**Word of Welcome**

**Oyvind Lie, Project Coordinator**

As Co-ordinator of the Integrated Project AquaMax, part of the research currently being pursued in EU Framework 6, I warmly welcome you to this first AquaMax Newsletter.

AquaMax started in March 2006 and is scheduled to run for four years at a total cost of approximately 16 million euros. The project involves 32 partners from throughout Europe with partners also from China and India.

AquaMax starts from the premise that fish play a unique role in human nutrition and well being, not only for the well known beneficial effects of their long chain omega 3 fatty acids, but also because they are a source of high quality readily digested protein, vitamins including especially vitamins A, D and E, and minerals including selenium and iodine.

**Rising demand for fish**

Global demand for fish is currently high and likely to become even higher as the beneficial effects of fish become more widely recognised. A recent UK government report www.fhf.org.uk considers the effect of diet on mental health, emphasising possible links between intake of long chain omega 3 fatty acids and mood, memory, ability to concentrate, impulsivity and behaviour. The report considers issues of education, crime, health and the well being of vulnerable sections of society, of immense importance to developed and developing countries alike.

Global fisheries are currently stagnating, if not declining, and cannot meet global demand for fish. Aquaculture has thus far managed to make up the deficit but its growth is becoming increasingly constrained by increasingly limited supplies of the industrial fish that constitute the fish meal and fish oil on which aquaculture feeds are so heavily dependent. There are also serious concerns over known and potential pollutants in fish meal and fish oil.

AquaMax addresses these problems by seeking to replace as much as possible of the fish meal and fish oil currently used in fish feeds with sustainable, alternative feed resources. The new feeds developed will be as free of undesirable contaminants as possible. They will maximise the growth performance, feed conversion efficiency, health and welfare of the farmed fish. Finally, they will maximise the health promoting properties, the safety, the quality and, most important, the acceptability of the final product to the consumer.

**Objectives**

The specific objectives are being pursued in four separate but inter-related Programmes.

1. Developing new fish feeds based on sustainable alternatives to fish meal and fish oil.
2. Assessing health benefits of consuming farmed fish for the pregnant woman and her child.
3. Determining the balance between risks from contaminants and health benefits of consuming fish.
4. Developing a framework to best communicate the risks and benefits of consuming farmed fish.
AquaMax seeks to develop feeds based on sustainable alternatives to fish meal and fish oil to produce healthy and minimally contaminated fish that are highly nutritious and acceptable to consumers.

The table below shows the estimated percentages of fish meal and fish oil currently used in feeds and the target percentages to be achieved in AquaMax for the four most important fish species produced in Europe.

Progress made
At the time of writing, approximately half way through the Project, AquaMax has completed a survey and analyses of possible alternative feed stuffs. We have also substantially improved and extended our analytical capacity for undesirable substances (contaminants). This has enabled us to select possible alternative feed materials and to produce novel feeds with markedly reduced levels of fish meal and fish oil and correspondingly increased levels of vegetable proteins and vegetable oils.

Testing new developed feeds
The new feeds developed in this project have minimal levels of contaminants and are currently being tested in growth trials with Atlantic salmon, rainbow trout, gilt-head sea bream and carp. The trials are nearing completion and the results of growth performance are currently being processed and assessed. Although the final outcomes will not be known until later this year, our preliminary findings make us optimistic if not confident that substantial replacement of both fish meal and fish oil in feeds with vegetable meal and vegetable oil is possible without notably affecting the growth performance of any of the four species of fish tested.

Table: Current Percentages of Fish Meal and Fish Oil in Feeds of Fish Farmed in Europe and Percentages Targeted in AquaMax

<table>
<thead>
<tr>
<th>Species</th>
<th>Current Fish meal %</th>
<th>Current Fish oils %</th>
<th>Targets in AquaMax Fish meal %</th>
<th>Targets in AquaMax Fish oils %</th>
</tr>
</thead>
<tbody>
<tr>
<td>Atlantic Salmon</td>
<td>35 – 47</td>
<td>25 – 33</td>
<td>12 – 16</td>
<td>8 – 12</td>
</tr>
<tr>
<td>Rainbow Trout</td>
<td>30 – 35</td>
<td>20 – 25</td>
<td>5</td>
<td>5</td>
</tr>
<tr>
<td>Seabream</td>
<td>40 – 45</td>
<td>15 – 20</td>
<td>15</td>
<td>10</td>
</tr>
<tr>
<td>Carp</td>
<td>20 – 25</td>
<td>5 – 10</td>
<td>0</td>
<td>0</td>
</tr>
</tbody>
</table>

Ethical Issues
Proper governance of ethical issues in AquaMax is being assured by an Ethical Review Panel. The Management Board does not permit any part of the AquaMax project to proceed if it has not been approved by the Ethical Review Panel.

Ethical issues arise in AquaMax are in relation to:
1. experimental research on fish and rodents,
2. research on pregnant women and children,
3. research on human biological samples,
4. data protection,
5. use of human resources for nutritional trials in China,
6. benefit sharing.

Thus far, the Ethical Review Panel has approved all current and planned activities in AquaMax.

All of the research programmes in this project are based on fish produced on the new diets developed in AquaMax and not on fish produced on current (traditional) diets.
Atopic diseases, e.g. asthma, hay fever, dermatitis and allergies, have increased dramatically in the last few decades. Such a rapid increase can not be due to genetic causes alone but must involve changing environmental factors amongst which diet has been strongly implicated. There is substantial evidence pointing to a dietary deficiency of long chain omega 3 fatty acids during pregnancy being a significant factor in infants developing atopic disease.

Pregnant women in the EU generally have low intakes of fish and are often advised to limit consumption of fatty fish during pregnancy because of the presence of contaminants. AquaMax has set up a dietary intervention study to investigate whether the consumption of fatty fish in pregnancy can reduce the incidence of allergic sensitisation and symptoms in the babies. The fatty fish (salmon) has been farmed using feeds developed by AquaMax and contains extremely low levels of contaminants.

Women selected
The study is being conducted at the University of Southampton. Healthy pregnant women at risk of giving birth to a child that will develop atopic disease (i.e. the mother, father or sibling of the expected child have allergic diseases) are being recruited. They are habitually low consumers of fatty fish (< 2 portions per month) and are randomly assigned to remain on their habitual diet or to consume two meals of salmon per week from 20 weeks of pregnancy until the birth of their babies. The research team is measuring immune parameters in the blood from the mother during pregnancy and from the infant at birth. The team will test for allergic sensitisation and symptoms in the infants.

Results
At the time of writing, recruitment is well underway and the first infants in the study have been born. Within the next few months a dedicated newsletter will be created in which the study is explained in more detail.

Damage from Contaminants, Health benefits of Nutrients, What is the Balance?

Considerable concerns have arisen in recent years over the presence of contaminants including persistent organic pollutants and heavy metals in fish.

The concerns have been mostly with marine fish but encompass farmed fish because of the extensive use of marine fish meal and oil in fish feeds, and there is much uncertainty in this area.

There is currently no established methodology for risk-benefit analysis that can be applied to fish. However, the extensive data and information generated by AquaMax will contribute to such assessments.

AquaMax will achieve major advances in knowledge in this area in two ways. First, by selecting alternative fish feed ingredients with low contaminants as described above.

Second, not only by encompassing direct toxic effects of contaminants in farmed fish, but also by considering modulating effects of beneficial nutrients in fish. This will be realised by complementing conventional technology with novel molecular genetic technology to mount detailed transcriptomic, proteomic and behavioural analyses of the toxicological consequences of contaminants and possible ameliorating effects of nutrients.

This ambitious study will be conducted in mammalian model systems in cell cultures and by feeding animals the fish produced in AquaMax.
Public opinion and risk assessment of farmed fish consumption

During previous years the public has often been presented with conflicting scientific advice regarding the potential risks and benefits of consuming various types of fish. Moreover, the assessment and management of food risk in general tends to be a politically and morally charged issue, which challenges national and international authorities. Thus effective food risk communication is increasingly recognised as particularly challenging.

Communication framework
AquaMAx aims to devise a framework to communicate the risks and benefits of consuming farmed fish to the public and other stakeholders. As such, the innovative 3-year project will contribute to the development of tailored and effective risk communication strategies regarding the consumption of farmed fish.

Activities
First, the project has analysed media coverage of farmed fish consumption to assess the media’s agenda setting and interpretations of risk and benefits.

Second, scientific experts on fish farming and aquaculture have been interviewed to gain an understanding of the scientific risks.

Third, focus groups will be conducted in seven European states to comprehend lay people’s perceptions of the risks and benefits of farmed fish consumption.

Finally, with the knowledge gained, a risk communication framework will be developed for efficient dissemination of the project’s results.

Colophon
AQUAMAX aims to replace as much as possible of the fish meal and fish oil currently used in fish feeds with sustainable, alternative feed resources. Fourteen countries with together 32 partners are participating in this project.

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Project Partners

The National Institute of Nutrition and Seafood Research (NIFES) is the leader of the project. The project involves 32 partners from throughout Europe with partners also from China and India.

1. National Institute of Nutrition and Seafood Research (NO)
2. Institut National de la Recherche Agronomique (FR)
3. Institute of Aquaculture, University of Stirling (UK)
4. CSIC Institute of Aquaculture Torre la Sal (ES)
5. Hellenic Institute of Marine Research (GR)
6. Research Institute for Fisheries, Aquaculture and Irrigation (HU)
7. Biological Research Centre, Hungarian Academy of Sciences (HU)
8. Nutreco Aquaculture Research Centre (NO)
9. Institute of Marine Research (NO)
10. DDG Fisheries, Indian Council of Agricultural Research (IN)
11. Joint Research Centre (ES)
12. University of Southampton (UK)
13. Institute of Nutrition and Food Safety (CN)
14. King’s College London (UK)
15. University of Granada (ES)
16. University of the Auvergne (FR)
17. University of Uppsala (SE)
18. University of Reading (UK)
19. Instituto Superiore di Sanita (IT)
20. Peipsi Centre for Transboundary Cooperation (EE)
21. Selonda Aquaculture S.A. (GR)
22. Halandor Kft (HU)
23. G. Barka Kft (HU)
24. Alpha Mos (FR)
25. WOW Creative Projects Ltd (GR)
26. Landcatch Natural Selection Ltd (UK)
27. Technology Crops Ltd (UK)
28. Viviers de France (FR)
29. Teutoburger Olmuhle GmbH and Co.KG (DE)
30. Caditec (ES)
31. Marine Harvest International B.V. (NL)
32. Federation of European Aquaculture Producers