Some of the recommendations also require clarification and consideration of their practicality. It is said that stunning should be verified by the lack of consciousness — is this for a sample of the harvest or for each individual fish? Although the ideal, the latter would be difficult to achieve when stunning and killing on a large scale, as may the requirement to re-stun any fish showing signs of regaining consciousness.

Another potential oversight is found where the recommendations state that fish should be killed following the use of potentially reversible percussive or electrical stunning: methods for achieving this are not provided.

Notwithstanding the lack of specific detail, the wholehearted adoption of the general principles included in these recommendations by the 178 member countries would greatly improve the welfare of farmed fish at stunning and killing around the world.

Welfare Aspects of Stunning and Killing of Farmed Fish for Human Consumption (2012). A4. Aquatic Animal Health Code, 15th Edition, 2012, Chapter 7.3. Available at: www.oie.int/en/international-standard-setting/aquatic-code/access-online/.

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A model for assessing animal welfare in pest control

Innumerable animals are killed or otherwise controlled as 'pests' around the world every year. In most cases, the animal welfare impacts of this control have been unknown. Where animal welfare has been considered, there has not been a consistent approach applied. This is despite a desire amongst practitioners and others to see animal welfare concerns addressed.

Driven by the consideration of this issue under the Australian Animal Welfare Strategy, a model for assessing animal welfare impacts in pest control has been developed with input from scientists, regulators and animal welfare, veterinary, pest animal control and livestock sector organisations. The model was first published in 2008. Since then, it has been used to assess the major pest control methods in both New Zealand (Fisher *et al* 2010) and Australia. This second edition brings together the Australian assessment and the model, revised in light of the assessment process.

The model lays out a two-stage scheme for assessing the animal welfare impacts of methods used to kill or manage animal pests. Part A examines the impact of a method on overall welfare and duration of this impact. Part B examines the intensity and duration of pain or distress caused by the killing technique (if applicable). The model takes account of impacts on the target animal only (the individual affected pest) and assumes best practice application of the method.

The assessment of a selection of pest control methods using the model was conducted by an expert panel using information from the scientific literature. The outcome is presented in a series of worksheets and figures showing method scores, with supporting evidence.

The model is intended to provide information for practitioners and regulators on the animal welfare impacts of methods, to encourage the use of more humane methods. It is also intended to highlight where more humane methods should be developed.

A Model for Assessing the Relative Humaneness of Pest Animal Control Methods, Second Edition (2011). Written by Sharp T and Saunders G, Australian Government Department of Agriculture, Fisheries and Forestry, Canberra, ACT. Available online and for download at: http://www.daff.gov.au/animal-plant-health/welfare/aaws/humaneness-of-pest-animal-control-methods. The full set of assessments is available at http://www.feral.org.au/animal-welfare/humaneness-assessment/.

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Fisher P, Warburton B, Beausoleil N and Mellor DJ 2010 *How humane are our pest control tools? (09-11326)*. MAF Biosecurity New Zealand Technical Paper No 2011/01. Ministry of Agriculture and Forestry: New Zealand. Available online: http://www.biosecurity.govt.nz/about-us/our-publications/technical-papers#how-humane-are-our-pest-control-tools.

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The use of animal-based measures to assess the welfare of broilers

The Animal Health and Welfare (AHAW) Panel of the European Food Standards Agency (EFSA) has recently published a Scientific Opinion which lays out an independent view on the use of animal-based measures to assess the welfare of meat chickens. The report is divided into three main sections. The first outlines the background work that was undertaken for the Opinion, the second discusses the terms of reference given to EFSA by the European Commission, and the third considers how welfare assessment may be further developed when taking into account factors that affect animal welfare, measures used to assess it, and the links between them.

Animal-based measures seek to evaluate the welfare status of an animal directly and to encompass any impact that environmental and management factors may have. Essential attributes of animal-based measures are discussed within the report, such as validity (the accuracy of a measurement to correctly identify a specific welfare consequence, ie sensitivity and specificity) and robustness (the repeatability and reliability of an animal-based measure).

EFSA provides an array of possible animal-based measures that may be used to assess broiler welfare and the strongest animal-based measures on-farm are considered to be: panting, dehydration, lameness, culls on-farm, on-farm mortality, plumage cleanliness, and emaciation. When assessing welfare at the slaughterhouse during meat inspection, the prevalences of the following are considered to be appropriate: foot-pad dermatitis, hock burn, breast burns, breast blisters, emaciation, ascites, and dehydration.

It is not expected that all measures will be used in all situations; the intention is that the list of measures should act as a 'toolbox'. EFSA states that the measures selected

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"will depend on which welfare outcomes (consequences) are to be assessed and the reason for wanting to assess them (eg whether part of a management/breeding strategy or to enforce legislation)".

Various circumstances in which protocols for assessment of broiler welfare may be employed are listed, and include: by a manager of a farm to monitor management decisions; by an auditing or accreditation organisation to check that a farm satisfies the necessary criteria to be part of a quality assurance or labelling scheme; by farmers to check that their farm satisfies animal welfare requirements and to track changes as a result of alterations to management or environment; by a competent/responsible authority to check that a farm satisfies animal welfare requirements according to legislation, and evaluate effects in practice of changes in animal welfare legislation; by scientists during an experiment, so that their results can be compared with the results collected by other scientists.

The methodology and interpretation of the animal-based measures given is not described, and instead the reader is directed to other publications for guidance, eg Welfare Quality® protocols (further information available at: http://www.welfarequality.net). Additionally, EFSA notes that to maintain repeatability and reliability over time requires regular training of assessors to 'recalibrate' them to a reference standard. Other important considerations outlined include ensuring that in assessing the welfare of a flock, the sample of birds examined must be representative and of sufficient size.

A number of animal-based measures have been developed and are currently being used in commercial practice (eg automated detection and scoring of foot-pad dermatitis at slaughterhouses); however, others still require further work. In particular, EFSA notes that: "There are currently no animal-based measures to use as welfare-outcome indicators on-farm or in the slaughterhouse to assess the issues of pain, frustration, boredom and other positive and negative emotional states in the standard broiler. Research in this area is lacking".

EFSA draws the report to a close with conclusions and recommendations for each of the four terms of reference. This Opinion is the latest in a growing series (similar reports were published in January 2012 for dairy cattle and pigs) following a request by the European Commission that EFSA review the use of animal-based measures to assess farm animal welfare. It is expected that similar Opinions will be published for other farmed species.

Scientific Opinion on the Use of Animal-Based Measures to Assess Welfare of Broilers (2012). A4, 74 pages. EFSA Panel on Animal Health and Welfare. *EFSA Journal* (2012); 10(7): 2274. doi: 10.2903/j.efsa.2012.2774. Available online at: www.efsa.europa.eu/efsajournal.

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New Zealand Code of Welfare for meat chickens

New Zealanders annually consume more chicken than any other meat and over 80 million birds are raised by around 160 poultry farmers every year to supply the domestic market. In an effort to ensure that the welfare needs of meat chickens are met, the National Animal Welfare Advisory Committee (NAWAC) has recently issued a new Code of Welfare: Animal Welfare (Meat Chickens) Code of Welfare 2012.

The Code covers all meat chickens raised for commercial production (both fully housed and those with access to outside areas), from in-shell chicks in the last half of development, to the catching of chickens ready for transport to the processing plant for slaughter. It does not cover the welfare of birds during transport or at slaughter; animal welfare during these times is protected by the Animal Welfare (Transport within New Zealand) Code of Welfare 2011 and the Animal Welfare (Commercial Slaughter) Code of Welfare 2010, respectively. Additionally, meat chicken breeder birds are not included within the scope of this Code.

Persons for whom this Code is intended are all those considered responsible for the welfare of meat chickens. In New Zealand, much of the poultry industry is vertically integrated and meat chicken hatcheries are owned by a small number of poultry processing companies, which also own the feed manufacturers. These companies contract out the rearing of birds, from one-day old to slaughter weight, to other people. The processing companies retain ownership of the birds and they therefore have an overarching responsibility for ensuring that the welfare needs of the chickens owned by them are met. Additionally, individuals responsible for the day-to-day care of meat chickens and any 'person in charge' at a particular point in time are also responsible for bird welfare.

The key areas considered by the Code are: Stockmanship; Food and Water; Shelter and Facilities; Providing for Behavioural Needs; Physical Handling; Disease and Injury Control; Hatchery Management; and Welfare Assurance System. Within these sections, a total of 15 minimum standards are provided, along with example indicators which may be used to show that a standard is being adhered to. Additionally, the majority of minimum standards are also followed by corresponding sections on recommended best practice, to encourage higher standards of welfare.

Also included within the Code is a list of interpretations and definitions of terms used, legislative requirements, and the titles of other Codes of Welfare, Codes of Recommendations and Minimum Standards, and other welfare Guidelines.

Animal Welfare (Meat Chickens) Code of Welfare 2012 (July 2012). A4, 34 pages. National Animal Welfare Advisory Committee, Ministry of Agriculture and Forestry, New Zealand. ISBN: 978-0-478-38897-8 (print), ISBN: 978-0-478-38898-5 (online). The guidelines are available at the MPI's website: http://www.mpi.govt.nz/biosecurity-animal-welfare/animal-welfare, or by emailing: animalwelfare@mpi.govt.nz.

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