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TURPRO

Improving productivity on turbot farms

The Challenge

Land-based aquaculture is an increasingly important sector within the fisheries industry. There has been a move towards farming a greater diversity of marine fish species, including cod, halibut and sea bass. New species promote growth in the aquaculture sector, and address an increasing consumer demand for farmed fish. Turbot is a large marine flatfish that has great potential in land-based aquaculture. It is native to Europe, difficult to catch at sea, is esteemed for its flesh, and has a high market value. However, technological improvements are needed to exploit turbot's potential. Lower costs and higher yields will enable small and medium-sized enterprises (SMEs) to expand production and ensure that Europe remains a world leader in turbot farming.

Project Objective

The co-operative research project TURPRO aimed to enhance productivity throughout the turbot production chain, from juvenile fish to the market. The project studied the impact of temperature, photo-period and water quality – key rearing factors – on growth performance, food conversion efficiency, age at first maturity and fish welfare, so as to enable a year-round supply of juveniles reared in intensive land-based systems at high densities. In addition, the impact of processing methods (e.g. slaughtering and storage), especially designed for turbot, on flesh quality and fish yield was investigated.

Output Highlights

Temperature
Temperature is an important factor determining turbot growth rates. The effect of step wise temperature regulation was studied as compared to a constant temperature regime, whereby juvenile turbot were reared at two different temperatures (16° and 20°C). After two months, part of the fish were switched (some went from 20° to 16° and others from 16° to 20°) and the other part continued to be reared at the same temperature, which yielded four sub-groups. The 20°-16° group gained 5-11% more weight over the same period compared to the other three groups.

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

Fish, Diseases

Project Information

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No longer exists

Photo-period
Extending photo-period is a means of delaying sexual maturity, which, in turn, is desirable to maximise growth. Juvenile turbot were reared at four different photoperiods, and although prolonged exposure to continuous light had a positive effect on the incidence of maturation, it did not have the same impact on growth. More experiments would therefore be necessary to establish the optimum turbot photo-period.

Water quality
The benefits of environmental manipulation of fish growth are reduced in systems with poor water quality. Maintaining water quality is essential in recirculation stocking densities with high stocking densities. Laboratory experiments with levels of ammonia and dissolved oxygen showed that chronic low and high Total Ammonia Nitrogen (TAN) reduced growth, but mild hyperoxia (oxygen overload) appeared to counteract the negative effects of this chronic exposure. Abrupt and limited peeks of TAN reduced growth significantly. Water renewal rates (WRR) were also tested and growth appeared to improve with WRR, but not significantly. Underlying mechanisms improving growth could not be explained by different levels of the water quality parameters analysed; it was therefore concluded that they are probably the sum of all water quality parameters.

Flesh quality
The flesh quality in turbot appeared to be highly affected by the season: fish slaughtered in November had a textural shear force which was approximately twice as hard as fast growing fish slaughtered in June. Quality was also affected by the stunning method (percussive stunning, electrical stimulation and exsanguination on ice) and following stress. When studying the processing methods, like gill bleeding, gutting, pre rigor filleting and freezing, it was found that the colour of the fillets can be tuned by the (post) slaughter conditions and that non-bleeding conditions (no gutting, no exsanguinations) result in a more crème colour of the fillet, which is more like the desired fillet colour of wild turbot.

Market opportunities
In the final phase of the project, the market opportunities for farmed turbot were determined and compared to those for wild turbot. In general the wild turbot appeared to be less firm and tenderer but also less sticky compared to farmed turbot. As to freshness, it was found that the shelf-life of farmed turbot can be seven days longer than the wild species. A consumer study showed that consumers attached most value to freshness, price, and quality or labelling.

Next Steps – Suggested Actions/Follow On

Market

- Turbot has a very high market potential. Although popular as a table fish in France and Spain, it is only just being discovered in northern Europe. It attracts high prices and fish farmers can make good profits from it. Production costs are nevertheless high for smaller European enterprises, and competition from China is increasing fast. The protocol produced by TURPRO, in the form of a practical manual, will help to reduce costs and increase productivity on turbot farms in a sustainable and environmentally friendly manner.