news
FP6 Collective Research Projects:
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finefish

Improving sustainability of European fish aquaculture by control of malformations

SIXTH FRAMEWORK PROGRAMME

The FINEFISH Collective Research Project is a new initiative supported by the European Commission. This is the second newsletter published by the FineFish consortium.

In this issue

Field trials in hatcheries

Finefish aims to combine hands-on experience and scientific know-how through interaction between SMEs and the researchers. The SMEs will run field trials that are intended to test improvements on rearing procedures at an industrial scale, but in a manner that is scientifically sound.

The first two field trials run by two hatcheries are explained in this Newsletter:

1. Testing disinfection products on Rainbow trout eggs
2. Changing waterflow to reduce lordosis in cod juveniles

Testing disinfection products on Rainbow trout eggs

Marie Forraz of Viviers de France (VdF) set up this field trial within the FineFish project. The goal of the work was to test several disinfection products at different doses in order to determine the potential effect of egg disinfection procedures on malformations, within a test on efficacy against Flavobacterium psychrophilum

The disinfectants of interest were:

* already used for egg disinfection in aquaculture and especially in VdF fishfarms, such as iodine and glutaraldehyde;
* environment-friendly, as hydrogen peroxide or peracetic acid;
* known as effective disinfectants namely against Flavobacterium.

The disinfectants were tested at different dosage levels, using normal aquaculture application levels as well as a range of different concentrations.

In order to measure the effect and the efficiency of the different disinfectants and their dosage, the efficiency against Flavobacterium was tested, as well as the hatching rate of the eggs, the survival rate of hatched fingerlings and the malformation rate and type of the hatched fingerlings.

The best disinfectant seems to be peracetic acid (less malformations) but it is not efficient against Flavobacterium. Incimaxx is interesting (best against Flavobacterium) but seems to induce more malformations on eggs than glutaraldehyde when compared to the control. Glutaraldehyde 25% 250 ppm or H202 35% 1000 ppm appear as the best compromises while Ammonium 10 ppm causes the death of eggs.

The results of these field experiments have given some very interesting first results, although the work has not yet been treated by statistical analysis. The trial needs to be repeated so as to draw absolute conclusions.

Company Viviers de France

Viviers de France (VdF) was founded in 1997 and operates 7 trout farms in the South West of France and North of Spain, becoming one of the largest trout producers in France. They also have a processing factory at Castets (Landes), which is the operational centre.

While trout is the focus of most of its products, the company also processes some salmon and other marine fish. VdF operates a selection programme for its trout broodstock, this being made within a dedicated fish farm at Sarrance. Hatching and juvenile growing are assured at 3 other sites in the area.

VdF has 2 subsidiary companies – Bell-Ile is a wholesale fish merchant while the Ferme Marine de Noirmoutiers produces turbot. Marie Forraz who is responsible for R&D acts for VdF within FineFish.

Colophon

The FineFish project aims to generate new practical knowledge on how to reduce the incidence of malformations in the major fish species used in European aquaculture production and to apply this to the professional sector. FEAP (Federation of European Aquaculture Producers), ten major European hatcheries and eight leading European scientific institutions participate in this Collective Research Project.

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Knowledge developed for Mediterranean species applied to cod hatchery

During the fieldtrip in Sunndalsøra (September 2006), all FineFish partners had the opportunity to visit the cod hatchery of Produnda.
Dr. Koumoundouros of the University of Patras (Greece), who is working mainly with seabass and seabream, saw that cod juveniles in the tanks were swimming hard and indicated that this might be an important cause for the lordosis occasionally observed in the cod hatcheries.

"swimming hard causes major skeletal deformities in cod"

Profunda developed, in cooperation with Linde Gas, a new type of inlet streamer for in-tank water distribution. At the end of February 2007 fish that had been raised in tanks using this new pipe were x-rayed. The x-rays proved that there was a very low incidence of lordosis and other skeletal deformities.
This work is seen as a fine example of how this Collective Research project can contribute to development

Company Profunda

Profunda is a Norwegian hatchery that produces cod juveniles for ongrowing. Profunda uses light manipulation to synchronise broodstock spawning and grows juveniles from the eggs produced. Juveniles are sold to customers at 3-6 grams for pre-ongrowing up to 80 grams in onshore facilities, before their transfer to sea cages.

The company was established in 1998 and in 2006 operates three sites, all in Norway, with a production of 3 million juveniles. Helge and Else Marie Ressem represent Profunda within the Finefish Consortium.

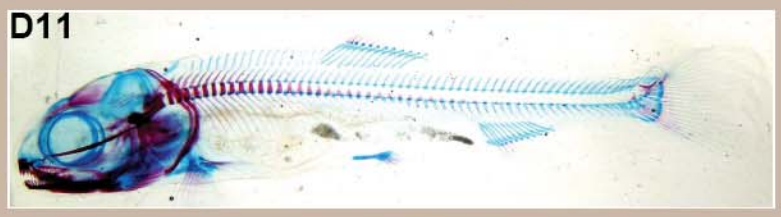
Skeletal development in rainbow trout

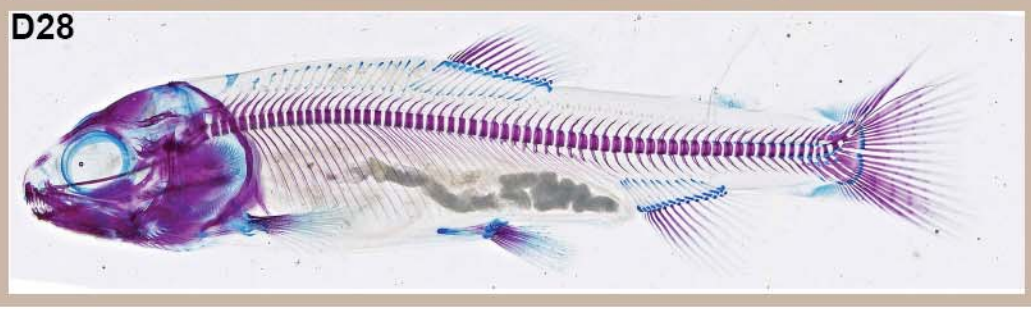
S. Fontagné, UMR NuAGe, INRA

"Ossification" is the process of bone formation in which connective tissues, such as cartilage are turned to bone or bone-like tissue. As young larvae are not fully ossified, two different staining products are used to follow the ossification process; Alcian blue and Alizarin red. The cartilage is stained blue whereas the ossified bone is stained red.

The three pictures are of rainbow trout fry, stained in Alcian blue and Alizarin red in three different life stages. The first picture shows the rainbow trout fry at the swim-up stage (mean wet weight: 100mg) and the ossification has not yet started as the fry is only stained blue. 11 days later (picture 2), the ossification has started; mainly in the head and in the tail.

The fry on picture 3 (28 days later, mean wet weight: 500mg) has achieved complete ossification. X-ray analyses are the best method to follow the skeletal development of larger fish.





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Evaluation of the effects of nutritional factors on juvenile deformities

Within Finefish, one specific work package is devoted to evaluate the effects of dietary/nutritional factors on deformities. The major objectives are:

a) to evaluate the effects of two groups of nutrients, putatively involved in morphogenesis, on the development of malformations,
b) to characterise the type of deformities associated with each nutritional factor and
c) to identify molecular markers associated with appearance of malformation.

Among the nutrients, the studies concern more specifically the influence of dietary calcium, phosphorus and vitamins A, D and C on bone formation, mineralisation and muscle growth. Some other studies focus on the effects of polyunsaturated fatty acids, phospholipids and oxidized lipids. Studies are made on rainbow trout, European seabass, gilthead seabream, Atlantic salmon and Atlantic cod.

Results to date

Studies undertaken so far in rainbow trout have dealt with (a) the influence of dietary calcium and phosphorus on bone formation and mineralization in first-feeding fry and (b) the effects of feeding different levels of vitamin A to broodstock, looking at broodstock performance as well as early growth and fry development. The experiments have shown that both dietary deficiency and an excess of phosphorus are detrimental to rainbow trout fry development; deficiency affects bone calcification in particular. Although there are no visible signs of dietary calcium deficiency (possibly through calcium absorption from freshwater), an in-depth study on skeletal development and associated metabolic parameters is under way.

"deficiency and excess of phosporus are detrimental to trout fry development"

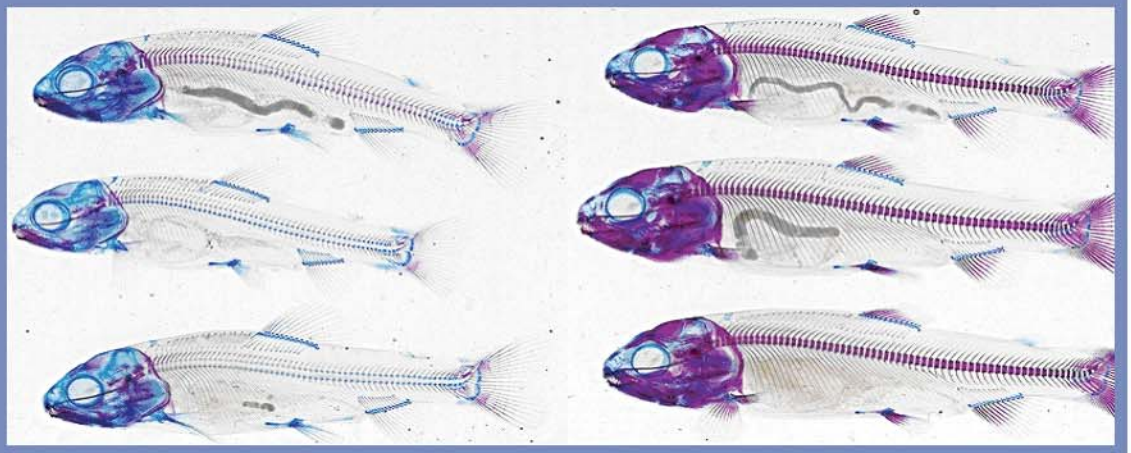
Studies coming up

In order to study the effects of nutrients on morphogenesis and development in European seabass, compound formulated diets were used from first feeding onwards. Studies undertaken so far have dealt with (a) analysis of the interaction between water temperature and dietary long-chain polyunsaturated fatty acid levels, (b) optimising dietary vitamin levels in order to follow closely the morphogenesis and ontogenesis of physiological functions. Studies underway include the effects of variable levels of dietary vitamin A levels on skeletal development in both gilthead seabream and seabass.

An interesting aspect in all of these studies is that multiple techniques (visual analysis, x-ray analysis, histology) are being applied for the analysis of skeletal growth and development in addition to biochemistry and molecular biology for assessing the mechanisms involved in muscle and bone development.

The R&D partners involved are UMR NuAGe (INRA-IFREMER, France), Akvaforsk (Sunndalsøra, Norway), National Centre for Mariculture (Eilat, Israel), Royal Veterinary College (London, UK) and CCMAR (Faro, Portugal).

Ossification can be altered by dietary phosporus defiency



The conclusion of the experiment done by the FineFish project was that the ossification process can be altered by dietary phosphorus deficiency. The picture above shows the results of this experiment.

The three fry on the left are 28-day fry fed on a P-deficient diet and the three fry on the right are 28-day fry fed on a P-control diet.

The fry are stained in Alcian blue and Alizarin red; the cartilage is stained blue whereas the ossified bone is stained red.

There was no difference of size was registered between rainbow trout fry groups whereas a significant difference in degree of ossification was noticed.

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Benchmarking hatchery data

When Finefish was being formulated as a project, the lack of hatchery performance data became evident. This situation meant that it is difficult to measure improvements – technical and economic – without having reference points to benchmark. One of the main objectives of the project became how to make a systematic collection of hatchery data and to analyse these with regard to the incidence of malformations in hatcheries and commercial fish farms. The results of this work would help to elucidate which factors pose the most important risks for the development of malformations in commercial hatcheries and fish farms.

"a new direction was needed using a professional approach"

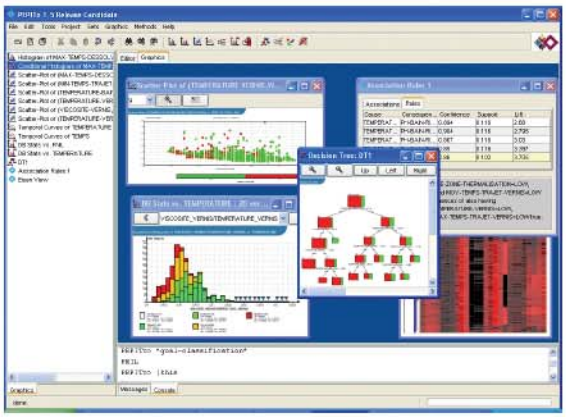
The data collection for benchmarking started by using a relatively simple Excel worksheet for follow-up and reporting. However, it was rapidly realised this approach did not meet the expectations of the SMEs and that, following discussion and examination of the problem, a new direction was needed using a more professional approach.

Data collection and management

Computer software that can recover and analyse production parameters exist in the market (Novafish, Superior Systems, Fishtalk, and other local systems or adaptations). Nonetheless, each SME has a different programme, adapted to its realities. The FEAP Secretariat met with a company, Pepite S.A., that is specialised in 'data mining', which is defined as "the nontrivial extraction of implicit, previously unknown, and potentially useful information from data" or "the science of extracting useful information from large data sets or databases".

Data mining is increasingly used in the sciences to extract information from the enormous data sets generated by modern experimental and observational methods. PEPITe will develop within the scope of the FineFish project a web-based system that is able to integrate all the available measurements within one standardized database.

"a significant step to improving the current levels of knowledge"



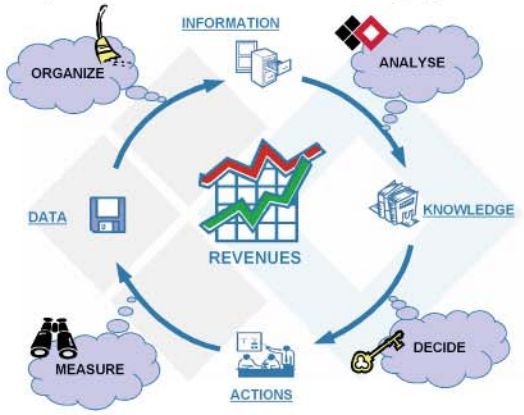
....PEPITe Data Mining Environment

With one database, it should be possible to use all of the information collected of the hatcheries, making it easier to apply data mining and predictive modelling tools. It is hoped that this approach will help to identify the key parameters which are believed to have an effect on the development of fish deformities.

Knowledge database

PEPITe will also establish a 'knowledge base' that can be updated during the project's progress, using the experience and knowledge of the technical people of the hatcheries and the scientists. It is regularly repeated that expert interpretation of the data obtained is a requisite. This database will expand with the development of knowledge (from both the expert knowledge and from the "common database" mining).

Pepite will develop, define and design, together with the partners, a database that needs to be tested and adapted prior to launching on the web. The marine hatchery of Ferme Marine de Douhet (France) has a very complete recording system in operation already and will be used as the test hatchery for further development of the web-based recording system.



The system will be gradually expanded to include all of the SMEs of the consortium. The software will be accessed through a web portal with a user-friendly interface; it is anticipated that the hatcheries could upload their own data sets and extract directly a synthetic analysis from these data. Thereafter it should be possible to open access to other participants allowing them to upload information and obtain more "general" results from the common database. Finally, once fully tested, the system will be offered to external hatcheries for full scale benchmarking.

A point of view

Pepite S.A. has, in general, developed tools for the improvement of manufacturing processes – such as steel, pulp-and-paper, and transportation. The idea of adapting hatchery production systems to this approach is an original idea and may provide an opportunity to use technology, as yet unused in this sector, to assist the identification of patterns and eventual solutions.

The point of view of the consortium is that the development of this system could offer the possibilities of being able to benchmark and compare the different hatcheries and their methodologies, giving results from data mining and analysis. This would represent a significant step to improving the current levels of knowledge and improve the understanding of the underlying mechanisms of malformations – the prime goal of the Finefish project.

For more information about the company PEPITe S.A. see website: www.pepite.be

Pepite