



Atlantic salmon in experiment with acute and chronic stress.

From the new research facilities at IMR, Matre Research Station.

Photos: Frode Oppedal

Can fish behaviour be used to monitor stress level and fish welfare in fish farms?

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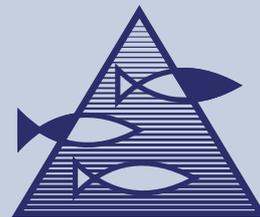
Farmed fish experience a number of stressors that may affect their health and welfare. Stressors can be acute, like crowding during transport or lightning during thunderstorms, or chronic, e.g. high stocking density and low water-exchange rates, which result in high levels of metabolites in the water for long periods of time. How these stressors affect the fish depends on species, stage and age, and also the degree of habituation to the stressors.

Behaviour is a result of both external and internal stimuli, and how fish swim, distribute and react to feeding may tell us a lot if we learn to read their “body language”. Are they satiated and satisfied,

hungry, scared, stressed or ill? Fish farmers observe fish behaviour in order to monitor feed intake and health. Because of the large numbers of fish and the volumes of their tanks and cages, only a fraction of the fish can be observed by eye or by camera. The observation periods are short and the farmers’ interpretations are based on their own experience and theories, which may well be good, but have usually not been tested scientifically. Their observations of behaviour are seldom stored in databases and the environmental conditions are not monitored in much detail. This makes it difficult to detect correlations between potential stressors and fish behaviour, performance and health, which in turn leaves few opportunities to learn from earlier experiences. There is therefore an obvious need for better and properly validated methods and technology for monitoring fish behaviour and their environmental conditions.

Important questions for the fish farmer (and the fish) concern how much stress fish can tolerate





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and where do the upper thresholds of stress for acceptable fish welfare lie? There are no straightforward answers to these questions, since we still lack much knowledge in this field. The new research facilities at the Institute of Marine Research, Research Station Matre, will give us a unique potential to manipulate environmental conditions in fish tanks and to monitor behaviour and physiological and immunological responses, in this way generating new knowledge about the ability of farmed fish to cope under farming conditions. The first experiments are already under way in the new "Environmental Hall", which is equipped with a computerised management system for water temperature, salinity, oxygen and other environmental parameters. Here, twelve tanks are monitored by 12 under-water and 12 surface video cameras. The recordings are analysed both

manually and by automatic video image analysis. In order to validate the correlation between stress and behaviour, feed intake, oxygen consumption and excretion of the stress hormone cortisol into the water are monitored. The effects of chronic stress on the immune response are also being studied.

The experiments are a part of the EU project FASTFISH – *On farm assessment of stress level in farmed fish*, a main goal of which is to identify and validate behavioural indicators that can be used to monitor and quantify stress levels in Atlantic salmon (*Salmo salar*) and sea bass (*Dicentrarchus labrax*) aquaculture, and to study how specific acute and chronic stressors affect the behaviour, physiology and immune response of farmed fish. A number of experiments will be carried out at different developmental stages of salmon and sea bass in 2006–2009 in Norway, Greece and France. Another important goal is to develop a database and expert system for the monitoring, assessment and documentation of environmental conditions, stress levels and fish welfare in salmon and sea bass fish hatcheries and farms. This system will be tested in the research facilities at IMR, Matre and HCMR, Crete, and in selected fish farms in Norway and Greece. The FASTFISH project is coordinated by IMR, and other partners include the Norwegian College of Veterinary Medicine, HCMR, Crete, the University of Crete, Greece, IFREMER, France and LEI, Wageningen University and Research Centre, The Netherlands. More information can be found on <http://fastfish.imr.no>.

Print screen from the video surveillance program, which shows vertical distribution of the salmon in the tanks.



Monitoring of horizontal distribution and swimming behaviour in the tanks.

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Fish health

