

Welfare Impacts of Controlled Atmosphere Methods for Stunning or Killing Animals.

June 29-30 2017. APHA Weybridge, Surrey, UK

Welcome

Welcome to this meeting on Welfare Impacts of Controlled Atmosphere Methods for Stunning or Killing Animals. Many millions of animals are killed using controlled atmosphere stunning (CAS) methods every year, so the question of whether these methods are humane is an important one.

CAS methods are controversial, and there are a range of views on whether or not they are humane. We believe that only robust scientific evidence can settle questions regarding the impacts of the various CAS methods on animal welfare.

Our intention in organising this meeting was to provide an update on the latest thinking on the welfare impacts of CAS methods and to map out what needs to be done in future to both assess and improve their humaneness.

CAS methods are used in many scenarios including the laboratory, slaughterhouse and in control of wildlife and we also hope this meeting will facilitate dialogue between those researching the impacts of CAS methods in these different areas and on different species. In particular we hope that some of you will leave with some new ideas for research to test the welfare impacts of various methods.

We are also mindful that in the 'real world' there are financial, regulatory and practical constraints on which CAS methods are used. We have therefore included contributions from those involved in the practical implementation of CAS methods and those with experience of trying to bring about real-world improvements in stunning or killing techniques.

We hope you find the meeting interesting and useful.

Organising Committee: Ngaio Beausoleil (Massey University), Huw Golledge (UFAW/HSA), Rebeca Garcia (Defra/APHA), Troy Gibson (Royal Veterinary College)

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Welfare implications of stunning fish with CO₂ exposure alone and in combination with hyperoxia or hypothermia.

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Carbon dioxide (CO₂) has long been recognized as a potent anaesthetic agent in fish. It is still widely used in the aquaculture industry in many countries including Sweden to stun fish prior to slaughter. However, serious concerns have been expressed regarding the welfare implications of this method as it typically results in severe aversive struggling behaviours and pronounced primary stress responses, including release of the stress hormones cortisol and catecholamines. In a series of studies on Arctic char (*Salvelinus alpinus*), an important cold-water aquaculture species in Sweden, cardioventilatory responses and blood physiological indicators of stress were recorded during CO₂ exposure alone and in combination with elevated oxygen levels (hyperoxia) or reduced temperature (hypothermia) to experimentally test if that can alleviate the adverse effects of CO₂ as previously suggested.

Ten minute exposure to CO₂-saturated water at 10°C triggered pronounced struggling and escape responses. These aversive behaviours were accompanied by gradually reduced heart and ventilation rates, hypotension and moderately increased plasma cortisol levels before equilibrium was irrecoverably lost after ~3 minutes. Cooling the water to 0.25°C did not significantly affect behaviour, cardioventilatory responses or the time until loss of equilibrium during CO₂ exposure, but the increase in plasma cortisol was significantly exacerbated. Ten minute exposure to water saturated with combinations of CO₂ and pure O₂ (10°C) resulted in similar aversive behaviours and plasma cortisol increase as with exposure to CO₂-saturated water alone. However, the hyperoxic CO₂ exposure resulted in a more variable cardioventilatory response, and all fish subsequently recovered in normoxia, which was not the case with pure CO₂ exposure. Collectively, these results show that neither hypothermia nor hyperoxia reduce behavioural or physiological stress responses during CO₂ exposure in Arctic char. Effective alternative methods to stun farmed fish are therefore needed to ensure that animal welfare conditions are met.