



WEALTH

Improving the health and welfare of farmed fish

The Challenge

Despite the development of more efficient diagnoses, sanitary controls and the use of preventive methods such as vaccination, the health and welfare of farmed fish remain a problem for the European aquaculture industry. It is generally believed that chronic stress, sub-optimal rearing conditions and stressful husbandry procedures lead to a compromised immune function in fish, and may ultimately cause an outbreak of infectious diseases. However, there is limited knowledge on how stress affects the immune function, what are the mechanisms that are involved, and what level of stress can be tolerated by the fish before the immune function and resistance to infectious diseases are negatively affected. Although some important components of this complex matrix have been identified and studied, current knowledge is incomplete and fragmented, and a holistic view of how the well-being of farmed fish can be maximised is still lacking.

Project Objective

To address these problems, the WEALTH project was established with funding from the European Union. The project involved 12 different European research laboratories and several fish farming companies. It aimed to gain an in-depth understanding of the factors affecting the health of farmed fish and identify the key development stages – and husbandry practices – in which fish are most vulnerable to stress-induced infections.

Output Highlights

Research focused on Atlantic salmon and sea bass. A range of experiments was conducted in flow-trough tanks, recirculation tanks and sea cages whereby the fish were exposed to different husbandry conditions and environmental stressors such as varying levels of O₂, ammonia, CO₂, stocking density, and varied light regimes, solely or in combination.

Stress responses were assessed using so-called “welfare indicators”, of which some were developed and tested during the project. The indicators applied included:

- Environmental indicators (e.g. oxygen levels) giving indirect measures of fish disturbances and metabolism
- Appetite and feed intake
- Growth rate and feed conversion efficiency
- Condition factor
- Fin abrasions/damages
- Behaviour and swimming activity



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EATiP Thematic Area of Relevance

TA1: Product Quality, Consumer Safety and Health

TA2: Technology and Systems

TA3: Managing the Biological Lifecycle

TA4: Sustainable Feed Production

TA5: Integration with the Environment

TA6: Knowledge Management

TA7: Aquatic Animal Health and Welfare

TA8: Socio-Economics and Management

Key Words

Aquaculture, Fish, welfare

Project Information

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- The stress hormone cortisol in plasma and water
- The integrity of primary barriers
- Histopathological changes in intestine, gills and skin
- Immune parameters during experiments and following immune stimulation
- Gene expression profiles

Another achievement of the WEALTH project was the development – and partial testing – of new physiological and molecular methods to understand the underlying mechanisms of the stress induced immune compromised fish. This was felt necessary, since in fish immunology only a limited number of tools were available.

Based on the results obtained, recommendations for improved welfare and health of farmed fish were developed. Due to findings of suboptimal and sometimes critical environmental conditions in commercial salmon and sea bass farming systems, it was suggested that better monitoring regimes be implemented both in salmon and sea bass farms to be able to have a better overview of the variation in the environment in the cages, and to take actions to avoid situations with impaired welfare.

Other results from the project suggested that the current limit of 25kg/m³ in salmon cages is high, and approaching this limit can increase the risk of impaired salmon welfare. For this reason, it was recommended to lower the limit to e.g. 20kg/m³ to reduce the risk of undesired oxygen conditions in the sea cages that can impair welfare and increase risk of disease outbreaks.

For sea bass, stocking densities of up to 70kg/m³ appeared to have no negative effect on growth performance or other welfare indicators tested – provided that the water quality was maintained at non-limiting levels. However, this was contrasted with poor environmental conditions found in commercial tanks and sea cage sea bass systems together with histopathological changes on the fish. Further studies are needed on commercial sea bass farms to determine safe levels of environmental factors and stocking density in order to ensure good fish welfare.

The Full Report:

More detailed information about the results and recommendations from the WEALTH project can be found in the WEALTH leaflet, which is available from the website (wealth.imr.no).

Next Steps – Suggested Actions/Follow On



Policy

- By providing quantitative information on factors affecting the health and welfare of farmed fish, WEALTH helped to develop EU aquaculture policy. Based on the recommendations made, guidelines for a code of practice on good husbandry can now be developed that will help the Union set the highest possible ethical standards to meet the growing concerns for the welfare of all farmed animals, including fish.