

<p>Institution: University of Cambridge</p>
<p>Unit of Assessment: UoA6</p>
<p>Title of case study: Farm animal welfare – changes to policy and practice</p>
<p>1. Summary of the impact (indicative maximum 100 words) Research carried out by Professor Donald Broom at the Centre for Animal Welfare and Anthrozoology at the University of Cambridge has had a significant impact on the policy and practice surrounding farm animal welfare in the UK and beyond. Work on sow housing, calf housing, laying-hen housing, farm animal transport and other scientific work on animal welfare has led to legislation, binding codes of practice and changes in animal production and management methods in the United Kingdom and other European Union countries and many other countries around the world. In the EU, each year this affects 16 million sows, 6.5 million calves, 320 million hens and 6 billion animals that are being transported.</p>
<p>2. Underpinning research (indicative maximum 500 words) The underpinning research was led by Professor Donald Broom (Professor since 1986) at the Centre for Animal Welfare and Anthrozoology (CAWA) in the Department of Veterinary Medicine, University of Cambridge, and focuses on the welfare of farm animals and other confined or transported species. A major strand of the Centre's research over the past two decades has been welfare in close confinement conditions. CAWA research explored the physiological and psychological effects of confinement on sows, assessing measures of adrenal function, behaviour (including stereotypies), bone strength, immune system function and opioid receptor density in the brains of animals kept in confined conditions compared with those that were loose-housed. This work demonstrated the various ways in which sow welfare was poorer when confined in stalls than when in loose-housing systems. The listed 1995 publication¹ is selected from 28 CAWA papers (Broom D.M. PI and Post-Docs Mendl M., Zanella A.J. and Marchant J.N.) on sow welfare in relation to housing as it remains the most carefully controlled comparative study in the field, and has been referred to by the major reports on the subject. A total of 28 physiological measures, 20 behaviour measures, three animal production measures and various health measures were used in the study. The sows were kept in three widely used housing conditions and were studied during four pregnancies. The paper shows the extent to which sow welfare was worse if the sows were confined in a stall in which they could not turn around and demonstrates no major problems if the sows were group-housed. Research by Broom and colleagues on the welfare of veal calves in small crates and other individually-housed calves have demonstrated high incidences of stereotypies and other abnormal behaviour in animals raised in confinement². In addition there is abnormal physiology and failure to develop normal anatomy, when compared with group-housed animals, as a result of dietary constraints imposed on confined animals. This paper is one of 12 CAWA papers (Broom D.M. PI, Trunkfield H.R.) on calf welfare but is selected because it was a review of the work and because it has been quoted by UK and EU reviews of calf welfare. The paper shows that the welfare of calves is poor when they are: housed individually, given insufficient space to lie and groom normally, deprived of fibre in their diet and given insufficient iron in their diet. A range of behavioural, physiological and health measures is quoted. Amongst the 12 papers on CAWA's work (Broom D.M. PI, Knowles T.G, Manser C.E. Post-Docs, Phillips C.J.C. Senior Lecturer and member of CAWA) on laying hen welfare are comparisons of hens from battery cages and from aviary systems that provided evidence linking bone weakness with inadequate exercise in small cages where wing-flapping is not possible³. The first part of the work showed that lack of exercise in hens, as in astronauts and elderly people, led to osteopaenia. These studies of bone strength involved use of tensiometers in the University's Department of Physics. The studies also demonstrated that the bone weakness resulted in increased numbers of bone breakages during the normal commercial handling of hens. The publications also had to explain that bone breakage is painful for hens.</p>

Impact case study (REF3b)

In addition to confinement studies, a parallel strand of CAWA research explored the welfare of pigs, sheep, cattle and poultry under loading and transport conditions. The main findings of 35+ papers (Broom D.M. PI, Hall S.J.G. Post-doc, Bradshaw R.H. Post-doc, Parrott R.F. collaborator from Babraham Institute, Cambridge) are that: loading is normally more stressful than travelling⁴, driving quality is a major variable affecting welfare, journey duration affects welfare differentially in different species, and stocking density affects welfare. It was possible to come to these novel conclusions because the welfare of the animals was studied during the journey and not just at its end, as had been the case in most previous studies. In the quoted paper, eight physiological indicators of the welfare of sheep transported in commercial situations were measured. The movements of the vehicle were monitored with a tri-axial accelerometer. The major effects on sheep welfare of the loading procedure and of driving the sheep transport vehicle on winding roads were clear.

Much of the research carried out by CAWA, in several hundred refereed papers and a series of books, has clarified concepts⁵ and pioneered the development of a range of indicators for quantifying animal welfare⁶.

3. References to the research (indicative maximum of six references)

1. Broom, D.M., Mendl, M.T. and Zanella, A.J. 1995. A comparison of the welfare of sows in different housing conditions. *Animal Science*, 61, 369-385.
2. Broom, D.M. 1996. Scientific research on veal calf welfare. In *Veal Perspectives to the Year 2000, Proceedings of International Symposium, Le Mans*, 147-153. Paris: Fédération de la Vitellerie Francaise. (Original data papers by Broom et al, some before 1993).
3. Knowles, T.G., Broom, D.M., Gregory, N.G. and Wilkins, L.J. 1993. Effects of bone strength on the frequency of broken bones in hens. *Research in Veterinary Science*, 54, 15-19. (Also other papers by Broom et al before 1993).
4. Broom, D.M., Goode, J.A., Hall, S.J.G., Lloyd, D.M. and Parrott, R.F. 1996. Hormonal and physiological effects of a 15 hour journey in sheep: comparison with the responses to loading, handling and penning in the absence of transport. *British Veterinary Journal*, 152, 593-604.
5. Broom, D.M. 1998. Welfare, stress and the evolution of feelings. *Advances in the Study of Behavior*, 27, 371-403.
6. Broom, D.M. and Fraser, A.F. 2007. *Domestic Animal Behaviour and Welfare*, 4th edn, (pp. 438). Wallingford: CABI.

4. Details of the impact (indicative maximum 750 words)

Although most UK/EU legislation resulting from this work was passed pre-2008, their impact throughout the EU between 2008-2013 has been substantial. This is due to several facts; i) the Directives had a phase-in period for existing units on farms, (of up to ten years), so that they were implemented within this period, ii) changes to legislation and their subsequent implementation has had further impacts in other countries around the world, which are on-going now, iii) legislation that was passed and implemented to 2008 remains current and continues to have on-going effects on animal welfare today.

Confined sow welfare: paper 1. (references in 5.1) Our research, together with similar work by others led to the **EU Directive 2001/93/EC** "laying down minimum standards for the protection of pigs" which banned the use of stalls and tethers for pregnant sows. The subsequent EFSA opinion on the welfare of sows also referred to CAWA work and ensured that the ban would continue. The Directive started to come into force in 2001 but the major change in conditions for the 13-14 million sows in the European Union has occurred in a few years leading up to 1st January 2013. The work has also been quoted in reports that have led to similar impacts in Norway, in New Zealand, with a legal ban on sow stalls and tethers in December 2011, in Australia, where a phase-out of stalls and tethers was announced by the Australian Pig Producers Association in November 2011, and in nine USA states during the last five years. The largest pig producer in the world, Smithfield of the USA, announced a ban on sow stalls and tethers on its farms in 2011 with a long phase-in period. At least seven large food retail companies in the USA will not buy pork if the sows were confined. The results presented in this paper were quoted in many television programmes and newspaper articles in the UK and other countries. Scientific reviews and reports such as those of the Farm Animal Welfare Council all refer to the study as key information.

The welfare of confined calves: paper 2. ^(references in 5.2) Our research led to the **EU Directive 97/2/EC** banning the use of small crates for calves after 8 weeks and specifying diet with fibre and iron. This had to be implemented on all farms by 1st January 2007. The number of calves affected in the EU is 26 million per year but the greatest impact has been on the welfare of those calves used for veal production. In practice, our data have influenced further changes in systems after that date as farmers developed their housing systems. The subsequent 2006 and 2012 EFSA reports and consideration by EU Member State Ministers have resulted in the ban being continued, e.g. see UK legislation 2007 and 2012. Legislation and codes of practice that prevent the keeping of calves in small crates have been initiated in many countries following this work. Between 2006 and 2009, five USA States have banned the use of small crates for veal calves. These results were quoted in many television programmes and newspaper articles, as well as by Farm Animal Welfare Council and in EU reviews. The EU scientific reports on calf welfare referred to CAWA work.

The welfare of laying hens: paper 3. ^(references in 5.3) This paper and other CAWA publications were quoted in EU scientific reports and led to **EU Directive 1999.74/EC**, banning the use of battery cages in the EU. This was mainly implemented in the three years leading up to the obligatory change date of 1st January 2012. It has affected the vast majority of the millions of laying hens in the EU. Similar legislation, referring to our work, has been passed in some USA states and codes of practice of supermarket and restaurant chains in several countries refer to our work, the most recent being the announcement late in 2012 of a ban on battery cages in New Zealand.

Welfare of farm animals during transport: paper 4. ^(references in 5.4) Our research was quoted in EU reports by the Scientific Veterinary Committee, The Scientific Committee on Animal Health and Welfare (2002) and the European Food Safety Authority (EFSA 2004 and 2011) and led to provisions in the **EU Regulation 14305/04 on the Protection of Animals During Transport (2004)**. The European Commission is preparing a revision to this, using research results from Professor Broom and other researchers. The research also led to Recommendations, binding in 170 countries, by the World Organisation for Animal Health (O.I.E.) following a report by the Working Group on Land Transport chaired by D.M.Broom. The O.I.E. Code detailing this was published in 2012. This and many other CAWA papers were quoted in television programmes, newspaper articles and scientific reviews.

Scientific information on animal welfare and its assessment: publications 5 and 6. ^(references in 5.5/6) Information from our publications, including terminology such as “animal welfare” not previously used in animal protection or other animal-related legislation, was used in formulating the UK Animal Welfare Act (2006). In relation to the Animal Welfare Act, Prof Broom submitted evidence to Defra, answered questions from Defra and had several discussions in person, by telephone and by e-mail with Mr. Elliott Morley, the Government Minister responsible. This Act has led to a series of prosecutions in the UK in the years since it was passed. Information from our work has also been used in formulating the legislation in several other countries, e.g. Malta in 2010, draft legislation in the People’s Republic of China in 2009, current plans for animal welfare legislation in Mexico. The development of scientific studies of animal welfare has increased public debate and understanding, has resulted in much media coverage, has led to hundreds of new academic courses in universities around the world and has formed the factual basis for the development of commercial standards for food of animal origin.

5. Sources to corroborate the impact (indicative maximum of 10 references)

1. The EU Directive on pig welfare 2001/93/EC is at:

<http://eurlex.europa.eu/LexUriServ/LexUriServ.do?uri=CELEX:32001L0093:en:NOT>

Our research is quoted in EU scientific committee reports, for example, (a) by the EU Scientific Veterinary Committee Report (SVC reports at

http://ec.europa.eu/food/fs/sc/oldcomm4/previous_en.html) of 30.9.1997 “The welfare of intensively kept pigs” refers to paper 1 on pages 92, 93, 97, 105 and

156 and to 25 other CAWA publications. (b) The subsequent EFSA opinion on the welfare of sows: “Animal health and welfare aspects of different housing and husbandry systems for adult breeding boars, pregnant, farrowing sows and unweaned piglets”. The Scientific Opinion of the Panel on

Impact case study (REF3b)

Animal Health and Welfare (Adopted on 10 October 2007)

<http://www.efsa.europa.eu/en/scdocs/doc/572.pdf> refers to paper 1 on pages 34, 35 and 89 and to 10 other CAWA papers. Several of the Conclusions and Recommendations of both reports, including the major Recommendation to ban the use of stalls and tethers for pregnant sows, refer to the results of paper 1 and other CAWA papers.

2. The E.U. Directive on calf welfare 97/2/EC is at:

http://ec.europa.eu/food/fs/aw/aw_legislation/calves/97-2-ec_en.pdf

Papers quoted in EU Scientific Veterinary Committee, Animal Welfare Section, Report on the Welfare of Calves of 9.11.1995 (committee reports, for example, (a) by the EU Scientific Veterinary Committee Report (SVC reports at http://ec.europa.eu/food/fs/sc/oldcomm4/previous_en.html) and later EFSA reports on calf welfare (<http://www.efsa.europa.eu/en/efsajournal/pub/366.htm>). The 1995 SVC report referred to 11 CAWA papers that were reviewed in paper 2 (published 1996). Paper 2 was presented at a meeting in France attended by government officials who voted to ban calf crates in 1997. The 2005 EFSA: "Opinion of the Scientific Panel on Animal Health and Welfare (AHAW) (http://www.efsa.europa.eu/en/science/ahaw/ahaw_opinions/1516.html) on a request from the Commission related to the risks of poor welfare in intensive calf farming systems" referred to many CAWA papers. The 2012 EFSA: "Scientific Opinion on the welfare of cattle kept for beef production and the welfare in intensive calf farming systems." (<http://www.efsa.europa.eu/en/efsajournal/pub/2669.htm>) is too recent to refer to paper 2 but did refer to eight papers by CAWA.

3. The EU Directive 1999/74/EC on the welfare of laying hens is at:

http://ec.europa.eu/food/animal/welfare/farm/laying_hens_en.htm

Papers quoted in The EU Scientific Veterinary Committee "Report on the welfare of laying hens" (30th October 1996 http://ec.europa.eu/food/fs/sc/oldcomm4/out33_en.pdf) described in detail the work of Knowles and Broom, some carried out with Gregory, and also referred to three other CAWA papers. The EFSA 2005: "Opinion of the Scientific Panel on Animal Health and Welfare on a request from the Commission related to the welfare aspects of various systems of keeping laying hens". Refers (page 29) (http://www.efsa.europa.eu/EFSA/efsa_locale-1178620753812_1178620775132.htm) to the original paper by Knowles and Broom reporting that lack of exercise in hens led to weak bones and also to five other CAWA papers.

The results of paper 3 and others by CAWA were quoted in the E.U. Communication to Parliament 8.1.2008.

The new Zealand legislation on laying hen welfare 2012 is at:

<http://www.biosecurity.govt.nz/animal-welfare/codes/layer-hens/index.htm>

4. The EU Regulation on the welfare of animals during transport is at:

<http://register.consilium.eu.int/pdf/en/04/st14/st14305.en04.pdf>

The papers are quoted in a series of EU reports e.g. "Report of the Scientific Committee on Animal Health and Welfare on the welfare of animals during transport, details for horses, pigs, sheep and cattle) 2002". (reports at http://ec.europa.eu/food/fs/sc/scah/outcome_en.html) Paper 4 is quoted on pages 11, 12, 14, 24, 34, 59, 102 and 107. 27 other CAWA papers are quoted in the report. The "Scientific opinion concerning the welfare of animals during transport" 2011 EFSA up-date to the above report quotes eight CAWA papers <http://www.efsa.europa.eu/en/efsajournal/pub/1966.htm>. The World Organisation for Animal Health paper on welfare during land transport, upon which the world animal transport guidelines were based, included 24 CAWA references.

5/6. The U.K. Animal Welfare Act 2006 is at: <http://www.legislation.gov.uk/ukpga/2006/45/contents>.

The Broom/CAWA papers on welfare concepts and assessment are quoted in most books, papers and government reports on animal welfare science. Political impact is described above and also includes most other Acts of Parliament related to animal welfare in the last 20 years