Better fish welfare using 'sensor fish'

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Farmed fish. Credit: Thinkstock

After many decades of salmon farming, recent years have seen studies into fish welfare in connection with issues such as how fish are treated in their cages. In particular, the fish farming sector is looking for better approaches to delousing.

Researchers have now developed an electronic sensor that can be used to measure the external factors that affect fish during processes such as delousing.

The project, Hydrolicerhas, been carried out by researchers to study a mechanical approach to the delousing of farmed fish. The method involves subjecting the fish to turbulence in a water chamber. Currents generated in the water mass effectively "lift" the lice from the fish with no need for chemicals.

"We have progressed from having no idea about what fish are exposed to in terms of mechanical stress to having access to a variety of measurements indicating the types of stresses involved," explains Torfinn Solvang, a research scientist at SINTEF, and manager of the Hydrolicer project.

The researchers discovered that the physical trauma incurred prior to delousing was probably more stressful than the process itself.

"The fish have to be moved from their cages into the delousing chamber using a pump system," says Solvang. "In order to feed the salmon into the pump, they first have to be crowded together so that the system can move fish and not just water. This process can take an hour or more, while the actual delousing is completed in less than thirty seconds," he explains.

The researchers also identified differences between pump systems. So-called ejector pumping, that works using high water pressure, exposed the fish to less physical stress (measured in terms of acceleration) than so-called impeller pumping, which moves the fish using a mechanical paddle installed in the water stream.

The results have encouraged the researchers to start looking for even more data on the stresses that caged fish are exposed to during a variety of operations, not least delousing.

Do fish feel pain?

Researcher Ulf Gøran Erikson, originally trained as a chemist, also works with farmed fish. He has been a close observer of developments in the industry for many years, and has worked a great deal with veterinarians on many of his research projects.

He says that there is an increasing volume of research suggesting that fish can feel pain, although to date, this has proved difficult to measure.

"We've sent everything from vegetables to plastic bottles through the pump systems," explains Erikson, who is also working on the Hydrolicer project.

"However, unlike the fish, neither vegetables nor the sensor fish are competent swimmers with the ability to position themselves intelligently. So it will be interesting to see if we can identify new methods of finding out how fish actually respond to various types of handling," he adds.

With all this in mind, cyberneticist and researcher Walter Caharija has been looking more closely into what happens to the fish during the delousing process.

Some of his results are now available as part of the Kvalisys project. This project aims to advance development of the sensor fish in order to obtain even more data linked to fish welfare.

The sensor fish is a cartridge-shaped object, about 50 centimetres long, containing electronic instruments and a small computer, designed to measure the responses of the fish around it.

"Think of a big tube through which the fish are pumped from the inlet of one cage to the outlet of another," says Caharija. "The instruments in the sensor fish instruments record temperature, pressure and acceleration and, not least, how the sensor responds to the time it spends in the pump

system," he explains.

Caharija, working together with the researchers from the Hydrolicer project, has developed an approach designed to reveal even more about fish welfare, and not least the links between how technology, mechanical stress and biological factors affect the fish.

For this reason, the sensor fish is equipped with a series of instruments to measure acceleration, water pressure, light conditions and temperature. It has a pressure-sensitive surface and is fitted with a GPS tracker.

Measurements made during the sensor fish experiments are providing researchers with opportunities to further develop more sensitive delousing methods, which are highly sought after within the aquaculture sector, not least because fish welfare is now becoming increasingly more important at all stages of the value chain. This hasn't always been the case.

"Ten years ago, and before that, there weren't as many inspections. Today, however, fish welfare is one of the most important priorities in the fish farming sector," says Erikson.

Next step – measuring stress

Erikson emphasises that they have not assessed all delousing methods currently in use, and that the sensor fish cannot help to meet all the challenges linked to fish welfare.

"We're talking about mechanical stress," says Solvang. "The sensor fish can't tell us anything about stress levels in fish – our electronics simply cannot measure this. At least not at the moment," he smiles knowingly.

Erikson and Solvang announced to Gemini that new projects are being launched in order to investigate a number of aspects of fish physiology.

"The next step is to measure fish heart rhythms. Only then can we arrive at some conclusions about how fish really respond to the various delousing methods," concludes Erikson.

Provided by SINTEF