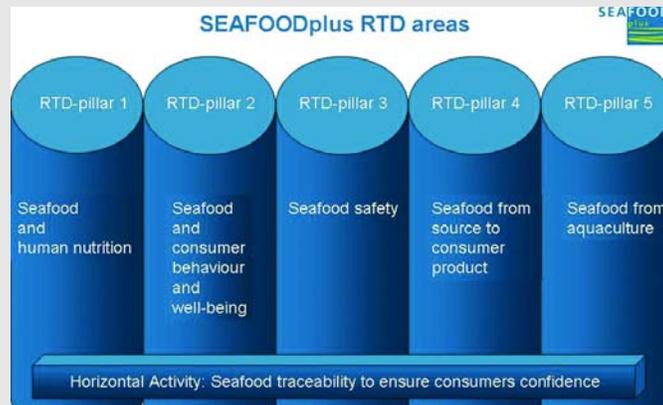


Seafoodplus – RTD Pillar 4: Seafood from source to consumer product

# Safe, nutritious, healthy products that are a pleasure to eat

RTD Pillar 4 is a kind of patchwork project. It unites various studies which can be summed up under the heading 'health, safety and product quality'. This project focuses on enhanced utilization of raw materials, as on new methods for making seafood products safer, more nutritious, and healthier. This also includes a better understanding of the elementary processes that occur post mortem within the fish fillet. The researchers also want to give the products a higher nutritional and health value through their enrichment with particular substances, similar to in functional food.

There are two general trends that currently dominate the seafood industry. The first is the scarcity of natural resources, for the stocks of a lot of the commercially significant species have reached their limits. For this reason no mentionable catch increases are to be expected. The second trend is the dynamic development of world-wide aquaculture. Not only is production volume rising but also the number of farmable species is increasing yearly. It is ultimately aquaculture that we can thank for the fact that per capita consumption of the growing world population during the last decade re-



Seafoodplus is subdivided into five strategic clusters which constitute the pillars upon which the overall project rests. The clusters are termed RTD pillars, short for Research and Technology Development Pillars. Each of the individual projects deals with an exactly defined content and topic and can be allocated to at least one of these pillars. A sixth area, which covers traceability issues is, in contrast to the vertical pillars, designed horizontally because it concerns all the RTD pillars.



Eurofish Magazine will carry a series of articles that will profile each of the pillars and the sub-projects under each pillar that together comprise the Integrated Project Seafoodplus. The articles will also be available from [www.seafoodplus.org](http://www.seafoodplus.org), the Seafoodplus website.

maintained almost constant despite stagnating wild stocks.

Strictly speaking there is a third trend, too, that influences today's seafood market. It is the increase in value adding of the raw materials, for more and more seafood arrives on the European market in processed form. Convenience products are enjoying growing popularity and are boosting seafood consumption because they are boneless and easy to prepare. But the constantly rising demand for fillets and other consumer-friendly products also means that only part of the raw material is put to commercial use. Yield is particularly dependent on the fish species and the size of the individual fish. Although in salmon, for example, the fillet accounts for a share of about 60 per



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cent, it is not even a third in the case of redfish. What remains once the fish has been filleted is usually processed to fish meal and fish oil. But in fact this is squandering raw materials for the latent value potential of what is considered byproducts is not being fully utilized. For it contains valuable raw materials that are currently not sufficiently utilized and whose health value is often not even known. The substances include bioactive peptides, n-3 lipids, nucleotides, collagen, gelatine, chitosan and mucopolysaccharides. In the context of the Seafoodplus project, groups of international researchers will now be investigating the health value of some of these substances with focus on bioactive peptides. Perhaps some of them will be utilizable for special foods to achieve specific health effects.

### Products that meet the consumer's wishes

A further project in RTD Pillar 4 is concerned with convenience products which are entering the retail sector in ever increasing numbers throughout Europe. These products are only lightly preserved and have a short shelf-life. These products always constitute a certain risk, however, because they can be contaminated with pathogenic bacteria. The processing industry has a number of different methods for minimising and preventing growth of undesired bacteria. Newly developed methods that are considerably more effective and can be dosed more accurately are to be tested in the course of Seafoodplus. They include, for example, anti-microbial active packaging or the use of non-thermal treatment – with the help of pulsed light, for example. This enables considerably better control of undesired bacteria which are either

deactivated or destroyed.

The fresher a seafood product is when it is placed on the market, the higher its acceptance among consumers. With every day that passes up to its sale, product quality and price decrease. And no wonder, for with increasing age the products often become rancid, the fish loses its firmness, and the texture becomes soft. And these are only the external effects, the ones the experienced consumer can perceive with his senses. As the seafood ages, various processes take place inside the fillet, too, and these progressively reduce the value of the product. Through oxidation with the oxygen in the air, for example, the quality of n-3 lipids is reduced. On the one hand, this reduces the health value of the product for the consumer and, on the other hand, chemical processes within the fillet are also triggered that can change the product in varying degrees. Fatty acids, for example, can be changed into radicals and hydroperoxides by oxidation. As metabolism continues these turn into hydroxyalkenal and aldehydes which are very reactive and, among other things, influence the activity of enzymes and proteins. Enzymes are responsible for the fact that the quality of the fish changes after slaughtering, for example. Up to now, the softening of the fillet was mainly thought to be the result of two groups of enzymes, so-called proteases: cathepsins and calpains. In the meantime, it is known that there are also other groups such as the protease 20S proteasome which play an important role here, too. But we still don't know anywhere near enough about the processes that influence the sensory qualities and nutritional value of seafood products. In an extensive project within this pillar the re-

searchers will shed light on essential connections in this context.

### Additional value adding through functional food

The fourth project in RTD Pillar 4 of Seafoodplus is concerned with the production of tailor-made seafood products that offer the consumer an additional benefit on top of the health value that exists naturally in the product. Similar to functional food, where vitamins, minerals or other substances are added selectively to foods, appropriate techniques are to be used to modify seafood to offer consumers enhanced health benefits. One worthwhile starting point, for example, is the content of n-3 lipids which, although they have a decisive effect on the health value of seafood products, are also unfortunately very susceptible to oxidation. Through the addition of special dietary fibres during processing it would be possible to delay or even prevent lipid oxidation. Such dietary fibres with anti-oxidative effect can be won from both marine and plant raw materials, for example from vegetables. They do not only protect the valuable fats in the fillet but also act as roughage. Other possibilities arise from feeding regimes at aquaculture facilities. If, for example, substances like Selenocysteines that are to be found in allium plants such as onions and garlic are mixed into the feed this might raise the health value of the farmed fish even further. The preventive effect of such substances against cancer seems to be already proven but will the substances still be found in the resulting fish fillet? The researchers hope that this idea may lead to new functional seafood products with a higher nutritional and health value. The development of such

products is part of the project. But before the first functional seafood products arrive on the consumer's plate there are several problems to solve and a lot of questions to answer.

### The following outlines the four central projects of RTD Pillar 4 of Seafoodplus:

#### Project 4.1 Propehealth High-added value functional seafood products for human health from seafood by-products by innovative mild processing

This project has several objectives. First of all the researchers want to scan the byproducts produced during seafood processing with modern, improved isolation techniques in order to discover 'new' substances that might be of health value. This will presumably lead to a whole catalogue of substances that, in addition to substances that are already known, will probably contain some new components. Which of them are 'bioactive' and may be useful in the production of functional seafood products will be investigated in subsequent tests. Prior to possible use it has to be clarified exactly what the benefits of the substances actually are and whether they might have a detrimental effect on a product's physical or sensory qualities. The last stage of this project will entail the practical application and testing of the substances. The focus here will be on the development of new functional seafood products. This will either be pursued jointly with a suitable partner from the food industry (apart from 7 research institutes there are also 3 small and middle-sized companies taking part in this project) or in co-operation with participants from Project 4.4.

**Project 4.2 Hurdletech**  
**Hurdle technology (including minimal processing) to ensure quality and safety of convenience seafood**

One of the main objectives of this project is to guarantee product safety and quality of convenience products. To this end, the researchers will initially examine what are the main sources of bacterial contamination during production processes. Next, they will analyse what effect different processing stages have on bacteria and their survival. For example, what influence do industry-specific types of processing such as salting, drying, smoking, acid-ripening or freezing have on the number and survival of the bacteria? The experiments will mainly concentrate on two product groups: lightly preserved fish products and convenience products. Lightly preserved products, in particular, constitute a high risk of contamination because they are mostly produced from fresh raw materials and the processing they undergo is often not sufficient to destroy pathogenic bacteria. The problems are different in the case of convenience products. Here, salt processed or dried raw materials are often used in which individual pathogenic bacteria can survive processing and then recover and develop rapidly – particularly since convenience products are often not sufficiently heated but only warmed in the microwave. In a further sub-project the researchers will examine what methods can be used to reduce bacterial contamination and prevent growing pathogenic and spoilage bacteria more effectively. The focus will be on active packaging and anti-bacterial effects.

**Projekt 4.3 Lipidtext**  
**Preventing seafood lipid oxidation and texture softening to**

**maintain healthy components and quality of seafood**

In this project the researchers will be investigating ways of maintaining the sensory quality and nutritional value of seafood products. They will be looking for ways to secure and maintain a large number of qualities: colour and smell, meat texture, n-3 lipids, maximum content of anti-oxidants, and minimum content of oxidation products which are potentially toxic. At the centre of the tests will be various seafood products ranging from fresh and frozen filets to special products that are enriched with fish oil. In preliminary analyses the researchers hope to clarify which basic processes influence sensory qualities and nutritional value and which role is played by changes in the lipids and proteins that occur in the meat after the fish's death. The focus will be on lipid oxidation (rancidity) and changes in texture. In some of their studies the participating researchers will co-operate closely with other projects from Pillar 4 and 2. Although this Project sooner belongs to the field of pure research (one of the topics is the kinetics of enzymatic processes) it is expected that there will also be substantial practical results. For example, methods for the effective use of anti-oxidants will be tested to identify particularly effective substances. Research institutes from Denmark, Sweden, Spain, France, Norway and Iceland are participating in this project, together with Unilever as a partner from industry.

**Projekt 4.4 Consumer products**  
**Consumer driven development of innovative tailor-made seafood products (with functional components from plants or marine origin) to improve health of consumers**

The main aim of this project is the development of functional seafood products from capture and farmed fish. These products will be enriched with health promoting components in order to achieve specific effects. For example, to have a positive influence on the health of the bowel, to improve lipid metabolism, and help to prevent certain forms of cancer. Some of the planned substances even have several effects. Certain dietary fibres, for example, may protect the valuable polyunsaturated fatty acids found in fish against oxidation and simultaneously act as roughage. In order to achieve the ambitious objectives of the project, researchers from different fields will be co-operating in a multidisciplinary team. The basic idea is simple. It is assumed that consumers

desire functional products with additional benefits, that they desire products with a high convenience grade, and that they desire products which are easy to prepare. During the course of their investigations the researchers will play through different variants to get as closely as they can to this goal. Starting with the best raw materials available, they will test how products change during processing, how it is possible to maintain the best quality and flavour qualities. In order to give the product additional benefits the possibilities for incorporating functional substances such as Se-(alkyl)selenocysteines via garlic in the feed during farming fish will be studied. Health claim studies and industrial implementation are the last part of this project. **MK**



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