Thermal delousing in anaesthetised small Atlantic salmon (Salmo salar) post-smolts: A case study showing the viability of anaesthesia prior to delousing for improved welfare during treatment for salmon lice

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Abstract

Delousing treatment for salmon sea lice (Lepeophtheirus salmonis) is considered a significant welfare concern in farming of Atlantic salmon (Salmo salar), where both industry and legislative bodies prompt for better methods. Currently, the most common method is thermal delousing, where fish are crowded, pumped into a vessel and exposed to ~28–34°C for ~30 s. Physical collisions occurring as a result of a loss of behavioural control lead to acute stress. Crowding triggers vigorous escape behaviour as salmon respond not only to treatment but also to being channeled to and from the treatment zone. A sequence of events considered to cause mortality and poor welfare. The present case study was motivated by an urgent need for delousing in groups of small salmon post-smolts in experimental research. For this purpose, a simple, small-scale system for thermal delousing was constructed, including anaesthesia to alleviate behavioural responses. The anaesthetised fish showed little behavioural response to thermal treatment, strong appetite within hours, and negligible mortality. The described method is regarded as a welfare-friendly alternative to industrial delousing in smaller fish groups, for example, in experimental research. We would encourage detailed research aimed towards gaining a deeper understanding of the welfare effects of anaesthesia prior to treatment for delousing.

Keywords: anaesthesia, animal welfare, Atlantic salmon, behaviour, handling, thermal delousing

Introduction

Over recent decades, the salmon louse (Lepeophtheirus salmonis) has become resistant to chemical therapeutants used for topical delousing of Atlantic salmon (Salmo salar) within sea cages (Torrisen et al 2013). Delousing has therefore shifted to mechanical treatments which require transfer of fish into treatment vessels. Today, the most common delousing method in Norway is thermal treatment, where salmon and rainbow trout (Oncorhynchus mykiss) are bathed in water with temperatures of 28–34°C for 30 s (Overton et al 2018; Stien et al 2019). The risk of elevated mortality after thermal treatment is higher than after non-thermal mechanical delousing (Overton et al 2018). The applied water temperatures seen during commercial thermal delousing will, if extended for minutes, induce severe tissue damage and death (Gismerkvik et al 2019; Nilsson et al 2019), and appear to be acutely painful to salmonids as the fish panic with strong struggling behaviour (Nilsson et al 2019) which can result in severe injuries due to collisions with the treatment chamber (Poppe et al 2018).

Administration of drugs with anaesthetic properties to fish prior to thermal treatment should lessen their behavioural responses and potentially reduce discomfort from exposure to high water temperature and further handling. Anaesthesia is generally divided into levels that are dependent on dose and time of exposure (for a review, see Sneddon 2012). The first level is ‘light sedation’ and characterised by fish maintaining equilibrium but showing reduced activity and a demeanour of disorientation. Isoeugenol (eg AQUI-S) is commonly deployed in aquaculture to induce light sedation in salmonids to lessen their response to handling (Zahl et al 2011) and is applied prior to thermal delousing in vessels with a pre-treatment well. There is unpublished evidence that light sedation ameliorated cortisol, glucose and lactate levels and adverse behaviour before, during and after simulated thermal delousing of small Atlantic salmon (Adams 2019). Maintaining equilibrium and locomotory behaviour in the fish is a requirement in the currently used constructional designs for thermal treatment, both for transportation and avoiding physical damage. However, deeper anaesthesia, as commonly and effectively induced in