



RTD Synopsis: TA 1 – Product quality, consumer safety and health

Over the last decade, food safety and functional foods have taken a central role in European research priorities. European consumers have become more aware of what they eat, how food reaches their table and what impact it has on their health. This awareness also applies to seafood, in the form of wild and farmed fish and shellfish, either fresh or processed. Fish producers have to supply a top quality product that is also healthy and safe for consumers.

Goal 1: Maximising health benefits and Goal 2: Highlighting the benefits of eating seafood to the consumer.

The largest project undertaken during FP6 was **SEAFOODplus**, and its objectives were to reduce health problems, to prevent major diseases and to increase well-being among European consumers associated with the consumption of high quality, health promoting seafood products.

Within SEAFOODplus, the aim of RTD *Pillar 1-Seafood and Human Nutrition*- was to determine the mechanisms and physiological processes that proteins and fatty acids found in seafood bring about in the human body; to assess the importance of seafood in diet in relation to lowering the risk of cardiovascular disease, colon cancer, inflammatory bowel disease; and to assess the role of seafood consumption in the promotion of health in young European populations.

- **1.1–FISHGASTRO**-The influence of seafood consumption, particularly of fish proteins, on gastro-intestinal health - results indicate that fish consumption helps overweight young people to lose weight while protecting lean body mass.
- **1.2–YOUNG**-The health effects of omega 3 fatty acids on young people and young families - reported that the intake of seafood had a positive effect on self reported symptoms of post-partum depression.
- **1.3–METAHEART**-The metabolism of omega 3 fatty acids and their influence on heart disease - established that the effect of fish oil on heart health was not as positive as had initially been anticipated and was associated with a lowering of heart frequency. Animal studies gave clearer indications that fish oil may have positive effects in some animals.

A further project addressing specifically health benefits of eating farmed fish is the FP 6 project **AquaMax** - Sustainable Aquafeeds to Maximise the Health Benefits of Farmed Fish for Consumers. This extensive project, focusing on the development of new, sustainable and high quality feeds, comprised 4 major research programs. Within Research Program 2 the health benefits of fish produced on the new feeds were validated through a nutritional intervention study on oily fish



consumption in pregnancy. This study was made possible thanks to the development of tailor-made salmon with minimal levels of contaminants and a high content of omega 3 fatty acids. Results showed that when pregnant women eat two portions of salmon per week, the intake of long chain Ω -3 fatty acids is significantly increased, as well as the levels of selenium and vitamin D. Moreover, they have a higher amount of long chain Ω -3 fatty acids in their bloodstream and in their breast milk. This dietary change can thus enable the mother to supply more optimally these nutrients to the developing baby before and after birth.

Within SEAFOODplus RTD *Pillar 3-Seafood safety*-aimed to make seafood safe for the consumer, by identifying risk factors, avoiding risks caused by viral and bacterial contamination and biogenic amines in seafood.

- **3.1-REFHEPA**-Genetic proof of dangerous viruses - developed and validated standardised real-time PCR assays for both Hepatitis A and Norovirus.
- **3.2-REDRISK**-Risk reduction in shellfish production – identified overflows of untreated sewage due to rainfall as a key sources of viral contamination of shellfisheries. High rainfall events could be used as predictors of viral contamination to form the basis for an early warning system.
- **3.3-SEABAC**-Estimation of risk through bacterial contamination - Real-time PCR and nucleic acid hybridisation assays permit the detection and enumeration of potentially pathogenic strains *V. parahaemolyticus* which could be used to provide early indication of risk to the seafood consumer.
- **3.4-BIOCOM**-Management of biogenic amines in seafood production – Developed an extensive mathematical model for histamine formation and growth. The model included the effects of temperature, salt, pH and carbon dioxide (modified atmosphere packaging) on histamine formation.

Within **AquaMax**, food safety was tackled by Research Program 3 – which focused on the assessment of the safety of fish farmed on the new feeds. Within this program innovative food safety toxicity tests were developed by identifying and characterising signature effects of key toxicants in fish. Moreover, actions of key toxicants and their amelioration by fish nutrients were assessed in developing animals and cultured cells and food safety tests were conducted in animals fed fish farmed on traditional and new feeds.

Within SEAFOODplus, the aim of *Pillar 4-Seafood from source to consumer product*- was to ensure that seafood products of high quality and offering maximum nutritional and health benefits are available to consumers.

- **4.1- PROPEPHEALTH** - High-added value functional seafood products for human health from seafood by- products by innovative mild processing –this project has successfully



developed processes for producing proteins from lean fish. These proteins can be incorporated into fish products to produce functional foods that reduce food intake, body weight, glycaemic index and insulin level.

- **4.2 HURDLETECH** - Hurdle technology (including minimal processing) to ensure quality and safety of convenience seafood. Results show that it is necessary to increase frying temperature to 65 °C in order to eliminate the risk of *Listeria* being present in products of minced desalted cod. Various drying technologies were evaluated for their effect on the level of different pathogenic and spoiling bacteria.
- **4.3 LIPIDTEXT** - Preventing seafood lipid oxidation and texture softening to maintain healthy components and quality of seafood. LIPIDTEXT aimed to improve understanding of the link between protein and lipid oxidation. Results show that lipid and protein oxidation occur simultaneously and that both processes are influenced by the same factors e.g. presence of haemoglobin and temperature.
- **4.4 -CONSUMERPRODUCTS** - Consumer driven development of innovative tailor-made seafood products (with functional components from plant or marine origin) to improve health of consumers. Results of the product preferences indicate that consumer choice was based on the fish product with little importance given to the content claim displayed on the product.

Goal 3: Ensuring the reputation of seafood production

Several projects addressed the need to improve consumer perception of seafood production.

Within Research Program 4 of the **AquaMax** Project, an assessment of public perception regarding farmed fish was conducted by an analysis of the media coverage on this subject and through interviews with experts and focus groups. A framework to communicate the risks and benefits of consuming farmed fish was devised and proactive strategies so as to communicate to the public and other stake holders were developed.

The FP6 **CONSENSUS** initiative looked at the perception of farmed product, within a wider study of fish perception in Belgium, Spain and Norway. The consumer study confirmed previous findings about the image of fish in general as being predominantly positive. The findings clearly indicated that farmed fish matches this overall positive image. Thus, no major problems with respect to the image of aquaculture in terms of perceived sustainability, health, safety, animal welfare, price, quality, convenience and sensory characteristics were detected. In general, consumers displayed only a moderate interest in the farmed or wild origin of fish. The experimental message testing indicated that communicating balanced information to consumers as tested in this study reinforces aquaculture's image in terms of safety, health and sustainability. Whereas direct gains of this type of non-persuasive communication in terms of aquaculture's image might seem rather limited, positive



effects on goodwill and perceived transparency, can be expected, which, over time, are likely to contribute to the positive image of aquaculture and its products.

Other projects addressed **labelling, traceability, current processing methods and standards** and how they can be improved to ensure the reputation of the European seafood production industry. Moreover, EU Regulation 178/2002/EEC on General Food Law requires traceability of a food, feed, food-producing animal or substance intended to be incorporated into a food or feed be established through all stages of production, processing and distribution.

- **FRESHLABEL (FP6)** - Integrated approach to enable traceability of the cooling chain of fresh and frozen meat and fish products by means of tailor made Time/Temperature Indicators (TTI) – developed intelligent labels which change depending on time and temperature and show the "Freshness Level" of food products and can improve cold chain management during transport and storage, can have a role in traceability of food products. TTIs can also reduce waste of food products based on the current estimated "shelf life".
- **CODE-EFABR (FP6)** has created a Code of Good Practice for Farm Animal Breeding and Reproduction Organisations to ensure that animal welfare and environmental standards are maintained. At the start of the food chain, farm animal breeders have a direct responsibility to provide quality genetically improved livestock (cattle, pigs, poultry, and fish) to farmers. They indirectly influence food safety and public health, product quality, efficiency, environment, animal health and welfare, and genetic diversity.
- **FLABEL (FP7)**-Food Labelling to Advance Better Education for Life- aims to determine how nutrition information on food labels can affect dietary choices, consumer habits and food-related health issues.
- **MYCORED (FP7)**-Novel integrated strategies for worldwide mycotoxin reduction in food and feed chains - aims to develop solutions to reduce mycotoxin contamination in economically important food and feed chains.
- **CONFIDENCE (FP7)**-Contaminants in food and feed: inexpensive detection for control of exposure
- **SENSBIOSYN (FP7)**-Biosensors and Sensors for the industrial biosynthesis process of widely used commercial antioxidants: nutraceuticals as additives for food and aquaculture promoting public health and safety. The purpose of this project is to develop sensors and biosensors for on-line monitoring growth parameters of algal biomass and their bioactive compounds produced by large scale systems, with a particular focus on a group of relevant industrial processes for the natural synthesis of antioxidant Xanthophylls.



Goal 4: Improving product quality

This has been divided into two areas of investigation which effect product quality directly and indirectly, Harmful Algal Blooms and Access to new technologies.

Monitoring toxic algae in European waters is subject to the EU Directive, 91/1491/CEE. Several projects aimed to address the shortcomings in monitoring, detection and mitigation measures after a HAB event and included **ALGADEC, HABIT, ESTTAL, BIOTOXMARIN and BIOTOX**.

- **HABIT (FP6)** gathered new knowledge on the effects of various physical processes involved in the distribution of HAB layers and developed new sampling techniques. These findings have increased the ability to predict HAB events and extended the event forecast range.
- **BIOTOXMARIN (FP6)** developed new methods for the fast, simple and cost-effective marine biotoxin detection for seafood and patient sera and which will allow their quantification. The strategies developed to raise antibodies for diarrhetic shellfish poisoning (DSP) toxin can be applied to other relevant groups of toxins causing paralytic shellfish poisoning (PSP), neurotoxic shellfish poisoning (NSP) and amnesic shellfish poisoning (ASP).
- **ESTTAL (FP6)** contributed to the understanding of genetic regulation of algal bloom formation and growth in response to environmental stimuli. It provided a data-set that will allow a better understanding of formation of HABs and the molecular basis of toxin production. Understanding the factors influencing toxicity will ultimately assist in prediction of the magnitude and environmental consequences of specific HABs - an important element of an early warning system.
- **BASELINE (FP7)** - Selection and improving of fit-for-purpose sampling procedures for specific foods and risks. The overall objective is to provide harmonised and validated sampling strategies, to enable the collection of comparable data to improve quantitative risk analysis of selected biological and chemical agents.

Fishing, aquaculture and the seafood industry in the Mediterranean region are mainly the preserve of small traditional companies and as such access to new and emerging technologies ensuring delivery of a high quality and safe fish and shellfish products can be a limiting factor for innovation.

- **ERMES (FP6)** provided the link between small producers and sources of technology and innovation. The main aims of the project were to facilitate access to Research and Development activities and new technologies for smaller companies in the Mediterranean region.

Future needs:

Greater access to information and technology was considered a main issue to be addressed in the future be it in the form of more dissemination of the use of TTIs and an investigation of industry and



consumer acceptance of TTIs would help to understand the limiting factors affecting their widespread implementation. ERMES established that the needs of SMEs in the aquaculture sector are oriented towards technology transfer and innovation rather than RTD. Knowledge transfer was the core need of the sector and must be addressed in the future. SMEs must be able to access new developments and be given adequate support in application of new technologies.

Uptake of the Code of Good Practice for Farm Animal Breeding and Reproduction Organisations is currently on a voluntary basis and policy needs to be reviewed before the code can achieve its full potential.

European research in the field of HABs needs to be integrated but the effort of these projects will assist in standardising methodologies of gene expression, microarray development, organism biology and toxin detection. More research is needed to further develop detection methods and to determine detection sensitivity. The comparative approach to sequence data-base analysis will allow for considerable standardisation in methods and protocols for identification and predicting HAB events.

A full list of the projects undertaken in Thematic Area 1 - Product quality, consumer safety and health can be found in the Annex. More detailed information is provided in the Technical Leaflet (TL) describing the main outputs and deliverables of each project.



Thematic Area 1: Product quality, consumer safety and health

F.P.	Acronym	Project Title
6	ALGADEC	Development of rRNA-Biosensors for the detection of Toxic Algae
7	BASELINE	Selection and improving of fit-for-purpose sampling procedures for specific foods and risks
6	BIOTOX	Development of cost-effective tools for risk management and traceability systems for marine biotoxins in seafood
6	BIOTOXMARIN	Development of novel analytic tools for the detection of marine biotoxins
6	CODE-EFABAR	A Code of Good Practice for farm animal breeding and reproduction
7	CONFIDENCE	Contaminants in food and feed: inexpensive detection for control of exposure
6	ERMES	European research for Mediterranean seafood
6	ESTTAL	Expressed Sequence Tag (EST) Analysis of Toxic Algae
7	FLABEL	Food Labelling to Advance Better Education for Life-
6	FRESHLABEL	Integrated approach to enable traceability of the cooling chain of fresh and frozen meat and fish products by means of tailor made Time/Temperature Indicators (TTI)
6	HABIT	Harmful algal blooms species in thin layers
7	MYCORED	Novel integrated strategies for worldwide mycotoxin reduction in food and feed chains
6	SEAFOODplus	Seafood for a better life (A separate TL is provided for each of the main research pillars)
7	SENSBIOSYN	Biosensors and Sensors for the industrial biosynthesis process of widely used commercial antioxidants: nutraceuticals as additives for food and aquaculture promoting public health and safety.