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How are things in the sea-cage?

Monitoring, controlling and documenting what is going on in the sea-cages is a growing problem for fish-farm operators.

In collaboration with the Research Council of Norway, Bergen Technology Transfer, Tendo Tech AS, Morten Hammersland Software, and SAIV AS, the Animal Welfare Research Group at the Institute of Marine Research (IMR) has developed a system for continuous monitoring of sea-cages. The system visualises environmental conditions throughout the water column, evaluates the welfare of the fish and transmits knowledge-based advice via the Internet.

BY TRYGVE GYTRE, LARS HELGE STIEN AND FRODE OPPEDAL

Since 1990, the volume of a typical salmon farm has risen from about 1,500 cubic metres to a current level of some 18,000 cubic metres. And the trend in the direction of even larger and more remotely sited farms is continuing. Meanwhile, customers are demanding better documentary proof that the fish have had a good life in the sea-cages.

The trend towards large, more remote farms has led to more problems for fish-farm operators in monitoring, controlling and documenting what is going on in their facilities in a satisfactory manner, at the same time as the consequences of poor operational decisions are becoming ever more serious. Automatic instrumentation of farms solves only part of the monitoring problem. The monitoring programmes of the future will also need to include intelligent automation of situation assessments.

FUTURE-ORIENTED SYSTEM

The IMR Animal Welfare Group has carried out a pilot project that has developed a prototype of a future-oriented monitoring system for aquaculture sea-cages. It is based on an automatic measurement system that gathers environmental and behavioural data from the entire water column, transmits the data to a central expert system and in the course of a few seconds can analyse the situation and send both the results and its knowledge-based advice back to the person in charge of the fish farm. At the same time, the system also provides historical documentation of the environmental conditions in the sea-cage.

The system comprises a profiling measurement sonde that measures the environmental conditions in the sea-cage, from the surface to the sea-bed, at regular intervals, a data transfer system that fetches the data from each sea-cage to a central database,

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The expert system measures the environmental conditions in the sea-cage and transfers the information to a central database.

an expert system that analyses the data, and a return system that brings the analyses and advice for each individual sea-cage back to the owners.

"THINKING" SOFTWARE SUGGESTS SPECIFIC MEASURES

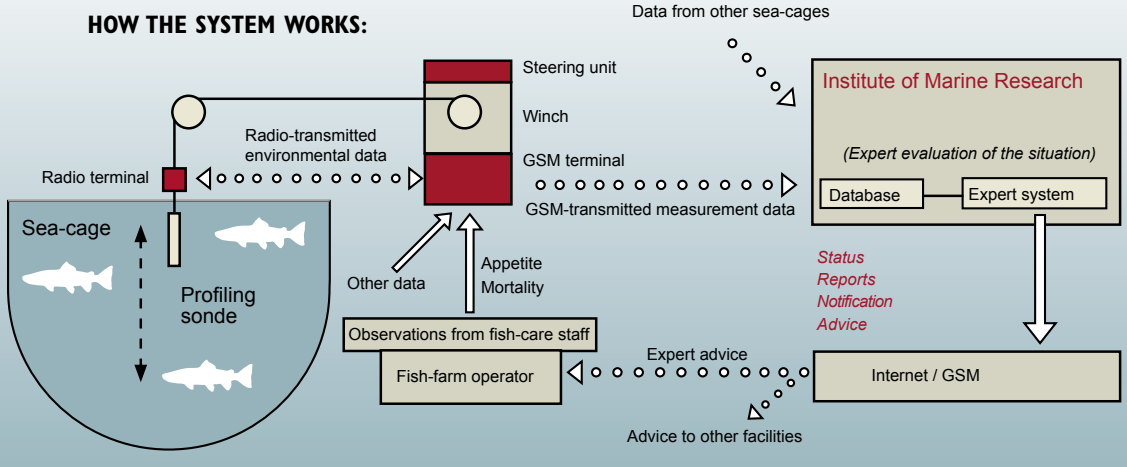
When it is fully developed, the sonde in the new system will include sensors for important environmental factors such as depth, temperature, oxygen, salinity, current speed and the location of the fish. Under the control of a programme, the sonde will be winched up and down the water column at regular intervals to predetermined water depths, where it will make a set of observations. The system that transfers data from the sea-cage to the IMR database uses a combination of radio and GSM.

The expert system is "thinking" software that in principle has access to all available knowledge about relationships between the environment and fish welfare. This knowledge is used by the programme to report on how things are with the fish in each individual sea-cage connected to the system. If necessary, the expert system will suggest both immediate and long-term measures to improve conditions. The return system is based on the Internet and/or GSM.

BASED ON GSM AND THE INTERNET

A logging measurement sonde that is regularly winched up and down in the water column sends measurement data from given depths to a GSM terminal by radio every time it reaches the surface. Comments from the farm's fish-care staff can be keyed in directly. The GSM terminal sends all the data on to the database at IMR, where they are analysed by an expert system. The measurement data and the results of the expert evaluation are transmitted to the person in charge anywhere in the world via the Internet or GSM.

HOW THE SYSTEM WORKS:



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