after freezing 80 °C or -20 °C at least 3 months especially due to anticholinesterases.

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## SPONTANEOUS REACTIVATION AND AGING KINETICS OF LIVER AND MUSCLE OF FOOD ANIMALS INHIBITED BY DICHLORVOS AND DIAZINON

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Spontaneous reactivation and aging of acetylcholinesterase (acetylcholine hydrolase, AChE, EC 3.1.1.7) from sheep, cattle, and pig livers and muscle was studied (pH 8.0; 22-25 °C), after inhibition by organophosphorus pesticides, dichlorvos (DDVP) and diazinon (DZN). Organophosphorus are among the most toxic of all substances that cause poisoning in food animals and are the most frequently encountered insecticides, commonly detected in agricultural products, animal-derived foodstuffs, environmental samples, and home use and represent a significant potential health risk. The first-order rate constants obtained for spontaneous reactivation ( $k_r$ ) was found to be higher in sheep compared to cattle, pig, and ranged between 0.133 to 0.323 h<sup>-1</sup> and between 0.021 to 0.088 h<sup>-1</sup> for DDVP and DZN respectively. Aging of phosphorylated AChE follows the kinetics of a first-order reaction with rate constants of aging ( $k_a$ ) higher in cattle compared to sheep and pig, and ranged between 0.013 to 0.021 h<sup>-1</sup> and between 0.009 to 0.01 h<sup>-1</sup> for DDVP and DZN respectively. Half-time ( $t_{1/2}$ ) for spontaneous reactivation and aging are higher in DZN compared to DDVP and ranged from 2.3 to 85.3 h (sheep), 3.2 to 76.3 h (cattle), and 2.9 to 58.3 h (pig), respectively.

The data of the present study indicate that there is real structure-activity relationship for the kinetics of spontaneous reactivation and aging. The main purpose of the this study was to investigate and compare the kinetic rate of spontaneous reactivation and aging, it is essential to establish that any return of hydrolytic activity following poisoning represents the dis-inhibition of pre existing enzyme and not synthesis of new enzyme.

Chemical products are prevalent in animals destined for human consumption in United Kingdom with serious public health implications. Animal handlers are at risk of contamination and can serve as source of contamination to susceptible hosts. Targeted pest control of poisoned animals, concerted veterinary/medical efforts, professional health instruction, active attachment of animal careers and good health care systems are necessary for effective control.

In conclusion, the results of the present study shows that the kinetic properties of spontaneous reactivation and aging for sheep, cattle, and pig AChE are comparable in view of interactions with DDVP and DZN. Furthermore, in clinical purpose, the level and time course of aging is important, because it is the factor that limits the period for a useful oxime administration.

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# FRAMEWORK TO PREDICT WHY CONCERNS ABOUT ANIMAL PRODUCTION EXIST

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Animal production has become a hot topic in public debate. Perceptions of citizens about animal production are a result of basic values and knowledge of animal production (see figure 1). They evoke concerns about animal production. Which concerns exist can be measured, but it is difficult to measure why these concerns exist.

The objective of this study was to develop a framework which can be used to study basic values and perceptions of citizens, farmers and farm advisors about animal production. With basic values and perceptions it is possible to reveal which concerns about animal production exist, and why they exist. The developed framework will be applied to different aspects of pig production, e.g. piglet mortality, weaning age, interventions (castration, tail docking), euthanasia sick/weak animals, housing, lifespan sow and use of antibiotics.

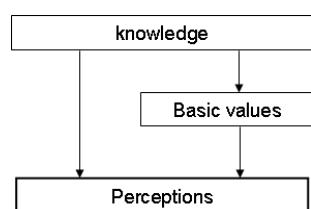


Fig. 1: What shapes perceptions

The first part of the framework exists of people's basic values with regard to different elements related to animal production, e.g. value animal, hierarchy human-animal, naturalness, justice, and doing good. The second part of the framework, which is domed by the basic values, exists of people's perceptions about factors related to different moral entities: the animal, the animal keeper, the consumer and the surroundings. For the animal factors are divided into welfare (physical functioning (metabolic/physical exhaustion, disease/ infections/injuries, mortality), mental (fear, stress, pain)) and intrinsic value (housing, scaling up, interventions like castration and tail docking, euthanasia, lifespan, quantity/size litters, weaning age, motherless care, taking care of the individual animal). For the animal keeper factors are divided into economics (income, freedom of trade) and health (working conditions, risks, physical effort, mental burden), and for the consumer into economics (price, freedom of choice), health (food security, public health) and experience product. Factors for the surroundings are divided into environment (waste products, infrastructure, ecosystem, smell) and landscape.

Elements of the basic values and factors of the perceptions can be rated with regard to pig production and can then be linked to each aspect of pig production. These ratings will reveal about which aspects concerns exist, and on which factors these concerns are based. Also differences between stakeholder groups will be revealed by these ratings. This knowledge can then be applied to distinguish those parts of animal production that need to be changed for further development in the production system, taking into account all relevant aspects to stimulate a broad-based foundation for the production system.

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# THE IMPOSSIBLE POSITION OF THE ANIMAL IN CIVIL LAW; HOW BEING AN 'OBJECT' CONSTRAINS ANIMAL WELFARE

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Lawsuits about animals are often initiated by owners or ex-owners who are angry. Angry about the congenital disease their pet suffers from. Angry about their pet dog or cat being attacked or killed by an aggressive dog. Angry about their ex-husband or ex-wife not taking good care of their beloved pet. Angry about the neighbour's pet causing trouble by fouling, barking or other unwanted behaviour.

All those lawsuits start with angry people, but are very closely related to animal welfare. Studying these lawsuits points out that we all consider inbred congenital diseases in pedigree dogs and cats as a threat to their welfare, yet legally the animal is just an object in lawsuits between owners and breeders. We consider an animal that needs serious veterinary care an object that can be declared 'total loss'. We allow governments to prescribe electric shock collars for dogs that bark too much to keep the neighbours happy. We don't acknowledge a legal based ownership of a pet, thus making it easy for people to dump their pets unpunished, or start a (legal) fight over the ownership of a pet.

A study about civil law and the many civil lawsuits where animal welfare is at stake, presents us clearly with the question whether our civil law is adequately equipped for considering the welfare of the animal involved. We can also ask ourselves whether civil law should be more adapted to our public laws that do concern animal welfare. The study shows how the law and lawsuits demonstrates that those different fields of legislation can be very inconsistent and even counterproductive in aiming for improvements in animal welfare. It might not be the first thing to think of, but a couple of changes in civil law regarding animals could make a big difference.

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**PRIORITIES BETWEEN WELFARE ISSUES:  
EXPERTS' CHOICES MADE IN THE WELFARE QUALITY® PROJECT**

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Animal welfare is a multidimensional concept, relying on several issues as different as human-animal relationship and pain due to injuries. When designing an overall assessment of animal welfare, one has to integrate these dimensions and thus must make choices on what is more or less important, whether these differences in priority outrank questions related to the limitation of compensations between issues, etc.

Within the European project Welfare Quality® (2004-2009), a standardized tool was designed to assess at farm level the welfare of cattle, pigs and poultry. This assessment model relies on a hierarchical structure, where animal welfare is broken down into four principles to be fulfilled (*good feeding, good housing, good health and appropriate behaviour*), subdivided into twelve criteria (eg *absence of hunger* and *thirst for good feeding*). Compliance of a given farm with these twelve criteria is derived from the interpretation and aggregation of about 40 measures (mainly animal-based). At each stage, the evaluation model was parameterised using experts' opinion. To go from the measures to the welfare evaluation at criterion level we consulted animal scientists. For the construction of principles we consulted both animal and social scientists. For the final overall evaluation, we additionally considered stakeholders' views. The assessment tool was tuned to fit the average judgement of these experts, thus modelling their opinion on i/ the interpretation in terms of welfare of the measures, ii/ the relative importance of the different measures, criteria and principles, and iii/ the level of compensation to be authorized between welfare issues. The analysis of the answers obtained in Welfare Quality® show that at principle level equal priority is given to the four issues. At criterion level, differences appear between the criteria, for example '*absence of thirst*' is judged as more important than '*absence of hunger*', whatever the species considered. In addition, the limitation of compensation between criteria (eg consider that a bad score on hunger cannot be compensated for by a good one on thirst) was also a very strong and common opinion among the consulted experts. Finally, at measure level, the interpretation of the data collected on farms is more or less severe depending on the criterion (eg more severe for measures related to health and feeding than for measures related to behavioural aspects) and depends on the prevalence of problematic situations on commercial farms (eg the interpretation of the percentage of too lean animals is more severe for fattening bulls than for dairy cows).

All these questions, illustrated here by the consultation process in Welfare Quality®, can also apply to other multidimensional topics, like the multicriteria evaluation of sustainability, for which welfare is one of the many issues to be considered simultaneously.

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## EQUINE INDUSTRY PERCEPTIONS OF THE POSSIBLE IMPACT OF THE CURRENT ECONOMIC RECESSION ON EQUINE WELFARE

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Cultural perception of animal welfare is intertwined with the economic well being and level of education of the keepers of the animals. In general, the greater the wealth of a country and the higher the education level of the population, the more concern is evident for the welfare of animals. Ownership of the domestic horse (*Equus caballus*) has changed beyond recognition in the past 30 years. Historically the horse was an animal kept to fulfil a purpose, such as agricultural toil, transport requirements or sporting pursuits. Increasingly the ownership of horses has become a leisure activity with proportionally less of the equine population being utilised for work or sport, with many more being classified as "leisure horses". This has led to a profound change in the equestrian profile of the majority of horse owners in the U.K. and it is unclear at the present time how this change in equestrian knowledge may affect the welfare of the U.K. horse population. Many aspects of the general care and welfare of the horse are expensive, which may lead to horse owners prioritising these routine management tasks to lighten the economic burden of horse ownership. It has been suggested that the change in the knowledge base of the horse owning public and the economic pressures placed upon them may lead to the welfare of the horse population being compromised as routine management tasks are omitted by less knowledgeable owners.

A survey questionnaire was designed by Sparsholt College BSc Equine Studies Year 3 students and distributed to a wide range of horse owners and managers in Hampshire. Each respondent was identified by their level of experience and equestrian qualifications, which were then related to how they rated 5 standard management tasks considered essential in the overall care and management of all horses. These tasks were *worming*, *regular shoeing/foot trimming*, *vaccinations*, *dietary supplementation* and *regular dentistry checks*. The management tasks were ranked on a 1-5 scale with the most important being assigned the value 5 and the least important the value 1. A significant difference was identified between the importance of these tasks ( $p=0.000$ ) with *regular shoeing/foot trimming* being the management task assigned the greatest importance by all levels of horse keepers and *dietary supplementation* being considered the least important. These results were then related to the horse keeper's level of equestrian experience and education however no significant differences between the opinions of experience groups were identified ( $p>0.05$ ). It was surprising to find that when asked which management tasks the respondents would consider economising on, 21% identified *regular shoeing/foot trimming* as an area that could be achieved at a lower cost even although this management task had been identified as the most important in the ranking scale. These results suggest a dichotomy between the horse keeper's attitudes to the importance of a management task, regardless of their level of experience, and their opinion of the possibility of economising upon its completion. Further research is required to identify how these economies would be achieved by horse keepers and the possible impact on the welfare of the general horse population.

### Making animal welfare improvements: Economic and other incentives and constraints



## USE OF FARMER FOCUS GROUPS TO EVALUATE A WELFARE SCHEME FOR SUCKLER BEEF CATTLE

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Schemes to improve farm animal welfare have existed in Europe since the 1990s. Reform of the Common Agricultural Policy (CAP) in 2003 provided funds for animal welfare initiatives. In 2008, Ireland's Department of Agriculture, Fisheries and Food (DAFF) launched the Animal Welfare, Recording and Breeding Scheme for Suckler Herds ('Suckler Scheme'). The main aims of the scheme include enhancing welfare standards and improving genetic quality of the national beef herd. This is a voluntary scheme based on economic incentives. Initial uptake was widespread with approximately 50,000 farmers joining (approximately 76% of registered beef suckler herds). Little research has focused on the attitudes of beef farmers' to animal welfare schemes. The objectives of this study were to seek farmers' opinions of the 'Suckler Scheme', to explore the underlying reasons for these opinions as well as perceptions of the scheme's relationship to welfare, and to elicit ideas for improving future schemes. In this study, four focus groups (each comprising 7+ suckler farmers) were conducted in November 2009 in four regions of Ireland. Participants were sourced through local veterinarians and invited to attend the focus groups. Ethical approval was obtained in advance and participants received a full explanation of how data would be managed before consenting to take part. Audio recordings were transcribed *verbatim* and then 'coded' for topics and views mentioned. Coding and thematic analysis were carried out using NVIVO 8, a software programme designed for qualitative data analysis. The majority of participants perceived all the scheme measures as being important and relevant to good farming practices while acknowledging that not all measures related to welfare but rather to data collection and breeding beef cattle. There was strong consensus that the measures relating to the minimum age at first calving and to meal-feeding at weaning have a positive impact on animal welfare and health. Two measures were criticized for being impractical (i.e. the amount of paperwork for recording animal events and the conditions concerning the disbudding of calves). The conditions for the timing of weaning were also criticized for having a negative financial impact at sales. Participants also suggested additional measures that could further improve animal welfare. The inability to produce high-quality beef animals at a profit is of concern to farmers. The majority anticipated that the data being collected via the scheme would help inform decisions when trying to breed a 'quality' beef animal.

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# USE OF A PRESSURE MAT SYSTEM TO ASSESS KINETIC PARAMETERS IN DOMESTIC CATS

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Pressure mat systems developed for humans may be useful in veterinary medicine for assessing subtle alterations in an animal's gait following injury or surgery, monitoring the effects of degenerative and neurological diseases and assessing the efficacy of treatment. However, before pressure mat systems can be used in this way analysis of normal animals must be carried out to assess feasibility, and to determine baseline values.

Assessment of the gait of trained cats has taken place in work to study disturbances of the nervous system, but is rarely reported for untrained, client owned domestic cats. Unlike horses and dogs, cats usually cannot be easily lead, and instead select their own direction, speed and gait. As training client owned cats prior to assessment is not feasible, any studies on baseline values intended to inform clinical assessment should also involve untrained cats.

This study had several objectives: firstly, whether a pressure mat system designed for human use can be used to assess the gait of untrained client owned domestic cats; secondly, whether peak vertical force differs if cats step up onto the mat rather than transitioning from a level surface; and thirdly, whether gait affects peak vertical force.

Eleven cats were sourced from a UK rescue centre and university staff and students. All cats were current or previously-owned pets. Each cat was encouraged using positive cues to traverse a 1m long pressure sensitive walkway, up to 25 times at a self-selected speed. If a cat became fatigued or unwilling to participate the session was discontinued. For the first 10 trials each cat undertook five consecutive trials requiring a 1cm step up onto the mat, and five consecutive trials without a step onto the mat. The order in which these blocks were presented was randomly selected. Any subsequent trials only involved a level surface. A trial was considered valid if the cat crossed the walkway in a broadly straight line and at a consistent speed. A step was considered valid if ground reaction forces reached zero at the end of the step and the step was placed entirely within the sensitive area of the plate. Peak vertical force (normalised for body weight) was calculated for each valid step.

A total of 108 valid trials were collected (mean 9.8 per cat, range 1-21) and provided 753 valid steps. Habituation to the surroundings was necessary for some cats. Stepping up 1cm onto the mat resulted in a difference in peak vertical force for the first step (86.16%BW +/- 1.93) when compared to later steps by the fore-feet (92.90%BW +/- 1.37;  $P=0.01$ ) and therefore transition from a level surface would be the preferred method. Peak vertical force measured when a cat trots (107.16%BW +/- 2.53) was greater than that measured at slower gaits (78.98%BW +/- 0.77;  $P<0.001$ ).

These preliminary studies suggest that a pressure sensitive walkway is a feasible method to analyse feline gait. The equipment is portable and data can be collected from a single cat within 20 minutes.

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# **EFFECT OF APPROACH MANNER OF AN UNFAMILIAR PERSON ON THE BEHAVIOURAL ACTION AND EYE/ EAR TEMPERATURES OF DOGS (*CANIS FAMILIARIS*)**

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The dogs can adapt their responses to human social cues; however, there have been few evaluations of the physiological reactions of dogs to such cues. In this study, five pet dogs were used as subjects to investigate the both behavioural and physiological response to approach manner of an unfamiliar person. We observed two types of approach (friendly and expressionless approach) by people of either sex, and the tests were filmed using a video camera. The dogs' body and eye temperatures were measured with a thermal video system and their ear temperatures were measured with a Vet-temp electronic ear thermometer.

The total durations of the two behavioural categories [social behaviour toward approaching person] (average; 42.13 sec.) and [social behaviour toward handler] (42.88 sec.) with a friendly approach were significantly longer than with an expressionless approach (14.75 sec.; 2.0 sec.) (ANOVA,  $p<0.001$ ; respectively). With the friendly approach, the total duration of [social behaviour toward approaching person] was longer than [refusal behaviour toward approaching person] (15 sec.) (Tukey,  $p<0.05$ ). Each type of behaviour was not affected by the sex of the approaching person. The thermal images for eye and ear temperature were positive correlated with each other (Pearson correlation:  $r=0.65$ ,  $p<0.01$  for the time point at which the approach began;  $r=0.66$ ,  $p<0.01$  for the time point after at which the approach ended). There were no significant differences in the thermal images or ear temperatures between the two measurement points.

These results suggested that the dogs quickly recognised the approach person's attitude. They might be also suggested that the dog's behavioural response was influenced by the approach manner rather than by the sex of the approaching person. There were no significant short-term changes in body temperature over a short time. Even if the measurement of ear temperature is difficult, it is possible to estimate eye temperature by using a thermal video system.

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# MEMBERSHIP OF A FARM ASSURANCE SCHEME IS ASSOCIATED WITH HIGHER COMPLIANCE WITH ANIMAL WELFARE LEGISLATION WHEN INSPECTED BY ANIMAL HEALTH

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Farmed animals in Great Britain are in a population sampled by Animal Health (AH) to check compliance with animal welfare legislation and the welfare codes. The inspection outcome is coded as full compliance with legislation and code (A), compliance with legislation but not code (B), non compliance with legislation but no adverse effect on the animals (C) or evidence of unnecessary pain or unnecessary distress (D). The aim of this study was to investigate whether membership of farm assurance or organic certification schemes was associated with differential compliance with animal welfare legislation. All major UKAS accredited livestock farm assurance and organic certification schemes in Britain were invited to participate. Data on membership history were included from ten assurance and five organic schemes. These were matched against 38,659 records of inspections made by AH from 2003 to 2008.

Multivariable multilevel binomial models were built comparing inspections where the enterprise was compliant with animal welfare legislation (AH code A and B) with inspections of non compliant enterprises (AH code C and D). Random effects were included to account for the repeated measures of inspection, and dependence between enterprise, location and county. The models controlled for year of inspection, reason for the visit, number of animals inspected, type of enterprise and country.

The percent of inspections A, B, C and D was 37, 36, 20 and 7% respectively. There was a pattern of reduced risk of codes C/D compared with A/B in all certified enterprises (Table 1). We conclude that farm assurance membership and organic certification were associated with higher compliance with animal welfare legislation.

Table 1. Associations between certification and AH codes C/D in pig, sheep, cattle and poultry enterprises in GB 2003-2008

|  | Pig |           | Sheep      |                  | Cattle     |                  | Poultry    |                  |
|--|-----|-----------|------------|------------------|------------|------------------|------------|------------------|
|  | OR  | 95% CI    | OR         | 95% CI           | OR         | 95% CI           | OR         | 95% CI           |
| Not certified by participating schemes | Ref |           | Ref        |                  | Ref        |                  | Ref        |                  |
| Assured                                | 0.7 | 0.5 - 1.0 | <b>0.6</b> | <b>0.5 - 0.7</b> | <b>0.5</b> | <b>0.5 - 0.6</b> | <b>0.4</b> | <b>0.2 - 0.8</b> |
| Organic                                | 0.8 | 0.4 - 1.5 | 0.6        | 0.4 - 1.0        | <b>0.3</b> | <b>0.2 - 0.6</b> | 0.8        | 0.4 - 1.8        |

OR (odds ratios) and 95% CI (confidence intervals) sourced from 4 binary logistic regression mixed models for each enterprise. Ref= reference category not known to be certified

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# ECONOMIC ANALYSIS OF HUMANE COMPREHENSIVE DOG POPULATION MANAGEMENT AS AN ALTERNATIVE TO MASS CULLING

***E Hiby***

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Rabies is perhaps the most feared zoonotic disease with almost 100% fatality once symptoms emerge and is present in all continents except Antarctica. Rabies persists largely as a disease of poor, rural communities in developing countries, where the primary human victims are children and the primary vector for human infection is the domestic dog. A study commissioned by the World Health Organisation (WHO) in 2004 to assess the burden of rabies estimated the annual number of human rabies deaths at 55,000, with 56% of these occurring in Asia, 44% in Africa, and the majority (84%) in rural areas. One person dies from rabies every ten minutes.

Rabies also has a considerable impact on animal welfare. For dogs, the suffering caused by rabies is not limited to the clinical disease itself but also results from inhumane control efforts and the persecution that stems from being the primary vector for human infection. In response to rabies, governments and municipalities often implement inhumane population control measures, which can include mass indiscriminate culls. Not only are these inherently cruel but also they are largely ineffective in reducing the dog population or human rabies incidence.

The cost of treatment post-exposure for people is very high and sometimes treatment is not feasible. The alternative is to address disease in the vector, the dog. It has been proposed that vaccination of the vector is as little as 10% of the cost of post-exposure treatment in the same location. As well as economic costs of rabies control there are societal elements to consider.

Rabies continues to be a significant problem in many countries despite the disease being entirely preventable through vaccination of the vector population and prompt treatment of people potentially exposed to the disease. There is a need for robust economic case studies to prove to governments that mass dog vaccination is the best solution rabies control as opposed to inhumane mass culling of domestic dogs.

This poster will discuss these economic aspects to humane rabies control and mass culling using the example of the mass vaccination campaign on Bali as a case study.

[WSPA, in partnership with our member societies advocates and implements humane comprehensive dog population management projects. Although these are primarily aimed at improving animal welfare, the implications of rabies cannot be ignored. Indeed, the success of many of these programmes will be judged according to their effect on the incidence of human rabies]

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## **ECONOMIC CONSIDERATIONS FOR BEST PRACTICE AND ALTERNATIVES IN EDUCATION AND TRAINING**

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Education and training within medical, veterinary medical and biology education and training may involve harmful animal use such as animal experimentation and the dissection of purpose killed animals. Innovative alternatives to this practice are increasingly being developed and implemented across the world. Alternatives are humane educational aids and teaching approaches that can replace harmful animal use. They may be non-animal alternative tools such as multimedia software and virtual reality (VR), digital video, and training models, mannequins and simulators. They may also be alternative approaches such as student self-experimentation, the use of ethically sourced animal cadavers, and supervised clinical work on human and animal patients. Through progressive curricular design, a combination of these non-animal methods, ethical cadavers and therapeutic practice can support effective knowledge and skills acquisition and reach beyond alleviating pain and distress to obviating welfare problems completely. Published studies provide further evidence of the pedagogical, ethical and economic advantages of replacement alternatives over harmful animal use, illustrating a growing commitment to best practice and fiscal responsibility. In this presentation, specific examples of alternatives and implementation from across the world will be given, with special reference to the economic opportunities and obstacles that universities may face.

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**DEVELOPMENT AND EVALUATION OF A NEW COMPUTER AIDED  
LEARNING (CAL) EDUCATIONAL RESOURCE WHICH AIMS TO MAXIMISE  
THE BENEFITS OF PRE-CLINICAL EXTRA MURAL STUDIES.**

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Pre-clinical Extra Mural Studies (PC EMS) provides veterinary students with experience working with animals and clients in a real life setting. First and second year students are required to complete twelve weeks of placements as part of the Pre-Clinical phase of the EMS course. The placement sites include farms, riding establishments and veterinary clinics. Students have an opportunity to develop the skills and knowledge accrued at University. EMS coordinators from each of the UK Veterinary Schools participated in a consultation exercise which concluded that a new educational resource could maximise the benefits of PC EMS by improving students' skills in animal observation and providing a link between University teaching and PC EMS placements. Animal welfare can be assessed via animal observation. Animal-based measurements or outputs, along with resources provided to the animals or inputs, can offer useful information relating to the overall welfare of animals. A Computer Aided Learning (CAL) educational resource, called Partnerships in EMS, was created to explain and illustrate the process of animal welfare assessment and provide users with an opportunity to rehearse animal welfare assessment before going on farm. The CAL also created a link between University teaching and farm placements and introduced students to the educational concepts associated with life-long learning such as problem-solving and critical thinking. Experiential Learning can be described as the process whereby knowledge is created through transformation of experience. Kolb's cycle of Experiential Learning involves four steps; concrete experience, reflective observation, abstract conceptualisation and active experimentation and these steps were incorporated into the new CAL educational resource. Students who had access to the CAL were more likely to identify animal-based measurements relating to (i) biological functioning such as the freedom from hunger and thirst, discomfort and pain, injury or disease in their PC EMS farm report than students who did not have access to the new educational resource. CAL students were also more likely to include a greater number of animal-based measurements relating to (ii) mental wellbeing in their PC EMS farm report than their non-CAL counterparts. These generic skills in animal observation and welfare assessment are a fundamental platform from which pre-clinical students will progress through their clinical years and beyond. The life-long learning skills developed by the Partnerships in EMS CAL have the potential to impact not only the professional lives of the veterinarians themselves but their clients and, ultimately, the animals as well.

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# **DO WE MEAN THE SAME ‘ANIMAL WELFARE’? FARMERS’ OPINION VS. PARAMETERS USED IN THE WELFARE QUALITY® PROTOCOLS**

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So far several studies have looked at consumer’s opinion on animal welfare to integrate into on-farm welfare assessment schemes. However, little is known if farmers and scientists use the same indicators to assess animal welfare. From a similar understanding good acceptance of welfare assessments is expected. This might be beneficial when communicating with farmers about their AW situation and developing improvement strategies.

As part of three European on-farm welfare projects (Welfare Quality® (WQ®), ANIPLAN, BEP) semi-qualitative interviews were carried out in Austria, Germany and Italy including 90 beef, 40 dairy farms and 60 pig farms. Farmers were asked to define AW and how they would assess it. The answers were processed using ‘inductive qualitative content analysis’ and allocated to six categories of AW indicators (i.e. behaviour, clinical signs, external appearance, productivity, activity levels, housing). The measures used in the beef, dairy and pig WQ® protocols were allocated to the same categories.

Farmers focussed on behaviour (26%) and productivity (22%) as indicators of good welfare. 14% of statements further related to the ‘external appearance’ (e.g. glossy coat). Within the indicators of poor welfare, farmers mentioned 27% clinical signs. Housing was only rarely mentioned (1%). Across species there were only minor differences in the use of indicators; pig farmers tended to use slightly more clinical indicators for poor welfare than beef and dairy farmers (34%, 23% and 25%, respectively). At measures level the WQ® protocols mainly contain clinical signs (48%), followed by housing design measures (16%), behaviour and external appearance (13% and 14%, respectively).

In general, farmers mention the same categories of welfare indicators as currently being used in the WQ® protocols. However, there are differences regarding the proportion of measures allocated to the different categories. This might be explained to some degree by practical issues regarding the ease of measuring clinical signs and housing issues, which are used to a high degree by WQ®. The WQ® assessment systems comprise an aggregation step taking different numbers of measures within welfare criteria and welfare principles into account. In the studies used here, however, the farmers were not asked to aggregate the measures and therefore no comparison can be made at this level.

The differences mentioned above should be addressed in order to raise acceptance when implementing AW assessment protocols. This is especially the case when no aggregation of information takes place and assessment results are fed back at the single measures level.

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# THE WELFARE AND ECONOMIC CONSEQUENCES OF LAMENESS IN FINISHER PIGS: A PILOT STUDY USING EXPERT OPINIONS.

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Lameness in finisher pigs is known to affect both animal welfare and profitability. However, quantitative information combining these consequences is lacking. In order to provide more transparency in the overall evaluation of lameness, it is relevant to evaluate and quantify the consequences for each of the underlying causes. This pilot study assessed the impact of 9 different causes of lameness on animal welfare and profitability using expert opinions.

Six researchers working with applied animal behaviour and welfare ('welfare experts') and 8 Danish pig veterinarians ('production experts') answered questionnaires regarding animal welfare and production, respectively. The welfare experts were selected on the basis of their expected knowledge of the different causes of lameness and consequences for animal welfare. The production experts were all experienced pig veterinarians with special interest in lameness. The degree of pain was used as a proxy for the welfare a pig suffering from each cause of lameness would experience. The experts were hence asked to score the degree of pain that a lame pig would experience on an arbitrary scale from 0-100 for each cause of lameness. The probability of euthanasia, treatment with antibiotics and analgesics, as well as the effect on the daily weight gain and feed conversion ratio were used to calculate the resulting profit margin for a pig suffering from each of the 9 causes.

According to the experts, fracture caused the highest degree of pain and the largest reduction in the profit margin, whereas lesions to the volar area of the feet caused the lowest degree of pain and only a low reduction in the profit margin. *Osteochondrosis dissecans* had a high impact on both animal pain and profitability. Among the 4 causes of infectious arthritis included in this study, *Mycoplasma hyosynoviae* caused the lowest reduction in the profit margin and had a low impact on pain, whereas *Erysipelothrix rhusiopathiae* had a high impact on both animal pain and profitability, according to the experts. Considering the welfare and economic consequences of lameness concomitantly may provide incentives for the farmer as well as society to focus future efforts and improve animal welfare.

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# INTRODUCTION OF THE THREE Rs ALTERNATIVES INTO VETERINARY EDUCATION IN KOREA: ASSESSING ATTITUDES OF PROFESSORS AND STUDENTS

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Two new Korean laws legislating animal welfare and the humane use of animals in science came into effect in 2008 and 2009. These are based on the Three Rs principles of Russell and Burch: replacement, reduction and refinement.

The attitudes of veterinary professors and students towards animal use in education affect their efforts in providing instruction and working for the health of animals and the enhancement of veterinary medicine. Training programmes are not yet available in Korea to improve their attitudes towards the animals used in laboratory practice, decrease handling stress to the animals, and offer more humane educational resources, such as alternatives to laboratory animal use.

The objectives of this study were: 1) to estimate the numbers of animals used and the use of the Three Rs alternatives in Korean veterinary education, 2) to assess attitudes of the Korean veterinary professors and students towards animal use and alternatives in their laboratory classes, and 3) to examine pre- and post-surveys assessing attitudes of veterinary professors and students on the trials of the Three Rs alternatives which have been applied in veterinary laboratory teaching at the Konkuk University, Korea.

Approximately 4,845 animals representing 20 different species were used in Korean veterinary education in 2007. Based on a pilot trial of the Three Rs alternatives into laboratory classes of Immunology, Laboratory animal medicine, Toxicology, and Surgery at the College of Veterinary Medicine, Konkuk University, a total reduction of 100 animals occurred during 2009 as compared to 2008. A majority of the professors and students recognized the need for development and implementation of well-proven alternatives to laboratory animal use and humane education.

The aim of this study was to present a comprehensive examination of animal use and the Three Rs alternatives in veterinary laboratory teaching from an ethical and humane perspective, including considering the views of the Korean veterinary professors and students. Korea has begun introducing formal courses on animal welfare and ethics for the humane treatment of animal use and requires an ethical protocol review system prior to animal use in education. Korea is moving toward emphasizing animal welfare, incorporating practices consistent with international standards. This information provides a baseline for monitoring results of replacement, reduction, and refinement measures to promote laboratory animal welfare in Korea.

## Making animal welfare improvements: Economic and other incentives and constraints



# **MAKING PIG WELFARE IMPROVEMENTS POSSIBLE HEALTH AND WELFARE PLANNING ON AUSTRIAN ORGANIC PIG FARMS**

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Improvement of pig welfare remains a huge challenge, in conventional farms as well as in alternative systems. After diverse experiences with the UK farm management tool 'Herd Health Plan' including positive aspects and problems it was decided to introduce this concept into Austrian organic pig farming. A farm specific planning tool was developed, integrating quantifiable data, considering farm economy and a farmer orientated process of setting goals and measures to achieve those. 'BEPBioSchwein' was introduced to improve health and welfare whilst reducing medicine use. At the same time effectiveness, acceptance and economic impact were evaluated.

On 60 farms (20 breeders, 20 breeding to finishing, 20 finishers) of relevant size (&57 sows (8-500); &175 finishers (65-800)) management, feeding and housing were assessed. A representative sample of pigs was evaluated by behavioural observation and clinical parameters based on an adapted WQ® protocol. Animal based assessments and treatment incidences were benchmarked. Based on this, goals (&2.8 goals/farm) and measures (&1.2/goal) to achieve those were decided by the farmer. Goals were categorised as health issues (107x), improving productivity (27x), optimising feeding (23x) and housing (12x). Another visit was carried out and after one year a final assessment took place (&3.9 visits/farm). Degree of implementation of agreed measures was evaluated, animals assessed to evaluate effectiveness of the tool and the health plan was updated. Achievement of goals was evaluated using predefined parameters for each goal.

Degree of implementation of measures was significantly correlated with the success regarding individual goals ( $\chi^2$ -Test,  $p=<0.0001$ ,  $n=165$ ). Overall some important parameters improved significantly (Wilcoxon-Test): poor body condition in pregnant (13.8% vs. 9%) and lactating sows (15.5% vs. 8.3%), bursitis in pregnant sows (60.7% vs. 53.7%) and respiratory symptoms in weaners (53.9% vs. 27.6%). Prevalence of pale suckling piglets increased (1.2% vs. 2.4%), whilst all other parameters remained unchanged. Farms aiming at reducing tail biting had a significantly higher reduction of short tails than other farms ( $\Delta$ -31.2% vs.  $\Delta$ -3.4%). Apart from increasing treatment of lameness in sows (3.3% vs. 6.7%) and less treatments of streptococcal disease in suckling piglets (0.7% vs. 0.1%), medicine use remained unchanged. Farmers highly agreed with the tool, specifically with the strategic approach. 'BEP' can be regarded as an innovative and practical advisory and management tool, which can be applied by various stakeholder such as Animal Health Service, (organic) farming associations or advisory bodies.

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# THE INFLUENCE OF NATURAL LIGHT AND STRAW BALES ON THE BEHAVIOUR AND LEG HEALTH OF BROILER CHICKENS

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This study aimed to assess the effect of natural light and straw bales on activity levels and leg health in commercial broiler chickens. Houses containing ~23,000 broiler chickens were assigned to one of four treatments in a 2 x 2 factorial design. Treatments involved two levels of access to natural light (NL) (present '+NL', or absent '-NL') and two levels of access to straw bales (SB) (present (30/house) '+SB', or absent '-SB'). All houses were windowed and artificially lit, and windows were shuttered where appropriate. Treatments were applied in one of two houses on each of two farms, and were replicated over four production cycles. Behaviour was observed in weeks 2-6 of the cycle. This involved observations of general behaviour and activity, gait scores (0 (perfect) to 5 (unable to walk)) and latency to lie (measured in seconds from encouraging a bird to stand). Performance and environmental parameters were also measured. Data was analysed using Genstat (Version 12.0) by ANOVA with (House\*Cycle)/Week as a blocking factor and NL\*SB\*Week as a treatment factor.

Average daytime light intensity and UV levels in the +NL treatment were 85.2 lux and  $3.37\mu\text{W}/\text{cm}^2$ , respectively, and in the -NL treatment were 11.4 lux and  $0\mu\text{W}/\text{cm}^2$ , respectively. Litter moisture levels were lower in the NL treatment (+NL 32.0, -NL 34.6, S.E.M. 0.73%,  $p<0.05$ ), but were unaffected by SB ( $p>0.05$ ).

The percentage of time spent lying was affected by NL (+NL 76.7, -NL 83.5, SEM 1.24%,  $p<0.01$ ), but not by SB ( $p>0.05$ ). There were 3-way interactions between NL, SB and week on time spent in locomotion or idling (i.e. sitting or standing immobile) ( $p<0.05$ ). Both treatment factors had inconsistent effects on these parameters across different weeks. Levels of preening, resting (i.e. lying with head resting on the breast, chest or floor) and aggressive behaviour were not affected by treatment ( $p>0.05$ ).

There was an interaction between treatments in average gait scores, with higher scores in the -NL-SB treatment than in all other treatments, and higher in the -NL+SB treatment than in the +NL treatments (+NL+SB 1.02, +NL-SB 1.00, -NL+SB 1.09, -NL-SB 1.28, S.E.M. 0.008,  $p<0.001$ ). Average latency to lie was significantly higher with NL (+NL 16.4, -NL 12.9, S.E.M. 0.37 sec.,  $p<0.001$ ) and SB (+SB 15.3, -SB 13.9, S.E.M. 0.37 sec.,  $p<0.05$ ). Enrichment had no significant effect on the average slaughter weight of birds ( $p>0.05$ ).

We conclude that environmental modifications have the potential to increase activity levels and improve the leg health of commercial broilers. Access to natural light appears particularly important in this respect.

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## BATHING BEHAVIOURS OF PEKIN DUCKS WHEN USING POOLS OF DIFFERENT DEPTHS

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This study forms part of a wider project investigating the provision of open water sources for commercially farmed ducks. A preference test was designed to determine preference between open water sources of different depths, but no significant preference for depth could be found. This paper intends to clarify the behaviours ducks performed while bathing inside the pools and whether these behaviours differed between the different depths. Sixteen groups of ducks (Cherry Valley Pekin) were studied. Each group consisted of 4 ducks with access to 2 different open water sources. Ducklings were commercially reared, and provided with access to the test pens and the pools at 21 days of age. Three different pools were assessed: shallow (SH, 10 cm depth), intermediate (IN, 20 cm) and deep (DE, 30 cm). All pools were big enough for all birds to be in them at any one time (100 x 110 cm). Test pens had concrete floors with straw bedding. A raised slatted floor area ran along one side of each pen and was accessible via a concrete ramp. This area was divided into two sections and each half contained a pool, a “decking area” (where ducks could rest by the water source) and a bell drinker. Birds were individually identified and pools were emptied, cleaned and refilled once a week. 24h video recordings were made using CCTV cameras at 29, 34, 36, 41, 43 and 48 days of age. Behaviour was continuously observed and bathing bouts were identified using Observer XT9. 2760 individual bathing bouts were recorded in total. Overall, ducks spent 9.1% of their time inside the pools and 11.4% at the decking areas, which should be taken into account when considering pool availability at the commercial level. All 4 ducks were inside the pool for 42.6% of the bathing bouts, and just 6.9% of the bouts involved a single duck bathing, which suggests that bathing behaviour has a strong social component. 64.1% of bathing bouts lasted longer than 30 minutes. Ducks bathed more frequently in SH pools (44.8%) than in IN (32.8%) and DE ones (22.4%), but they spent more time per visit at DE pools (average 34 minutes), compared to IN (24 minutes) and SH (13 minutes). 180 bouts are being further analyzed, 10 bouts per recording day and pool type, to better describe the bathing behaviours.

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## **ENVIRONMENTAL FOOTPRINT: A CONSTRAINT ON ANIMAL WELFARE?**

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The environmental footprint of livestock production whether that is land use, emissions to air, soil and water, carbon footprint or water footprint is coming under increasing focus. As the overall environmental footprint becomes a key driver of the intensive livestock industry is doing what is good for the environment in terms of resource management at a juxtaposition to what is good for welfare? The paper explores these themes and determines whether the environmental footprint of different livestock production systems could become a constraint on the drive for extensification and ultimately drive the policies and pre-requisites currently in place that define best practice and animal welfare.

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## **WTO: ITS HISTORY, POLITICAL LEGITIMACY AND THE ECONOMIC CONSEQUENCES FOR FARM ANIMAL WELFARE**

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Consider the following premises: First, science has convincingly proven that animal species farmed in the UK are sentient. Second, rational moral arguments demonstrate that farmed animals should have, at the very least, a *life worth living*, if we are to utilise them for food and fibre, and often kill them prematurely. Third, the important interests of sentient animals, such as those encapsulated in the 'Five Freedoms', should be protected and enforced through legislation, as are the important interests of sentient human beings. Fourth, a large proportion of the human population of the UK, a group of liberal and democratic nations, desire that farmed animals should have, at the very least, a *life worth living*.

It would appear to follow from these premises that the UK Government would be acting reasonably, should it enact more legislation, in order to further protect the important interests of farmed animals. Indeed, in a democratic and humane nation, it is the Government's duty to do so, as part of guardianship of sentient animals if nothing else. Is it not reasonable that farmed animals should have a life worth living?

However, it is often stated that further regulation to protect farmed animals might put the UK farming industry at risk. Furthermore, such action might result in the welfare problem 'being exported'. This is because UK consumers might purchase animal products of overseas origin, partly due to a lack of information, unless of course these animals were also raised to UK standards.

The UK is a member of the WTO and as such is bound by its rules. This limits her power in such cases by stipulating that she cannot protect her own economic interests, for instance by placing barriers to trade (in this case for the legitimate protection of farmed animal welfare). Given the history and role of the WTO, why are sentient animals treated under the agreement without regard for their sentiency?

It could be argued that the UK, together with certain other WTO members, could help improve future farmed animal welfare universally, by lobbying WTO to change its rules with regards to sentient animals. However, some might argue at a philosophical and/or political level that WTO does not have democratic legitimacy. The nations of the UK are individually sovereign, which trumps the consideration of any possible improvement in farm animal welfare, especially that doubtful and contingent on a multiplicity of future world events.

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## FACILITATING CHANGES TO REDUCE INJURIOUS PECKING ON FREE-RANGE LAYER FARMS

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A recent survey found that 55% of farmers reported injurious pecking in their free-range flocks by the end of lay, and that up to 99% of birds within a flock are affected by this behaviour. The severity of injurious pecking varies widely, ranging from limited feather removal to cannibalism and death, with different risk factors associated with each of these pecking behaviours. Injurious pecking has both welfare implications for affected hens and economic implications for farmers.

The overarching aim of the project is to reduce the levels of injurious pecking in current commercial flocks of free range hens in the UK by transferring evidence based (scientific) knowledge into practice.

The project involves comparing the performance and levels of injurious pecking on 45 control farms and 45 treatment farms given advice. Several strategies have been adopted for both delivery and evaluation of the impact of the changes. This poster considers two of the methods used to facilitate changes in management and the provision of resources for hens.

Each farm was visited 4 times with data collected on feather score, evidence of injurious pecking, behaviour, range use and other factors, including economic performance. Following the initial visit to the outgoing flock, tailored interventions were suggested for each treatment flock, some of which needed to be implemented prior to placement.

1. Initially advice was given in the form of a letter with lists of advised changes but this evolved into a summary of each farm's current beneficial practices with ideas of how to build on these using colour photographs to illustrate how other commercial farmers were using the suggested strategies already.
2. As a further incentive to change, the project provided a proportion of the materials required for certain interventions, to kick-start the change process. Examples of these include shelters for range, highly absorbent litter for problem areas, pecking blocks and alfalfa.

Farmers found both these strategies effective in encouraging them to make changes: 93% made changes in response to the letter (option 1) and 88% were encouraged to make changes in response to the interventions offered in option 2. Only 30% would definitely have made changes without financial incentive but 39% might have. Virtually all farmers (93%) were sufficiently convinced by the effectiveness of the interventions that they will use them again.

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## FARMERS, THEIR VETS AND ANIMAL WELFARE

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One of the main determinants of a good quality of life is good health. As animal health experts veterinary surgeons are thus an important resource, yet in the UK the demand for and number of large animal vets has been falling. This is causing concern both within and out with the profession. For example, questions are being asked about the adequacy of veterinary coverage for emergency services to sick and injured animals in some remote areas. The present and, if numbers of vets continue to decline, future market solution thus may not be socially acceptable. New policy intervention may therefore be required but it is unclear what the most effective and/or efficient interventions would be. To identify these a better understanding of the factors influencing the demand for veterinary services – and how they might be increased – is required.

As a first step the study reported in this paper investigated how cattle and sheep farmers view and use their vets. Across a sample of 150 respondents we found a high level of trust in the ability of vets (93%) and of agreement that all sick animals should be given appropriate treatment (92%). In addition, 99% of respondents felt that good animal welfare was important and need not be expensive. However, only 42% believed that using the vet regularly increased animal welfare. From a range of options that might encourage farmers to use their vet more the greatest agreement was found with the statement ‘if I felt they could solve the problem’. Whilst cost was stated to be a barrier many respondents also indicated that they used the vet when it was not cost-effective. A number of risk factors, including perceptions of the vet’s ability, were found to be important in determining veterinary usage.

This study provides new insights into how farmers view their vets and factors influencing their decisions about veterinary usage. In particular it highlights the decision complexity, that they may not be configured in the same way as other types of decisions made by farmers and that personal subjective assessment of risk factors may be highly influential. The results raise questions about the most efficient and effective economic incentives with regards to increasing veterinary usage by livestock farmers.

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# IMPROVING WELFARE IN COMMERCIAL FISHING – CONSTRAINTS AND OPPORTUNITIES

## *A Mood*

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The following broad measures are identified as having the potential to improve the welfare of commercially-caught wild fish:

- using methods of capture and types of hook/net which reduce injury and stress
- reducing the duration of capture
- developing methods of landing that minimise injury and stress
- humane slaughter methods
- avoiding the use of live fish as bait
- reducing numbers caught using a range of fish conservation measures.

Measures that reduce capture stresses also benefit conservation since bycatch animals may be released with increased chances of survival. Reducing stress and injury through quick capture, followed immediately by humane slaughter, also improves fish eating quality.

Spiking the brain and percussive stunning are two traditional methods of humane slaughter. High-value fish, such as tuna, are sometimes killed by spiking to improve flesh quality. These potentially humane killing methods may not be practical for catches comprising larger numbers of smaller fish, and en-mass humane slaughter technology will need to be adapted from aquaculture.

Fishing methods which appear to have the greatest potential for humane capture include fast hook and line methods (avoiding the use of live bait fish) and trapping where traps are retrieved in short intervals. Methods involving surrounding nets and short capture durations may also be potentially relatively humane.

Constraints to the development of models for humane harvesting of wild marine fish include the increased labour and time required to refine catching methods and implement humane slaughter. These, and reducing capture durations, are likely to mean processing smaller catches. For larger fishing operations especially, development of humane slaughter and handling technology and practice will be required. In the context of tackling overfishing, a major problem in global fisheries, catching smaller numbers of higher value fish may not necessarily be seen as a disadvantage. The cost of fishing would be increased, though there would be benefits in terms of both eating and welfare quality.

There are good reasons for developing humane marine harvests. In addition to fish quality, conservation and potentially huge animal welfare benefits (according to an estimate by the author, around one trillion fish are caught from the wild each year), many consumers are likely to welcome an opportunity to buy more humanely-caught fish. The development of niche markets for higher welfare fish could help provide sustainable jobs in fishing.

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# **ON THE RELATIONSHIP BETWEEN ECONOMIC GROWTH AND ANIMAL WELFARE**

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This paper explores the macroeconomic relationship between economic growth and the demand for animal welfare as evidenced by the expenditure on forms of welfare regulation and the total expenditure on welfare-related goods and services by private individuals. Economic theory suggests that increased Gross Domestic Product per capita will increase demand and consumption for normal goods. Cross-country empirical evidence for other environmental public goods postulates the existence of an inverse 'u' or an environmental Kuznets curve relating growth and improved environmental parameters. This suggests that countries must grow to escape poor environmental conditions. This literature explores whether this finding holds for all pollutants and where (the level of income) the turning points lie. This paper considers whether the same relationship holds for investment in animal welfare. We consider what the relevant investments in welfare are, and how they relate to growth. We conclude that the relationship between income and welfare is more complex than the simple arc of the environmental Kuznets. While growth does increase investment in welfare, low income households have other more pressing needs that justify significant welfare investments.

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# **ESTIMATING THE NON-MARKET BENEFITS OF INCREASED WELFARE MEASURES FOR MEAT CHICKENS IN ENGLAND: EVIDENCE OF HETEROGENEITY AND STRATEGIC BEHAVIOUR**

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This paper reports on a choice experiment study of public preferences for improvements in broiler chicken welfare. Efficient welfare regulation requires all costs and benefits to be considered including the external benefits and costs. Accordingly non-market benefits assessment is required to measure the total economic value of welfare improvement. Analysis of the choice experiment revealed evidence of preference heterogeneity within the sample, particularly with respect to price; this was confirmed by a random parameters logit analysis of the choice data. A latent class model was then used to reveal the existence of a large segment within the sample who may have been behaving strategically to ensure provision of higher welfare. This is consistent with previous research findings on public attitudes to animal welfare and their consequences for consumer behaviour. A smaller segment within the sample displayed preferences consistent with an awareness of higher welfare substitute products.

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## INCLUDING WELFARE OUTCOME ASSESSMENTS WITHIN FARM ASSURANCE: VIEWS OF THE KEY PLAYERS

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The use of outcome-based welfare assurance has been advocated as an approach to improve farm animal welfare. An industry-funded research project investigated the feasibility and benefits to the pig sector of including some welfare outcome assessments within farm assurance schemes. Agreement within the pig and farm assurance (FA) industries was achieved to enable training of 31 FA assessors and six veterinary surgeons in five welfare outcome measures. Discussions included the trade-off between the number of measures and the time and cost of assessment. The veterinary surgeons subsequently collected data relating to these measures on farms, mimicking one proposed mechanism for inclusion within the FA schemes. The views of each of the groups of key players on the inclusion of welfare outcome measures within farm assurance were recorded in different ways. Notes were taken at meetings with industry representatives, questionnaires were completed by FA assessors and the 46 producers whose pigs received welfare outcome assessments, and the veterinary surgeons produced written reports on their experience.

Twenty seven (87.1%) FA assessors stated they would be happy to perform welfare outcome assessments as part of their annual audit, providing they were paid for any additional time this took. In common with some veterinary surgeons there were concerns raised over the practical difficulties of assessing pigs ("audit results and ease [of assessment] will depend on accommodation for pigs") and of the potentially negative implications of collecting welfare outcome data, if this increased pressure on producers from retailers ("This may be a demand of supermarkets which will cost producers and be of no benefit"). Some producers made comments indicating they would value the potential benefits of welfare outcome assessments ("management benefit useful to discuss with my vet"), however others did not believe the benefit would be delivered ("market buys on price, not welfare"). Most producers considered it a problem to increase the length of time of the annual FA audit (69.9%) and almost all considered it a problem to increase the cost of the audit (91.3%). The problems foreseen by industry representatives related both to the effect on the people they represented, for example the working conditions of FA assessors, and to a wider concern for the industry as a whole, for example through possible negative publicity. Dialogue with industry representatives was required to identify these concerns and offer possible solutions to encourage outcome-based welfare assurance as a route to improving farm animal welfare.

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# INFORMATION ABOUT THE RISK OF TAIL BITING AND ECONOMIC INCENTIVES REGARDING PREVENTIVE MEASURES

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Tail biting is one of the most important animal welfare problems in modern pig production. For instance, the prevalence of tail biting in slaughter pigs in Finland has been at least 11 per cent. Tail biting is also an economic problem. It increases carcass condemnations and veterinary costs, and reduces growth of pigs.

To reduce the risk of tail biting, producers may prefer reactive measures to proactive prevention because there is a great uncertainty about the occurrence of tail biting. Investments in preventive measures could be more profitable if the producer knew *a priori* when the measures are needed.

The goal of this paper is to examine how information about the risk of tail biting impacts return on preventive measures in a finishing farm. We examine 1) no-straw housing vs. housing where plenty of straw is constantly applied, and 2) policy which provides pigs with straw only when tail biting is observed in the pen and removes the biter and the victim from the pen vs. not applying such a policy. Straw as enrichment is examined, because inadequate access to straw is a major risk factor for tail biting. Economic viability of straw-based bedding is also questioned because of its labour intensity. Another argument for not providing with straw is that commonly used slatted floors do not function properly with straw. The analysis is carried out with a numerical stochastic dynamic model, which simulates the development of tail biting and maximises return on pig space by optimising preventive measures and the timing of slaughter.

An investment in partly slatted no-straw housing generates a higher return on pig space than an investment in facility where straw is provided continuously. The labour and material costs are higher in the latter alternative. In contrast with the case of continuous provision of straw, the producer has economic incentives to use preventive measures temporarily whenever tail biting is observed in a pen. This is because of increased risk of tail biting epidemic when one incident has been observed in a pen.

The results suggest that producers have incentives to adjust prevention policy when new information about the risk of tail biting is obtained. However, this compromises animal welfare, because incentives for continuous prevention are inadequate. Animal welfare could be improved by policies providing which support investments in animal-friendly housing, consumers providing with price premium for animal-friendly housing and management, or improved production technologies.

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# CHALLENGES, CAUSES AND SOLUTIONS TO HUMAN-WILDLIFE CONFLICT IN AFRICA

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Conservation offers, not only global benefits of saving species, habitats and ecosystems, but also biodiversity as a commodity for global and regional consumers.

Unfortunately, the cost of this commodity is borne by a localized minority who see little, if any, benefit. Where benefit accrues, it is insufficient and unequally distributed. Our study is set out to examine the existing wildlife conservation with a view to informing the initiation of ecosystem management that takes the account ecological as well as socio-economic and institutional factors.

People are a fundamental part of nature. Their needs and desires must be considered throughout the management of the natural resource if such resource is to be utilized sustainably. Natural resources such as land, plants and wildlife have a direct effect on both the welfare of animals and of the society. Wildlife management therefore requires an integrated approach involving socio-economic and institutional management (Meffe et al, 1997).

Increasingly, agro-ecological and socio- economic factors and international policies help to explain the stiff competitions between wildlife, particularly large mammals and humans for the scarce resources (Pimm et al, 1995; Balmford et al, 2001).

Some large mammals, such as elephant, rhinoceros and large carnivores are either critically endangered or declining rapidly as a result of human / wildlife conflict (Emslie and Brooks, 1999). The impact of the African elephant on humans is considerable and this places the species in line of being both a pest and an endangered species (IUCN, 2000). Agro-ecological factors influence productivity and suitability of given areas, resulting in higher conflict levels.

Socio-economic factors such as rapid population increase have also contributed to conflicts. About 70%-80% of African population is predominantly rural, agriculture being the main source of employment.

The human demographic trends have put pressure on high potential land and thus the encroachment on protected and water catchment areas. Rangelands (supporting 80%-90% of large wildlife) have been converted, albeit unsuccessfully, to agricultural use. Incompatible land use practices, such human settlement in the ASALs and wildlife migratory routes have further reduced wildlife habitats and escalated direct conflicts. Consequently, the wildlife population has declined by 60% between 1997 and 2002 in Africa (Agatsiva, 2004).

Conservationists face the challenge of identifying strategies that mitigate human-wildlife conflict (Boo, 1990). I hope that this presentation will contribute to a wildlife management strategy based on informed decision- making and consensus among stakeholders and further create avenues for future research

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# PAIN ASSESSMENT IN WORKING DONKEYS IN MEXICO

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In donkeys, it can be very difficult to assess pain from looking at the animal's behaviour and clinical signs. This paper outlines an alternative approach using pain-relevant pathologies.

A trained observer examined 52 live donkeys at a slaughterhouse in Mexico. The type of animals represented was as follows: age (25% = <5 years, 75% = 5-15 years), sex (12% stallions, 40% geldings, 48% females), body condition score (scale 1-5, 65% = score ≤ 2, 35% = score ≥ 2.5), girth (113cm ±SD 6.) and height (110cm ±SD 6). The examination included the oral mucosa, heart (HR) & respiratory rates (RR), rectal temperature (RT) plus an evaluation of 6 demeanours and 44 behaviours/signs that could relate to pain, and an overall pain visual analogue score (VAS\_A) was derived. (VAS 0cm = no pain to 10cm = the worst pain).

At post-mortem, lesions/pathologies were grouped by system-organ/tissue, ranked (mild, moderate, severe) and classified according to the following potentially painful conditions: 1) trauma, 2) inflammation, 3) over-distension of tubular or hollow organ, 4) perforation/ rupture of tubular or hollow organ, 5) stripping/ ulceration of mucosal surfaces, 6) serosal adhesions, 7) swelling within a confined space, 8) exposure of sub-chondral bone in joints. From this a second pain assessment was formed (VAS\_P).

The results from one month's data showed that donkeys given a higher pain score post mortem presented with a greater severity of lesions in more systems as well as a higher heart rate ante-mortem than those donkeys with a lower post-mortem pain score (Table 1). Moderate to severe pain identified ante-mortem was often recognised as severe pain at the post-mortem stage. These initial observations show promise, and so further data will be collected to test the strength of the relationships between ante-mortem and post-mortem pain assessment.

**Table 1** Summary of clinical and pathological findings (raw means, SD) of 52 donkeys assessed for pain ante & post mortem at a Mexican slaughterhouse.

| PAIN | HR<br>(±SD)     | RR<br>(±SD)     | RT<br>(±SD)    | VAS_A<br>(±SD) | VAS_P<br>(±SD) | Systems presenting lesions (% of group) |     |      |   |    |      |      | Lesion severity (% of group) |          |        |
|------|-----------------|-----------------|----------------|----------------|----------------|---|-----|------|---|----|------|------|------------------------------|----------|--------|
|      |                 |                 |                |                |                | 1                                       | 2   | 3    | 4 | 5  | 6    | 7    | Mild                         | Moderate | Severe |
| A    | 48.7<br>(8.33)  | 19.4<br>(4.01)  | 37.4<br>(0.36) | 1.2<br>(1.80)  | 1.7<br>(1.20)  | 65                                      | 81  | -    | 8 | -  | 15   | 38.5 | 73                           | 77       | 23     |
| B    | 55.3<br>(7.76)  | 33.6<br>(19.92) | 37.5<br>(0.32) | 1.6<br>(2.14)  | 6<br>(0.90)    | 87.5                                    | 100 | 37.5 | - | 62 | 12.5 | 50   | 100                          | 100      | 50     |
| C    | 61.7<br>(12.75) | 23.6<br>(10.50) | 37.3<br>(0.52) | 6.5<br>(3.15)  | 9.6<br>(0.58)  | 92                                      | 77  | 15   | 8 | 46 | 8    | 61.5 | 85                           | 61.5     | 100    |

<sup>a</sup> Pain category from post-mortem appraisal: A) Mild pain: VAS\_P from 0 to 3.5; n=26 B) Moderate pain: VAS\_P from 3.6 to 7.5; n= 8 C) Severe pain: VAS\_P from 7.6 to 10); n=13 / <sup>A</sup> Systems code: 1) Integument, 2) Alimentary & adnexa, 3) Urogenital, 4) Lymphoreticular, 5) Respiratory, 6) Cardiovascular and 7) Musculoskeletal. VAS code: VAS\_A was pain assessment from ante-mortem clinical examination; VAS\_P was pain assessment from post-mortem pathology.

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# ATTITUDES TOWARDS THE USE OF GENETICALLY-ENGINEERED ANIMALS IN SCIENCE

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In the past decade the number of genetically-engineered animals used in science has more than doubled and this increased use of genetically-engineered animals is driving an increase in the overall numbers of animals used in science. These increases challenge the accepted ethic and regulatory basis of animal experimentation - the Three Rs, that aim to replace, reduce and refine the use of animals.

There exists a range of personal and societal values surrounding the use of animals in science, and the development of sound animal welfare policy requires understanding of this range of values. This knowledge can be translated, along with scientific information and expert opinion, to ensure that use of animals in scientific procedures falls within the bounds of public acceptance. To date, the majority of research on people's views towards animal use has focused on concerns about animal-based research in general, or on concerns about the genetic engineering of animals used for food production, and little is known about people's views on the use of genetically-engineered animals in scientific research. To address this gap, we conducted an interview-based study to explore people's attitudes towards the creation, use and regulation of genetically-engineered animals in science.

Twenty participants – researchers, animal care staff and members of the public – were interviewed between January and October 2010. Participants tended to be more accepting of the use of genetically-engineered animals for biomedical applications compared to the use of these animals in food production. Most participants indicated that they used a cost-benefit analysis when deciding what is acceptable. However, there was a strong focus on protecting animal welfare, and on the need for better communication with the public. Key themes to emerge were: the need for post approval monitoring of new genetically engineered lines; the need to limit the pain and distress caused by genetic engineering; and the need for distinct guidelines for the creation and use of genetically-engineered animals.

Participants were not morally opposed to the creation or use of genetically-engineered animals in science. However, they did highlight key concerns regarding the genetic engineering of animals for scientific purposes. As such, our research provides a better understanding of people's values, which can be used to inform animal welfare policy and achieve socially acceptable scientific practice.

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# **DOG IDENTIFICATION: OCCURRENCE, VIEWS AND BENEFITS OF MICROCHIPPING**

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The current law regarding dog identification is the Control of Dogs Order 1992. This requires all dog owners to identify their dog(s) with a tag with the owners name and address on it whilst in a public place. However, the current method of identification is not permanent and there appears to be minimal publicity regarding current legally required dog identification. Therefore, the aim of this research was to evaluate the current compliance and views from the dog owners' perspective of current dog identification legislation. To acquire this information a questionnaire was distributed through three online pet related forums and by visiting two locations within five pre-defined areas in England. Overall, 459 questionnaires were completed, which included 241 paper based respondents and 218 online respondents. With regard to identification tags, 85.4% of respondents stated that all their dogs wore one; however, 76.5% of them had insufficient information on them to satisfy the legal requirement. On the topic of microchipping, 84.3% of the 459 respondents stated that at least one dog was microchipped, with 15% of these stating some form of adverse reaction to the microchip had occurred. Of the 72 (15.6%) dog owners who stated that their dog was not microchipped, 47.2% would consider getting their dog microchipped, of which 19.4% plan to in the future and 13.9% did not state their reason. 33.3% would not consider getting their dog microchipped, with the most common reasons being either due to the dog's age or due to health concerns or previous bad experience relating to microchipping. Overall, this research identified a low level of compliance regarding current dog identification law and associated disadvantages with this non permanent method. Permanent identification such as microchipping appears to be a well established method of identification, despite not being a legal requirement. We conclude that the increasing occurrence of microchipping and the benefit compulsory microchipping would have on dog related problems and welfare such as reducing the number of stray dogs and tackling dangerous dogs is likely to be of economical benefit for owners, local authorities and animal welfare organizations. Further, other possible methods of identification such as tattooing are also discussed in comparison to microchipping and some of the disadvantages associated to microchips such as microchip adverse reactions.

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# THE SUPERMARKET LABELS JUNGLE: CAN CONSUMERS MAKE A REALLY INFORMED CHOICE?

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Most major companies now have a corporate social responsibility (CSR) statement but there is no well-established format, making it difficult to compare the value or even meaning of commitments. The onus remains on consumers to educate themselves, a task further complicated by the differing information given out by numerous ‘expert’ organizations. Although labelling requirements in the EU have toughened in recent years, there is still room for creative marketing, with messages all too often open to interpretation.

For example, how should a consumer assess a commitment ‘only to sell cosmetics which have not been tested on animals’ compared with a commitment ‘not to sell cosmetics whose ingredients are tested on animals’? In reality both statements are misleading and allow the possibility of animal testing.

To reinforce the impact of their CSR commitments, many companies work with NGOs to use approved labels: examples are the red tractor (signifying British-produced food meeting a certain standard monitored by an independent body), the Freedom Food label (signifying RSPCA approval of the farm) and the BUAV leaping bunny (signifying products not tested on animals). Some labels are trademarked, giving them legal force. However, rival schemes abound, and consumers may struggle to distinguish a ‘leaping bunny’ from some of the other kinds of bunny appearing on cosmetics labels. Moreover, there may be several levels of possible commitment to an issue, such as the distinction between free-range, barn, enriched cage and battery eggs. An alternative approach by some supermarkets, notably Tesco, is to impose their own standards, which are partly documented on their website but not subject to independent scrutiny.

In this paper, we discuss the role of certification bodies and the case for a metastandard in the animal welfare field. A code of conduct would add a level of transparency and thus enable consumers to navigate the jungle of standards, whilst highlighting the really ethical companies from those who hide behind ambiguous marketing messages.

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## AN APPROACH TO VALIDATING ANIMAL WELFARE INDICATORS

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The aim of this research study was to develop valid, feasible and reliable indicators of sheep welfare. In the absence of a reference standard for animal welfare assessment, the approach taken by this study used a combination of evidence from the scientific literature, expert opinion, and field study testing to validate animal-based outcomes of sheep welfare.

The consensus opinion of a panel of experts in sheep health, production and welfare ( $n = 30$ ) was used to identify the on-farm welfare concerns for young lambs (aged  $\leq 6$  weeks), and growing lambs (aged  $> 6$  weeks and  $< 1$  year) and adult sheep (aged  $\geq 1$  year). Expert opinion was used provide face and consensual validity to the identification of potential welfare indicators that were included in on-farm assessments. The suggested on-farm issues were categorised into the FAWC five freedoms concepts, which were used as the framework for the initial identification of welfare indicators. Accordingly, the panel subsequently suggested over 20 animal-based outcomes of sheep welfare.

The diagnostic validity, reliability and feasibility of these indicators were subsequently examined in 3167 adult sheep and growing lambs, and 1681 young lambs on 50 study farms across Northern England and Wales. Since welfare indicators are akin to diagnostic tests, epidemiological principles used to validate diagnostic tests were applied in this study. Accordingly, the diagnostic accuracy (sensitivity and specificity) and inter- and intra-observer reliability of 9 observers was examined. In the absence of a reference standard for animal welfare assessment, the findings of a trained, experience assessor were designated the reference test. This approach permitted the effect of training, experience and occupation of the observers to be examined.

In addition to the validity of the measures, the validity of the study population was scrutinised using guidelines for the validation of randomised controlled trials. This was used to inform the interpretation of diagnostic test evaluations and to examine the generalizability of the study findings to the general sheep population. We will discuss the approach of validation of animal welfare indicators, and will present data from the study to illustrate the considerations and implications needed when evaluating the validity of measures of animal welfare.

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## **HEALTH BENEFITS OF HIGHER WELFARE ANIMAL PRODUCTS AS AN INCENTIVE TO ALTER CONSUMER PURCHASING BEHAVIOUR**

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One of the main reasons cited by consumers for purchasing “higher welfare” animal products is a perception that they are “healthier”. If this perception is true, marketing of higher welfare animal products on this basis could provide a powerful incentive to alter consumer purchasing behaviour.

Conventional production systems often involve permanent indoor housing and the use of livestock breeds selected for high productivity. The former may restrict opportunities for exercise and behavioural expression, whilst the latter is associated with a number of production-related conditions that may cause pain and/or increased mortality.

A preliminary examination of the literature reveals a number of potential nutritional advantages associated with animal products produced in systems that offer greater opportunities for exercise and behavioural expression (e.g. pasture-based, free-range and organic) and/or from less productive breeds (e.g. slower-growing meat chickens). These include a more favourable fatty acid composition, lower total fat content and higher levels of certain micronutrients.

We propose to review the relevant literature in order to assess the strength of the evidence for nutritional benefits of a range of animal products in relation to production system and/or breed type. This poster will discuss the available evidence and its potential to support health-based marketing claims for higher welfare animal products.

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# THE EFFECTS OF POSITIVE REINFORCEMENT TRAINING ON EQUINES' LOADING BEHAVIOUR

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Loading situations are potentially dangerous for horses and for humans. In those situations aversive stimuli are in relatively general use, which may increase the horse's discomfort and increase the amount of resistant behaviour. Positive reinforcement training (PRT) techniques have been stated as useful training tools in animal training; with PRT the animals usually become more cooperative and exhibit less fear reactions. PRT could be more effective than negative reinforcement training, which is normally used in equine training.

The aim of the study was to examine the possible effects of PRT on equines' loading behaviour. 24 horses in total were divided into three groups, with 8 horses in each group (A, B & C). Polar Equine heart rate belt was used together with a Garmin Forerunner 310XT GPS-watch to record the data. Group A and group B horses took loading tests in which their heart rates, loading behaviours and total loading times were recorded. Group B and C horses went through a PRT programme during which they were clicker-trained to walk and reverse on and under trailer-resembling objects. The horses were taught to walk on a platter, walk up and down the ramp and under a canopy with a tarp on it. After finishing the training programme, the horses in group B and C took additional loading tests with the same data being recorded.

It was discovered that the trained horses load quicker. The average loading time decreased by 40 % in group B (n=8) horses after the training programme. Fear-related behaviours and resistant behaviours were 17 % lower in trained horses (n=16) and the average heart rates and peak heart rates were significantly lower in the trained horses than in the non-trained horses (n=16) ( $p=0.01$ ; two-sample T-test). The peak heart rates were 25 % lower in the trained horses and the average heart rates were 24 % lower in the trained horses (n=16).

Training horses to voluntarily load with the use of positive reinforcement training and trailer-resembling structures can be beneficial in the equine industry. In equine training the main focus has been negative reinforcement, but the potential advantages of PRT have not been fully exploited. Effective and potentially cost-effective ways of training results in reduced stress reactions and possible risks and it may also lead to enhanced welfare. Potential implications of PRT could be especially useful in those husbandry procedures that normally cause fear and discomfort to horses.

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## RABIES: A SIGNIFICANT CAUSE FOR MISERABLE DEATH OF PET DOGS

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We are considerably bothered about the welfare of laboratory animals and the ways to reduce, refine or replace the animals in the laboratories. Most of the responsible bodies round the globe are seriously working on these aspects with fruitful results. There is a field where very little is being done for the welfare of companion/pet animals. Generally it is presumed that pet animals are well cared, nourished and sheltered during their active functional period in life. Once the utility or the need is over, the plight of these animals becomes pathetic and they end up in painful and miserable death. The real story in store is broadly on this aspect and very specifically about the dogs which are brutally killed for minor behavioural problems.

The observations were derived during a research work on nervous system disorders in dogs. Over a span of two years postmortem of 180 dogs were carried out including 125 suspected cases of rabies. Among these only 14 (7.8%) carcasses were confirmed positive for rabies by different techniques including direct Fluorescent Antibody Technique (FAT) and Reverse Transcriptase-Polymerase Chain Reaction (RT-PCR). These animals had shown nervous signs of varying degree from profuse salivation to wandering gait, aggressive behaviour, paralysis and dumbness before their natural or unnatural death. There were also cases ( $n=11$ ) which had certain transient behavioural symptoms of less severity, but ferociously killed by local people due to their apprehension about rabies. None of these animals had rabies but suffered from obstruction in the gastro intestinal tract at various locations and had shown symptoms of discomfort and pain that wise men mistook as signs of rabies. One of the animals was a carrying bitch fell prey to the spite of man that had severe hit injuries and bleeding in the cranial cavity.

Undoubtedly rabies is deadly to any species, man or animal in which it is affected. Lack of curative treatment makes it still more dangerous and adds to the fear about the disease. There are effective methods for ante mortem diagnosis of rabies by examination of corneal impression smear. But these are not being done, for the difficulty to collect samples from suspected animals especially dogs. It is high time now to popularize the different diagnostic methods for rabies and the effective vaccination programme. There should be effective measures to mitigate the sufferings of pet dogs just because they had behavioural abnormalities which are curable but killed mistaken for rabies. This would also raise the need for effective welfare plans for pet animals in developing countries.

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# THE ITALIAN APPROACH TO WELFARE DURING TRANSPORT OF DEER BRED FOR MEAT: IMPLEMENTATION OF REGULATION (EC) 1/2005

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## Introduction

In Italy, deer bred for human consumption are immobilised for transportation to other farms or to game reserves where they are shot and taken to a game handling establishment for post mortem inspection to commercialise the meat. Seldom, they are transported to the rare slaughterhouses authorised for game on the national territory.

Four terrestrial transports of less than eight hours, of 45 deer of the species *Cervus elaphus*, bred for meat, were observed over a period of four months during winter.

The aim of this study was to evaluate the implementation of Regulation (EC) 1/2005 in game compared to farm animals.

## Main Findings

The observed capture techniques such as darting, nets, or enclosures, provoked a high level of stress in animals, which are bred in semi-intensive conditions and are unfamiliar with humans, engendering issues in the respect of European Regulations. In addition, the animals' reactions were rarely repeatable and could not be predicted. Planning is crucial but variables related to environment, facilities, human management and animals influenced the duration of the operations, jeopardising the animals' welfare. Cases of escape, traumas in animals and in humans, hyperthermia, and extreme stress were observed.

Darting, although less invasive, created difficulties related to the manipulation of the animals. Furthermore, the legislation forbids the lifting of the animals' body parts and the impossibility to control the withdrawal periods in game reserves limits the use of drugs.

Environmental factors such as inappropriate enclosures and land inclination created a risk both for animals and humans.

Loading represented an important hazard for the inappropriateness of one of the means of transport used, which was not specific for deer and determined risks of falls, escape and traumas.

Management and experience were determinant for the success of the operations, as it was not possible to apply by analogy what were basic requirements for farm animals. Furthermore, stocking densities and journey times are not specified by law.

Traumas were mainly caused by mixing of horned/unhorned animals or mixing of young/ adults. The journey duration represented one of the main hazards.

## Conclusion

The stress due to human management, weather conditions, inadequacy of facilities and equipment, duration of operations and journey time, created circumstances in which the control of hazards was extremely difficult. The implementation of the legislation in force is partially complicated by its lack of specificity for the management and transport of farmed deer.

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## FARMERS (AND RESEARCHERS) AREN'T STUPID – BUT DO THEY HAVE THE KNOWLEDGE?

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Farmers are often criticised for not improving animal welfare by adopting high welfare practices. The objective of this paper is two-fold; first to illustrate the need for more practical/applied solutions to commercial problems; second to highlight the need for better communication between farmers and scientists. It describes the results of the evaluation of three knowledge transfer (KT) events for a wide range of sheep industry representatives. These events were held across Scotland and presented information on: the identification and treatment of hoof problems; improving sheep productivity; and increasing the working life of rams. More than 270 farmers and allied industry representatives attended, of which 50% completed and returned an evaluation form. Three underlying themes were investigated; new learning, increased understanding of the issues and barriers to implementation. The results show that sheep farmers' knowledge about some health and welfare issues is incomplete. For example Shelly hoof was new to 42% of farmers at the identification and treatment of hoof problems event. In addition, up to 98% of all respondents stated that they had a greater understanding of the issues being presented from attending the events. The barriers that prevent application of the information included insufficient practical information and shortages of labour. Furthermore, respondents also commented that information presented at events was not always applicable in commercial situations. These results indicate that both farmers and scientists need to be responsible for, and understand their roles in, improving animal welfare. Communication between farmers and scientists need to be improved so that a) scientists can produce more practical/applied welfare science and can communicate these messages effectively to farmers and b) farmers can provide scientists with practical feedback that will improve the applied aspects of the research as well as capitalising on the opportunities to learn. By strengthening the link and knowledge flow between farmers and scientists the likelihood of animal welfare practices being accepted and adopted in commercial situations will be greatly increased.

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# WELFARE OF RACING GREYHOUNDS - PRIORITISATION OF ISSUES

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The welfare of racing greyhounds has fallen under the spotlight several times in the recent past. Cruelty cases have attracted mass media attention, whilst an independent enquiry has recommended, and led to, significant changes in the governance of the sport. In spite of calls from some bodies for specific legislation to control the industry, in the UK, it appears likely that the greyhound industry will continue to self-regulate.

To continue to be financially viable, and publicly acceptable, it is essential that the industry prioritises the welfare of the dogs. As an industry striving for financial solvency, resources available for improvements in greyhound racing are limited and hence it important that those welfare initiatives embarked upon produce the largest net welfare gain for the resources invested. Since, as with many animal-using industries, there are multiple potential welfare issues associated with varying stages of a greyhound's life, the industry and charities alike are faced with the challenge of deciding which issues warrant the greatest attention.

Via a review of the literature, and structured interviews of personnel involved in the industry, I identified 48 potential welfare issues associated with the breeding, rearing, schooling, training, racing and re-homing of greyhounds; some of which are relatively minor or of short duration, whilst others are potentially severe or chronic in their welfare impact. To prioritise these, I devised a simple scale of net welfare cost, multiplying the likely duration, severity (as rated by five dog welfare experts) and the number of animals affected. According to this scale, the priority issues to be tackled include:

- lack of opportunities to socialise during rearing,
- distress caused by confinement in a kennel during training,
- euthanasia of dogs unsuitable to be rehomed,
- high occurrence of dental and periodontal disease throughout the dogs' life.

Concentrating on these issues might be expected to maximise net welfare gain. But it could be argued that a welfare scale should not be not linear, since suffering and its elimination are more important than improving conditions for animals which are already considered to be acceptable. Hence an additional aim of any welfare improvement programme should be the elimination of the worst suffering or the most severe welfare issues. For greyhounds, those rated on average by the welfare experts to be most **severe** (at least 4.5 out of 5) were:

- the disappearance of weaker individuals during rearing and non-chasers during rearing and after sales trials,
- high rates of osteosarcoma;
- occurrence of life-threatening injuries e.g. broken limbs and major injuries e.g. muscle damage during race meetings;
- delays in veterinary care for severe injuries occurring during schooling trials.

The greyhound industry could best maximise the use of its resources through a combination of interventions aimed at overcoming the most severe issues and initiatives aimed at producing the greatest net welfare gain. Similar prioritisation exercises may be useful for a variety of animal-user industries.

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# **WELFARE INTEGRATION INTO CONSERVATION BIOLOGY: EVALUATION OF ENCLOSURE SUITABILITY FOR ENDANGERED PHEASANTS**

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The maintenance of behaviourally-sound and genetically-viable populations of threatened species is a prime aspect of zoo-based conservation biology. However, captivity can lead to the degeneration of learned behaviours and alteration of release thresholds for key species-typical activities. Creation (and maintenance) of 'positive welfare' is an important consideration for all those involved in the keeping of wild animals in captivity. Assessment of behavioural need, motivational triggers for behavioural display and the interaction between behaviour and environment need to be a part of evidence-based husbandry if such populations are to be successful, sustainable and viable in the long-term. The Animal Management Centre at Sparsholt College Hampshire holds five species of pheasant that are part of populations owned by the World Pheasant Association. These birds are used for captive breeding to maintain sustainable zoo populations, as well as being part of conservation breeding initiatives that augment fragmented wild populations. This study focussed on three species with differing native habitats; Temmink's tragopan (*Tragopan temminckii*), Himalayan monal (*Lophophorus impejanus*) and Reeve's pheasant (*Syrmaticus reevesii*). Final year students on the BSc Animal Management degree collected behavioural data for two 30 minute periods, once-a-week, between October 2010 and February 2011 to ascertain environmental effects on overall behavioural repertoires. State behaviours, recorded via focal point sampling, illustrated how the birds use their time in a managed environment indicating a significant difference between species for time spent on show ( $P = 0.000$ ). A significant difference for 'on or off show' was also seen between male and female birds of each species ( $P = 0.000$ ). Finally, data on position and location of individual birds in the aviary was analysed to judge quality of space provided and 'usefulness' to each species housed. Birds showed preference for areas of cover, most markedly so in the tragopans and female Reeves's pheasant which were on view the least amount of time. However, male Reeve's and monal pheasants showed the widest behavioural repertoires. Such findings appear concurrent with accepted work on pheasant behavioural ecology; females preferring to remain hidden whereas males can be more 'showy'. Clear inter- and intraspecific differences in enclosure use in all three species were apparent, underpinning the need for natural biology to be factored into enclosure furnishing. It would appear that habitat recreation is an important aspect for ensuring that animals feel secure enough to facilitate performance behavioural displays linked to courtship and hence reproduce successfully. Such research provides an understanding of the importance of behavioural choice and an animal's 'ability' to have control over its surroundings to the promotion of good welfare in species managed artificially.

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## THE ECONOMICS OF MOVING TO HIGH WELFARE FARMING

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There is a widespread assumption that moving to high welfare systems and outcomes for farm animals invariably entails a substantial increase in production costs. However, analysis of industry data shows that in certain cases, such as changing from battery to free range eggs or from sow stalls to group housing, higher welfare farming adds little to the costs of production. In addition high welfare farming practices can achieve economic benefits as compared with intensive production. In better welfare systems, animals will tend to be healthier. This can lead to savings in terms of reduced expenditure on veterinary medicines and lower mortality rates. The provision of straw and/or additional space for finishing pigs can result in better feed conversion ratios and improved growth rates. Similarly, compared with high yielding dairy cows, lower yielding but healthier cows with better fertility and longevity can deliver higher net margins due to lower heifer replacement costs and higher sale prices for the calves and cull cows. Economic drivers that could stimulate higher welfare include (i) the mandatory labelling of meat and dairy products as to farming method to enable consumers to make informed choices, (ii) more ambitious use of those measures in the CAP Rural Development Regulation that enable farmers to be given financial support for improved welfare and (iii) the use of fiscal measures to reduce the cost for farmers of implementing high welfare production or to reduce the price paid by consumers for high welfare food. Livestock production, in particular industrial production, produces negative externalities including environmental degradation, greenhouse gas emissions and loss of biodiversity. These negative externalities represent a market failure in that the costs associated with them are borne by third parties or society as a whole and are not included in the costs paid by farmers or the prices paid by consumers of livestock products. The negative externalities of livestock production should be internalised in order to avoid market distortions and provide incentives for their reduction.

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## **ADVICE AND FARMER SUPPORT: MAKING IMPROVEMENTS AND OVERCOMING WELFARE CONSTRAINTS IN ASSURANCE SCHEMES**

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Farm assurance and organic certification schemes are well positioned to promote and ensure welfare improvements within their farmer membership. Within the inspection and certification systems farmers are informed where they are not meeting the standards of a scheme in their annual membership inspection. Some schemes are conducting more formal outcome-based welfare assessments as part of their certification process. This will stimulate a need for farmers to find sources of advice in order for them to fully understand how to overcome any highlighted issues. As the inspection body itself cannot provide advice, farmers must explore the options available to them through other routes. Existing routes to information vary from the farm vet, industry level guidance through to a dedicated team in an associated organisation provided specifically for their scheme member farmers. The format of advice for those farmers that are interested in accessing the information, varies from one-on-one advice, technical factsheets, workshops and industry-led producer groups.

The ‘AssureWel’ project has reviewed the forms of advisory support available to farmers and developed an integrated framework to provide advice in support of welfare assessments in the certification process. Information flow should start at the time of the assessment with clear signposting to ensure that the farmers are aware of any issues and where the advice for their particular issue exists. Through the collection and comparison of inspection data, schemes are able to identify farms that are in obvious need of further individual, targeted support. Different farmers find different formats more suitable for them than others and so a range of methods need to be included in order to approach this highly sensitive issue. From the individual level, the advisory framework should expand to incorporate group work. Individual farmer working in isolation may limit further improvement. However, a coordinated group approach can encourage the direct use of ‘emotional’ drivers (competition and peer pressure, pride and care for their animals) in addition to the traditionally-stated ‘economic’ advantages (health and production improvements, opening up to new markets). Understanding farmer-identified constraints to welfare issues (e.g. lack of capital for building investment, capacity, training and knowledge) and providing advice of how to overcome these (e.g. using grants and support, information and advice) should generate greater farmer interest and understanding. Finally the framework needs to integrate with industry initiatives thus encompassing the full-range of approaches to encourage and motivate the full-range of farmers to improve farm animal welfare.

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# A BEHAVIOURAL ANALYSIS OF FARMERS' AND CONSUMERS' ATTITUDES TOWARDS ANIMAL WELFARE

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The literature abounds with studies that analyse consumers' attitudes towards animal welfare, however the number of studies that attempt to investigate farmers' welfare attitudes is much lower. Amongst the various factors potentially affecting the welfare attitudes of farmers and/or consumers, some are common for both categories (*e.g.*, education, age, gender, access to information and income).

This paper analyses the impact of *a priori* determinants of animal welfare attitudes and perceived responsibility of farmers and consumers in Great Britain. We use two large datasets of 900 observations (farmer survey completed in 2010) and, respectively, 938 observations (consumer survey completed in 2006). We employ structural equation models with observed and latent variables to compare the impact the different factors have on either farmers' or consumers' welfare attitudes and perceived responsibility. SEM is a statistical technique for testing and estimating relationships amongst variables, using a combination of statistical data and qualitative causal assumptions. The paper analyses the impact of socio-demographic, economic and informational factors (amongst others) on welfare attitudes. The 'common' variables (included in both models) were education, age, gender, access to information and proxies for economic situation, namely 'occupation' for consumers and 'perceived effects on business of economic factors, such as access to capital and labour availability' for farmers.

The models have an adequate overall fit to the data. All tested determinants were found to have a significant impact on welfare attitudes in both models. Comparing only the 'common' impacts, the model for determinants of farmers' welfare attitudes showed level of education as the main determinant, followed by frequency of access to information, gender and perceived effects of economic factors. The model for determinants of consumers' welfare attitudes showed frequency of access to information as the main determinant, followed by occupation, age, level of education and gender. The variance explained by the low number of 'common' factors is, as expected, relatively small in both models; however this increases when other determinants are added to the models (*e.g.*, 'attitudes towards biosecurity' in the farmers' model and 'number of children' in the consumers' model).

The paper concludes with a discussion on the likely relative impact of the two strategies to improve animal welfare, *i.e.* altering farmer or consumer behaviour.

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# THE IMPACT OF HUMAN-ANIMAL RELATIONSHIPS IN ZOOS

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Despite their popularity and place in our tourism history, in recent years zoos have undergone considerable change in both their structure and function. The primary attraction of zoos is still, of course, their animals. However, changes in public expectations and the zoos' own objectives mean that today there is far more scrutiny of the way in which their animals are being managed and utilised. Increasingly, this has meant a consideration of the relationships between the animals and the humans with whom they interact.

Human-animal relationships are now considered to be important determinants of animal welfare and have been principally studied in relation to livestock production. Human behaviour has been shown to significantly impact the animals under the care of humans both directly and indirectly. The effects on livestock include the adverse impact of inappropriate handling during production and slaughter, where fear and stress, physical trauma, ease of handling, reproductive performance, growth, health, meat quality and welfare may all be affected. This research has also shown that the person's attitudes are highly predictive of their behaviours and that these attitudes and behaviours are amenable to change: training using cognitive-behavioural intervention techniques to improve attitudes and behaviour has been effective in reducing animal fear and stress and increasing animal productivity in a number of livestock production systems.

Similarly for zoo animals, human behaviour may impact on the animals both directly and indirectly: inappropriate interactions by keepers and visitors may affect fear and stress, behavioural problems and the welfare of zoo animals, while community concerns may affect visitor attendance as well as regulators' decisions on animal access and use at zoos. Understanding visitor and keeper attitudes and experience also appears to be the key to manipulating these interactions to benefit the animals, the quality of the display, and hence in turn the economic viability and sustainability of the zoo industry.

In this paper we will look at the relationships that can develop between zoo animals and the people with whom they interact: the zoo visitors and the zoo keepers.

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# IMPROVING FARM ANIMAL WELFARE: GETTING THE CONSUMER INVOLVED

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Societal interests and concerns for animal welfare are increasing. In order to better involve the consumer in strategies to improve the animals' welfare, it is important to gain knowledge on how the public defines farm animal welfare and on their attitudes, perceptions and concerns. Results discuss the public conception of farm animal welfare, variety in societal attitudes towards animal welfare and the ambivalence between citizen sayings and consumer doings. They are a summary of six different citizen and consumer studies in Flanders.

An integrated study approach revealed a conception for farm animal welfare, consisting of seven dimensions: three animal-based (Natural Behaviour; Animal Health; Suffering and Stress), and four resource-based dimensions (Feed and Water; Housing and Barn Climate; Human-Animal Relationship; Transport and Slaughter). This contributes to the discussion on the relative absence of animal-based parameters in welfare legislations, assurance schemes and indices. The conception has many common grounds with existing conceptions, though characterised by a limited public awareness and practical knowledge of animal production practices. These findings can be applied to address several imperfections of current welfare-oriented initiatives that originate from a poor understanding and/or a poor addressing of public expectations, concerns and perceptions in relation to farm animal welfare, and to better align public perceptions with scientific evidence.

Variables that relate to familiarity with agriculture and life-style values and beliefs with respect to animals, animal welfare and production were more determinant in explaining societal differences in attitudes and concerns in relation to farm animal welfare than classical demographic variables. Variation in society necessitates segmented market approaches, in which profiling variables should go beyond the classical demographic variables, and information provisions, communication strategies and marketing strategies should address the specific expectations of the target segments.

Finally some influencing factors that contribute to the poor reflection public concerns for animal welfare in actual food purchasing behaviour were researched. Opportunities from initiatives that raise public awareness and consumer involvement in relation to farm animal welfare issues and that narrow the distance with the producer were concluded from the positive influence of perceived consumer effectiveness; suggestions in terms of price strategies followed on the revealed differences in price perception of higher welfare products among consumers with a high versus low engagement in pro-welfare behaviour; recommendations for labelling and communication efforts were derived from findings in relation to the public's opinion and perception towards animal welfare-related information, product availability, dissociation, and product attribute importance.

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## PIG PRIORITIES

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To ask pigs what their priorities for welfare expenditure are the following choice tests, with as counterbalance social contact, were used:

Two pigs were placed in each of two double pens, each with an open and a closed pen partition. In one double pen the open partition was at the side of the stable door, in the other pen the closed partition was at this side. This experiment revealed that an open or closed pen partition did not have a high priority for pigs: Pigs preferred a, open or closed, pen at the side from which the caretaker (food and “social contact”) entered twice a day.

Another experiment showed that, as expected, social contact has a high priority: Pigs preferred a pen close to another pig over an identical pen without social contact. However, surprisingly, pigs preferred a pen without, but with earth on the floor, over a pen with social contact but with a bare floor. This showed that earth on the floor has an even higher priority than social contact.

Given the choice between a pen with a slatted floor and social contact and a pen with a closed concrete bare floor but without social contact pigs preferred to lie on the slatted floor close to another pig but also as close as possible to the closed floor. This position of the lying place suggested that a closed floor had a higher priority during standing and walking than during lying. Apparently priorities may differ during different behaviours. In an experiment in which two pigs were present in each double pen (no social contact as counterbalance) they showed, as expected, a clear preference for the pen with a closed floor.

Given the choice between a pen with peat dust with social contact and one with wood shavings without social contact pigs preferred to stay on the peat dust with social contact during the day but during the night the wood shavings without social contact had a higher priority. Thus, priorities during lying may change with time of the day. Another experiment revealed that at night lying on straw had an even higher priority than on wood shavings.

Pigs which had not had contact with straw during their entire life still preferred straw without over a slatted floor with social contact. It is concluded that choice tests with a counter balance are a valuable tool to establish animal priorities.

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## USE OR LOSE YOUR BOTTLE: THE EFFECTS OF FOSTERING AND ARTIFICIAL REARING ON LAMB MEAT QUALITY

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A strong and positive maternal-neonate relationship is essential for the survival of precocious lambs. The absence of such a relationship can lead to emotional and nutritional stress, a decrease in their immune responses and an increased cortisol response. Maternal separation and artificial rearing of lambs could jeopardise lamb welfare compared to normal maternal care. Previous research has compared welfare implications and meat quality characteristics of artificially reared and maternal-ewe reared lambs in milk production systems. Meat quality implications of artificially reared lambs are of more significance in a commercial meat production system. Initial investigations explored the influence of artificial or fostered rearing systems on the meat quality of lambs within a commercial meat production system. Eighty eight north country mule lambs were assigned to one of five treatments; three commonly used foster methods (birth fluids, restraint and cervical stimulation concurrent with birth fluids), one artificially reared (bottle fed with a milk replacer) and one control treatment (reared by natural mother) were taken to slaughter at six months old. Cold carcass weights were recorded and the left *Longissimus dorsi* (loin) muscle was used for pH, water holding capacity (WHC) and colour measurements ( $L^*$ , $a^*$ , $b^*$ ). Results demonstrated that the meat quality characteristics measured were not found to be significantly influenced by the rearing conditions. This could be due to the amount of time post weaning (2 month) before they were slaughtered. The results further indicate that the meat quality of the six month old lamb is not affected by the rearing technique selected by the shepherd in its early stages of life. However, the shepherd would need to consider the time and economic costs involved with artificial rearing and could opt to use fostering as a method to reduce these costs. This would also decrease the emotional stresses and potential welfare issues that could be involved with the lack of a maternal bond.

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# PREDICTING THE ECONOMIC COSTS AND BENEFITS OF CHANGES AIMED AT REDUCING LEVELS OF INJURIOUS PECKING ON FREE-RANGE LAYER FARMS

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The majority of UK flocks of free-range hens are affected by injurious pecking. Additional to the welfare cost for millions of hens, losses to the industry from mortality exceed £12 million, with substantial additional costs associated with lost egg production and increased feed costs.

The overall aim of our project is to reduce the levels of injurious pecking in current commercial flocks of free range hens in the UK by transferring scientific knowledge into practice. We produced a shortlist of management changes with the greatest potential to reduce injurious pecking if implemented on UK free-range farms. We recruited 45 treatment farms and provided each farm with tailored advice appropriate to the individual circumstances of that farm. The level of injurious pecking on each farm was monitored before any changes were made. For the subsequent flock, a variable number of management changes were made and ongoing management advice was provided. Levels of injurious pecking were monitored throughout and compared with data from 45 control farms where no advice on injurious pecking was provided. Analysis is ongoing to assess the effectiveness of the advice in improving bird welfare.

Before being willing to implement management changes most farmers required reassurance that the changes would be financially beneficial. This poster illustrates how a simple cost-benefit analysis of proposed interventions was used to inform decisions from an economic perspective. Where data were available from previous flock performance figures, these were used in the calculations. Otherwise national averages were used.

The table summarises simplified cost and benefit calculations standardised for hypothetical flocks of 10,000 hens. In reality a number of these may be integrated to give an overall 'bottom line' figure and some enrichments could be written off over more than 1 flock. Comparing actual versus predicted costs and benefits will be part of the evaluation of the success of the project.

| Flock | GM last flock (£/bird) | Cost of interventions (p/bird)   | Predicted benefit (p/bird)                                  | Predicted GM this flock (£/bird) |
|-------|------------------------|--|---|----------------------------------|
| A     | 6.80                   | Providing 8 range shelters (7)   | Mortality reduced from 12 to 10% (12)                       | 6.92                             |
| B     | 7.17                   | Increasing inspections (6.9) & providing 20 breeze blocks (0.2)                | 2% reduction in feed costs from improved feather cover (20) | 7.37                             |
| C     | 7.05                   | Adding whole bales of straw to litter area to promote foraging behaviour (1.2) | Mortality reduced from 8% to 6% (12)                        | 7.17                             |

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## COLLABORATIVE LEADERSHIP IN CODE OF PRACTICE DEVELOPMENT

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The welfare of farmed animals has been a topic of increasing interest to society. Animal welfare science is a growing field of research. However, concerns have been raised that the welfare of farmed animals has not kept pace with societal concerns and research findings. Farmers often feel that farmed animal standards are thrust upon them without an understanding of economic and market realities.

In Canada, a collaborative leadership approach has been taken through the National Farm Animal Care Council (NFACC) to give voice to societal, researcher and farmer perspectives. NFACC provides a forum for open dialogue amongst groups that have a diversity of ideas on animal welfare.

The aim is to develop processes that address farm animal welfare in a manner that is based on science, practical for farmers and respectful of societal values.

Progress on farmed animal care and welfare requires buy-in from many stakeholders, including farmers. Canada's Code of Practice development process is an example of how improvements in farmed animal welfare can be achieved by ensuring all stakeholders are full participants in the process. The credibility of the Codes is based on scientific rigour, collaboration of all key stakeholders and consistency of approach.

Canada's Codes of Practice are national guidelines for the care and handling of the different species of farm animals. They promote sound management and welfare practices through recommendations and requirements for housing, management, transportation, processing and other animal husbandry practices.

The Codes of Practice represent a national understanding of animal care requirements and recommended best practices. They have been prepared with the input and support of scientific experts and by consensus of diverse groups involved or interested in farm animal care and welfare. Canada is of the opinion that the collaborative participation of all key stakeholders is critical for broad acceptance and implementation of the Codes.

Canada's Code of Practice development process will be described along with how Scientists Committees are utilized to address priority welfare issues within each species.

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## **REDUCING DAIRY CATTLE LAMENESS: A NOVEL APPROACH TO IMPLEMENTATION OF EXISTING KNOWLEDGE**

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### **Introduction**

Dairy cattle lameness is a high priority animal welfare issue and farmers are under pressure to produce “lame free milk”. Consequently, the wealth of research findings and experiential learning about dairy cattle lameness management needs to be implemented on farm. However, there is some evidence that effective implementation of this knowledge is not taking place.

Two key routes by which farmers can be brought to implement lameness management strategies on farm are 1) enforcement; this might be through legislation, the use of policy instruments, retailer pressure or farm assurance. Or 2) through encouragement; working with farmers to help them make changes to their management practices. An encouragement route, loosely based around the principles of social marketing, is described here.

### **Project Approach**

The project was set up to develop practical and effective ways of implementing existing knowledge on farm to reduce dairy cattle lameness and involved 130 intervention farms and 80 control farms in England and Wales. Each farm received four visits from a project team member over the three project years. During these visits herd lameness prevalence was recorded and implementation of change encouraged [intervention group only].

A key feature of the project was the recognition that all farms are different, have different problems and that the farmers themselves have valuable existing knowledge of what can be implemented on their own farms. There were six tools employed in the project; identifying benefits and barriers, facilitating action plans, establishing “norms”, encouraging commitment, using prompts and offering incentives. These tools formed a package to help farmers to plan how change might be implemented, encourage implementation and sustain successful changes over time. The facilitation element was critical and very distinct from giving advice.

### **Project Outcomes**

The welfare outcome of the intervention was measured in terms of lameness prevalence; this reduced over time in both intervention and control groups ( $P<0.05$ ). Lameness reduction over the course of the study was significantly greater in the intervention group than in the control group (intervention – time interaction  $P<0.01$ ). This was underpinned by project farmers implementing a far greater number of lameness related management changes than was seen across the wider UK dairy farming population (an average of eight versus one change per year).

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## PUBLIC UNDERSTANDING OF THE ASSURED FOOD STANDARDS AND RSPCA FREEDOM FOOD FARM ASSURANCE SCHEMES

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Farm assurance schemes represent the bulk of agricultural production in the United Kingdom and have the potential to benefit livestock, humans and the environment. The welfare effectiveness of such schemes is dependent on the consumer purchasing products from welfare friendly systems, which in turn is dependent on product availability, affordable prices and knowledge of labelling schemes. The aim of this study was to ascertain consumers' recognition and understanding of two farm assurance schemes: (i) Assured Food Standards and (ii) RSPCA Freedom Food, and to explore the link between socio-demographic variables on consumers' awareness and understanding of the schemes including: gender, annual income and pet ownership. A self-completed questionnaire was utilised to collect attribute data, regarding participants' ( $N=120$ ) socio-demographic status, attitudinal and behavioural data concerning consumers purchasing decisions, recognition and understanding of farm assurance logos and opinion on current food labelling. Recognition of farm assurance logos was moderately high. A significantly higher level of recognition ( $P = < 0.001$ ) was seen for the Assured Food Standards logo, compared with the RSPCA Freedom Food logo. However, consumer understanding of the farm assurance scheme criteria was poor and purchase intent of farm assured products was low (45.8%). Despite no significant associations between recognition of either logo and socio-demographic variables, levels of comprehension of farm assurance scheme criteria were significantly different depending on socio-demographic categories. The findings from this study have highlighted a lack of transparency in the market place concerning food labelling due to inadequate information and limited availability. It is therefore recommended that marketing strategies need to be improved and developed to allow for increased transparency of information about livestock production from 'farm to fork'.

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Economic and other incentives and constraints**

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# PRIORITISING ISSUES IN ANIMAL WELFARE: FINDINGS FROM AN ONLINE SURVEY OF VETERINARY SURGEONS

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Animal welfare is central to veterinary care but attempting to prioritise the wide diversity of welfare issues in veterinary fields from agricultural species through companion animals to laboratory rodents and wild animals is exceptionally difficult. As part of an effort to explore how this might be approached we report preliminary findings of an online survey of members of the British Veterinary Association (BVA) which asked participants to prioritise twelve animal welfare issues highlighted at the Animal Welfare Foundation Forum and by members of the BVA Ethics and Welfare Group.

The survey, open to members of the BVA through the BVA website, presented the twelve issues in Table 1. For each issue participants were asked to rank the issue with regard to the criteria in Table 2 from 1 (most severe) to 12 (least severe).

Over 300 BVA members have completed the survey to date. 40% were small animal veterinarians, 21% in mixed practice and 13% were students. The top three issues with regard to each of the five criteria are given in Table 3 together with the averaged ranking of each issue.

This survey is limited to showing the importance denoted by those participating without being able to determine their knowledge of animal welfare. Nevertheless it is hoped that this survey will be a useful exercise in moving towards a prioritisation of animal welfare issues from a veterinary perspective.

| Issue                                  | Acronym used in table 3 |
|--|-------------------------|
| Genetic problems in dogs               | GPD                     |
| Dairy cow lameness                     | DCL                     |
| Exotic pet welfare                     | EPW                     |
| Finishing pig welfare                  | FPW                     |
| Broiler breeder hunger                 | BBH                     |
| Bone fractures in laying hens          | BFH                     |
| Broiler leg weakness                   | BLW                     |
| Quality of life of laboratory rodents  | QLR                     |
| Lack of system of welfare surveillance | SWS                     |
| Anticoagulant use in rodent control    | ACR                     |
| Slaughter without prior stunning       | SWS                     |
| Commercially caught fish welfare       | CFW                     |

Table 1: Animal welfare issues.

|   |
|---|
| Duration of the problem   |
| Severity of the unpleasant experience                                     |
| Number of animals affected  |
| Strength of scientific basis for believing that issue compromises welfare |
| Extent to which welfare issue is created by humans                        |

Table 2: Criteria to be used to judge importance of each issue.

|                              | Most important | Second most important | Third most important |
|------------------------------|----------------|-----------------------|----------------------|
| Duration of the problem      | GPD (4.1)      | DCL (4.3)             | EPW (5.5)            |
| Severity of the problem      | SWS (3.7)      | BFH (3.9)             | DCL (4.8)            |
| Number of animals affected   | BLW (4.6)      | CFW (4.6)             | BBH (4.7)            |
| Strength of scientific basis | DCL (3.4)      | BFH (4.1)             | SWS (5.3)            |
| Extent of human causation    | SWS (4.1)      | GPD (5.2)             | ACR (6.1)            |

Table 3: Prioritisation of the three most important issues with averaged scores (1 most important, 12 least important)

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## TELEMETRY METHODS FOR ESTIMATING ACTIVITY AND METABOLIC RATE IN FARMED FISH

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Increasing public demand for ethically sourced fish reared under appropriate conditions, along with recent developments in legislation for farmed animals have increased pressure on regulatory authorities to improve fish welfare. As a consequence, there has been increasing scientific focus in this field. However, there are problems with observing the behaviour and physiology of individual fish held in large homogeneous groups, such as those often used in aquaculture systems. Now, however, new telemetry methods using archival tags that incorporate tri-axial accelerometers promise to provide a repeatable and robust methodology that will enable quantification of fish behaviour and energetics. Fine-scale behavioural patterns can be monitored with tri-axial accelerometers along with overall dynamic body acceleration, which has already been shown to relate linearly to oxygen consumption in a range of terrestrial species and one species of elasmobranch. In this project, accelerometers will be deployed on two commercially important fish species, Atlantic cod (*Gadus morhua*) and Atlantic salmon (*Salmo salar*), to assess the relationship between oxygen consumption and dynamic acceleration. Subsequently, metabolic rates of fish can be monitored remotely for a variety of conditions (variable stock densities, temperatures, feeding regimes, water qualities, and environmental heterogeneity) and as a function of their displayed behaviours (also monitored with the accelerometers). We anticipate that findings from this study will help to identify objective metrics of well-being for fish held in aquaculture based on behavioural and energetic cues from accelerometers.

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## WHAT IS 'A FAIR PRICE' FOR ANIMAL WELFARE?

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Deciding how much progress along the positive/negative welfare continuum should be funded is a complicated economic issue. The sustainable treatment of animals is at least partly determined by the resources available to farmers, and higher welfare standards may entail higher production costs, thereby requiring higher prices. But how much payment should be morally required of consumers, the public and the animals themselves?

This paper considers ways in which prices within the farming industry can be said to be fair. It suggests that the best way to assess whether a price is fair is to evaluate what price would lead to a fair *outcome* for all concerned. This is preferable to considering whether it is part of a legitimate process of exchange of goods (e.g. libertarian capitalism), especially when considering external effects of transactions on people or animals other than the participants. The paper then discusses three ways to define a fair outcome: preference utilitarianism, contractarianism and capacities-based assessments.

Preference utilitarianism would allow transactions that lead to an overall benefit, even if some humans/animals are made worse off (i.e. transactions should be Kaldor-Hicks efficient). It may be possible to combine insights into humans' preferences (e.g. from economics and sociology) and animals' preferences (e.g. from consumer demand studies). However, this approach would conclude that prices that benefit well-off humans at the expense of the worst-off humans or animals are still fair.

This suggests an alternative approach to assessing fairness based on Rawls's idea of an imaginary contract that rational people would sign if they did not know how it would affect them personally. Rawls's approach could be applied to include nonhuman animals (e.g. if the imaginary signatories did not know if they represented humans or nonhumans). This might mean transactions are fair only if they benefit some people without harming any worse off people/animals (i.e. Pareto efficient). This might require that animals are compensated, and FAWC's concept of a life worth living is considered in this light. This approach also suggests that there should be a minimum standard of welfare for all humans and animals: this may be a life worth living. Alternatively, the minimum fair standard could be based on Sen's concept of capacities, adapted to include nonhuman animals. This paper suggests basic capacities and opportunities along the positive/negative welfare continuum that should be afforded to all people and animals, in order to be fair.

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