

## Reports and Comments

### Overview on fish welfare indicators and their use for best management practices for salmon farming

Fish welfare is a growing area of concern and activity as evidenced by the fact that 180 million salmonoids (salmon and trout) eggs are produced each year in the UK alone, making it the largest livestock sector in that country after broiler production. It is predicted by 2030 over 60% of global demand for fish for human consumption will come from farmed stock.

This Report looks at farmed fish welfare and, using salmon farming as its model, looks to review current welfare practices within the finfish industry. By focusing on the indicators used to assess the welfare of farmed salmon it also looks to identify which might be relevant to other farmed fish species — in particular, catfish and tilapia, and to inform discussion of how enhanced welfare practices could be adopted.

The Report consists of ten sections, that variously address what is meant by welfare, list existing sources of guidance and standards on finfish welfare, the stressors that lead to poor welfare, finfish health and biosecurity and welfare indicators. It also explores current certification schemes and the welfare indicators used in some common salmon certification schemes and the criteria for incorporating such into any scheme. Finally, it lists recommended welfare measures that can be incorporated and audited.

The Report starts by acknowledging that the concept of welfare in fish and whether they can feel pain (and experience pleasure) is the subject of some debate and takes the position that fish are sentient animals and do — a view reflected in current EU legislation. As such, the authors argue we should look to minimise any procedure that can potentially cause distress.

They also explain what the term welfare means to them, adopting Marian Dawkins' definition of welfare in the Report, ie that 'good' welfare is when an animal is healthy and has what it wants. They argue that this definition encompasses the different approaches which emphasise a functional, a feelings and/or a nature-based view of welfare. They also highlight their belief that the concept of allostasis (stability through change) is important when considering welfare indicators as it is the capacity of fish to respond to changes.

The Report then details the different life stages of farmed Atlantic salmon (*Salmo salar*) and the farming events each stage experiences and the various risk factors/stressors they are exposed to and a short overview of each, eg stocking density, feed, water flow, water quality, handling and crowding, transport, vaccination and grading, social stress, predator control, parasites and disease (including sea lice) and humane slaughter.

Section 6 addresses welfare indicators considered essential in the development of best management practices to monitor and maintain health and welfare in the salmon industry. The welfare indicators considered most important are mortalities, condition and growth rate, fin damage,

physiological parameters, such as hepatosomatic index and behaviour — including the spatial distribution of the fish in their tanks/pen. The Report includes several tables listing indicators that can be used to monitor the welfare of individual fish and those in groups, indicators for different stressors over the different life stages of Atlantic salmon and the accepted parameter levels for different life stages and events, eg oxygen saturation levels, water pH, etc. The section finishes by looking at the research undertaken on the major stressors and welfare indicators identified for salmon.

The Report then explores what lessons can be learnt from salmon for other species like tilapia and catfish. Based on a search of existing literature they found research into the welfare of these latter species is less established than for salmon and that there is an almost total lack of recognised welfare indicators for them. Areas of research still to be developed within the tilapia and catfish industry include water quality control, harmonisation of grading and handling protocols, staff training and professional development, transport and slaughter. Other areas of welfare concern are the relatively limited level of nutrition development in the context of rapid intensification of the farming of both species, live transport and the use of ice stunning. Effective measures to mitigate stress caused by crowding and handling are also needed.

Biosecurity is another issue for farming tilapia and catfish, as a significant proportion of the industry is based on 'open' systems, ie nets and cages in rivers and lakes; making escape into the wider environment more likely. It also makes management of parasites and pathogens problematic.

The literature search also identified issues that have still to be effectively addressed in salmon, including control of parasites, bacterial and viral infections, handling and vaccination, transport and stunning and management of predators, and control and mitigation measures for extreme environmental events, such as storms and temperature change caused by global warming.

The Report concludes with the hope that development of new technologies will drive change and improvements and allow Precision Fish Farming (PFF) to become more widespread. In such systems, the authors envisage that sonar and sensor systems would be used to control feed and manage waste. Real-time monitoring of fish behaviour through the use of sonar systems and cameras could also become a reality, along with real-time monitoring of environmental parameters to ensure fish welfare.

**Farmed Fish Welfare Practices: Salmon Farming as a Case Study** (2019). A4, 56 pages. Authors: Rey S, Little DC and Ellis MA. Published by Global Aquaculture Alliance publications and available online at <https://www.aquaculturealliance.org/blog/animal-welfare-salmon-study/>.

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