Whether the European Parliament and Council will provide legislative proposals for more specific requirements for fish at the time of killing should become evident after December 2014. However, FAWC also mention that "greater public understanding of [fish] welfare issues… informed by scientific evidence… is needed… to motivate ethical consumer choice".

Opinion on the Welfare of Farmed Fish at the Time of Killing (2014). A4, 36 pages. Farm Animal Welfare Committee (FAWC). Available at: http://www.defra.gov.uk/fawc/.

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Animal welfare monitoring procedures at slaughterhouses

According to European Council Regulation 1099/2009 on the Protection of Animals at the Time of Killing, which has applied across Europe since 1 January 2013, "[animal welfare] monitoring through indicators… should be carried out to evaluate the efficiency of the [slaughter] procedure under practical conditions" and reliable results on the status of animal welfare at the time of killing can only be obtained if business operators develop monitoring tools to evaluate the effects of the management of daily procedures. Article 5 states: "…checks shall be carried out on a sufficiently representative sample of animals and their frequency shall be established taking into account the outcome of previous checks and any factors which may affect the efficiency of the stunning process". A range of requirements are listed under Article 16, including that the indicators of consciousness, unconsciousness and death must have criteria for determining whether the results shown by the indicators are satisfactory and if the results are not satisfactory, then the cause must be identified and the necessary changes made to the operation procedure.

To assist with these aims, in December 2013 the European Food Safety Authority (EFSA) published a series of scientific Opinions on slaughterhouse monitoring procedures for bovines — slaughter with prior stunning (penetrative captive-bolt) and slaughter without stunning; pigs — slaughter with prior stunning (head-only electrical or gas); poultry (chickens and turkeys only) — slaughter with prior stunning (electrical water-bath or gas) and slaughter without stunning; and sheep and goats — slaughter with prior stunning (head-only electrical) and slaughter without stunning.

The EFSA's aim is to suggest procedures that Food Business Operators (FBOs) can use to help prevent negative welfare outcomes for animals at slaughter. The procedures use 'toolboxes' of animal-based welfare indicators, selected by EFSA on the basis of their sensitivity, specificity and feasibility, to assess signs of consciousness in animals stunned during slaughter, and signs of unconsciousness and death in animals slaughtered without stunning. EFSA has also identified common risk factors for the slaughter scenarios and types of stunners and their welfare consequences and provided examples of sampling protocols based on those risks.

When animals are stunned during the slaughter process, EFSA recommend that the risk of poor welfare can be better detected if animal welfare monitoring is focused on detecting indicators of ineffective stunning, ie, failure to lose consciousness or recovery of consciousness after stunning. An indicator is considered to be 100% sensitive if it detects all conscious animals as conscious and 100% specific if it detects all unconscious animals as unconscious. It must also be feasible, which depends on the slaughterhouse layout.

EFSA recommend that operators choose at least two 'recommended' indicators and thereafter may choose 'additional' indicators according to the individual's expertise and the infrastructure of the slaughterhouse. The 'additional' indicators are relatively low in sensitivity or feasibility and are insufficient for use on their own, without 'recommended' indicators. The indicators are phrased neutrally (eg 'breathing') in the toolboxes but depending on whether the indicator is present or absent, the outcome may be a conscious or unconscious, or live or dead, animal. Each animal must be repeatedly assessed for consciousness, or life, during a number of key stages of monitoring, which vary depending on the slaughter scenario and the stunning equipment used. For example, for poultry stunned using an electrical water-bath, the two key stages are: (i) between the exit from the water-bath stunner and neck cutting; and (ii) during bleeding. Flow charts of the toolboxes at all key stages, the outcomes for consciousness, unconsciousness and death and any necessary interventions (eg back-up stunning) are displayed in the scientific Opinions for all species and slaughter and stunning scenarios.

In the case of animals slaughtered without stunning, every animal must be monitored (EC Regulation 1099/2009). Where animals are stunned, EFSA recommend that slaughterhouse personnel should check all animals immediately after stunning, during neck cutting or sticking and during bleeding and that operators should confirm each animal is not conscious, and/or not alive, before further processing takes place. In addition, the Animal Welfare Officer (AWO) should periodically assess a sample of the slaughter population using the EFSA sample size calculation tool (EFSA Stun Model software) to estimate: i) sample size needed to achieve the desired accuracy at a specific failure rate threshold); and ii) expected failure rate (ie a tolerance level for the highest, acceptable proportion of potential failed/ineffective stuns), given the sample size. Based on EFSA's definition of a slaughter population, slaughterhouses killing multiple species of mammals or multiple species of poultry may need a separate protocol for each mammal, or bird, type. The tool is intended to act as a 'standard' sampling protocol but EFSA states that it was established for information and consultation purposes only and… it has not been adopted or in any way approved by the European Commission".

In the scientific Opinions, EFSA suggest different risk factors and scenarios which can define the level of the monitoring protocol required by each slaughterhouse when stunning, eg whether it should be a 'normal'/standard

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protocol (eg using the EFSA sample size calculation tool) or, if necessary, a 'reinforced'/tightened protocol. If risk factors affect the quality of the stun, EFSA state it will not be necessary to increase the sampling frequency. However, when a conscious animal is detected or when a risk factor (eg employment of new personnel) reduces the sensitivity of an indicator the sampling frequency will need to be increased, and a reinforced protocol adopted. The increase in the sampling frequency is relative to the reduction in sensitivity of monitoring but EFSA report that this value may be unknown and so, testing one-tenth of the slaughter population, in one sampling period may be necessary. Risk factors might include: the outcome of previous checks (particularly if they indicated risks to animal welfare); changes in the type or size of animal slaughtered; personnel working patterns; and the level of competence, experience and/or fatigue of an individual operator, which EFSA suggests can affect the quality of stunning *and* the quality of monitoring of the effectiveness of stunning.

EFSA note that as a result of the "…scarcity of scientific publications reporting correlation between unconsciousness or death ascertained by EEG and the behavioural and physiological indicators to detect unconsciousness and death that could be used in slaughterhouse conditions… Further scientific studies should be carried out to collect valid information on indicator sensitivity and specificity". In December 2013 EFSA published a scientific Opinion on guidance for researchers on the EFSA assessment criteria for studies evaluating the effectiveness of stunning interventions used at slaughter.

EFSA also suggest that the sensitivity, specificity and feasibility of welfare indicators will improve as personnel acquire competence (through relevant knowledge, skill and experience) in monitoring indicators, via education, training and assessment. Hence, EFSA suggests that harmonised training programmes for personnel with responsibility for monitoring and ensuring animal welfare at slaughter, are required throughout the EU, and recommend that: "until such time as any improvement in sensitivity or specificity resulting from personnel training is objectively demonstrated, the values given in [the scientific] Opinion for calculating the sample size should be considered as a minimum requirement" for animals stunned during slaughter.

Sample Size Calculation Tool for Monitoring Stunning at Slaughter (2013). A4, 18 pages. Technical Report, EFSA supporting publication 2013: EN-541. European Food Safety Authority (EFSA), Parma, Italy. Available at: http://www.efsa.europa.eu/.

Scientific Opinion on Guidance on the Assessment Criteria for Studies Evaluating the Effectiveness of Stunning Interventions Regarding Animal Protection at the Time of Killing (2013). A4, 41 pages. European Food Safety Authority (EFSA) Panel on Animal Health and Welfare (AHAW), Parma, Italy. Available at: http://www.efsa.europa.eu/.

Scientific Opinion on Monitoring Procedures at Slaughterhouses for Bovines (2013). A4, 65 pages. European Food Safety Authority (EFSA) Panel on Animal Health and Welfare (AHAW), Parma, Italy. Available at: http://www.efsa.europa.eu/.

Scientific Opinion on Monitoring Procedures at Slaughterhouses for Pigs (2013). A4, 62 pages. European Food Safety Authority (EFSA) Panel on Animal Health and Welfare (AHAW), Parma, Italy. Available at: http://www.efsa.europa.eu/.

Scientific Opinion on Monitoring Procedures at Slaughterhouses for Poultry (2013). A4, 65 pages. European Food Safety Authority (EFSA) Panel on Animal Health and Welfare (AHAW), Parma, Italy. Available at: http://www.efsa.europa.eu/.

Scientific Opinion on Monitoring Procedures at Slaughterhouses for Sheep and Goats (2013). A4, 65 pages. European Food Safety Authority (EFSA) Panel on Animal Health and Welfare (AHAW), Parma, Italy. Available at: http://www.efsa.europa.eu/.

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Cattle, badgers, and achieving bovine TB free status for England

England's cattle have the highest level of bovine tuberculosis in Europe. In the recently updated Strategy for Achieving Officially Bovine Tuberculosis Free Status for England, the Secretary of State for Environment, Food and Rural Affairs, Owen Paterson, states that: "Bovine tuberculosis (bTB) is the most pressing animal health problem in the UK. The crisis facing our cattle farmers, their families and their communities cannot be overstated. It is a devastating zoonosis that threatens our cattle industry and presents risks to other livestock, wildlife species such as badgers, domestic pets and humans".

Bovine tuberculosis (bTB) is a chronic respiratory disease that the farming industry has been battling for decades. Caused by the bacterium *Mycobacterium bovis* (*M. bovis*), cattle are the main host of the infection, but other mammals are also susceptible. Transmission between hosts is usually through breathing in the bacilli aerially, although infection may also occur through ingestion of contaminated feed or water.

Efforts to control bTB include an ongoing countrywide strategy of cattle testing, removal and slaughter of infected animals, movement restrictions of infected herds, and post mortem surveillance of animals at slaughter for bTB lesions. Across Europe, these control and surveillance methods are used and the European Commission has allocated a large amount of money to co-fund bTB control and eradication programmes to assist countries in becoming Officially TB Free (OTF). A number of countries have been successful in achieving OTF status but, so far, the level of bTB in England continues to rise.

It is not clear why bTB is steadily increasing in England, but one theory is that badgers are acting as a reservoir of infection. Over the past few decades numerous reports have been written (eg Zuckerman review, Dunnet review, Krebs report, The Randomised Badger Culling Trial, Independent Scientific Group report), examining the role of badgers in bTB infection of cattle and experimental culls have been carried out to assess

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