

Draft Strategic Research Agenda

Introduction/Scope

The scientifically demonstrated beneficial effects of seafood have led the European authorities to establish recommendations to increase its consumption.

Increased dietary seafood intake protects against the development of cardiovascular diseases (CVD), and may provide beneficial developmental outcomes for foetuses and infants. Seafood has also been associated with protection against, or symptom alleviating effects, for Alzheimer, type 2 diabetes, obesity, inflammatory bowel diseases, rheumatoid arthritis, ADHD and various psychological conditions. Building on the proven health effects of seafood consumption, and the pan-European governmental advice to increase the seafood intake, one may exploit these as means to promote the industry.

The European aquaculture industry holds a dominant position when it comes to utilization of technology for the benefit of the consumer regarding food safety. Methyl mercury (me-Hg) and persistent organic pollutants (POPs) are currently considered to be the most prominent contaminants in seafood, but because aquaculture allows control and surveillance of the feeds, the cultivated organisms and the environment, the industry have the possibility to tackle these challenges. Microbiological hazards represent a potential threat to seafood as for all types of foodstuffs. In close cooperation with other food producers, ways to further improve the control of pathogens should be developed.

It is of paramount importance that the industry maintains its high standards on food safety issues and complies with the EU regulatory requirements in all regions of the world where it sources products. This will become increasingly important within the globalized market for feeds and seafood products. Whereas other regional aquaculture industries may not have to comply with such strict food safety regulations, the European industry must have high standards of food safety and robust defences in place to counteract negative attention, should issues arise from less controlled farming environments.

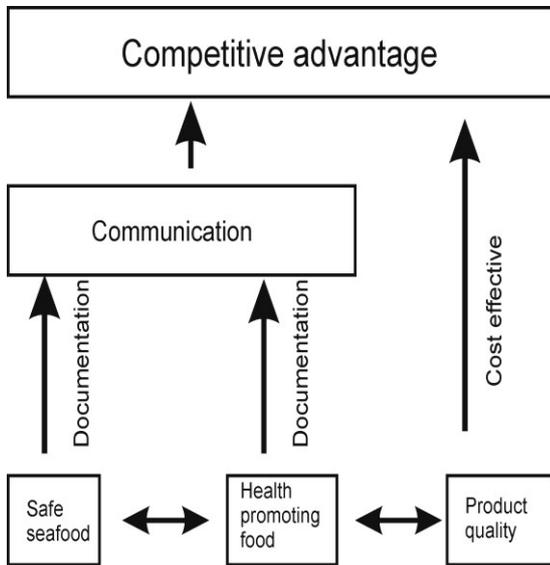
The European aquaculture industry delivers safe and healthy food to the market, but must, in addition, improve its reputation by communicating that seafood farmed to European standards is produced responsibly. A challenge is to provide the general public, media, NGOs and authorities with relevant documentation about the safety, healthiness and production methods of European aquaculture and products produced to the same standards in other countries. It will be increasingly important to understand the public's concerns and amend its message accordingly to achieve the desired impact.

Competitive advantage

The scope of the EATIP is all aquaculture products sold in Europe, not just those produced in Europe. But one of our objectives is to enhance the competitiveness of products farmed in Europe. Being a global leader in technology development and innovation, the European aquaculture industry holds a competitive edge. Maintaining the competitive advantage is particularly important within seafood safety. However, we must bear in mind that European aquaculture products in general tend to be more expensive than terrestrially farmed protein sources. It is therefore imperative that the industrial research is tailored to ensure that it adds value, not simply cost.

Research projects should be prioritised by weighing the potential benefits for the consumer and needs for the industry against project cost and the cost of implementing the new technology and innovations in the industry.

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Sustaining and building a competitive advantage through the production of high quality, healthy and safe seafood is imperative. Having documentation and communicating these, as well as being cost-effective are prerequisites for this aspect.

Goal 1: Maximising the health benefits

Much of the increase in seafood consumption in Europe is due to the influx of ethnic groups where seafood plays a more significant part in the diet. Despite this influx, the current seafood consumption across Europe is 16 – 17 kg per capita, yet scientists believe Europeans need to consume at least 23 – 24 kg / capita to achieve the benefits provided by fish. The most significant benefits can be achieved by introducing seafood to the consumers who don't currently eat it.

Research into food and health is a shared responsibility for scientific communities, governments and food industries. The fact that aquaculture products are found to deliver significant health benefits is possibly the best sales argument that the industry possesses. The industry should therefore continue to contribute to further documentation of its most powerful marketing tool.

Major research challenges

a. Seafood as an efficient provider of Long Chain n-3 Polyunsaturated fatty acids (LC n-3 PUFA's)

The health benefits of long chain fatty acids in fish are starting to appear on the 'radar' of mainstream consumers but could benefit from a clearer unambiguous message. The contribution of seafood to cardiovascular health is strongly supported by epidemiological data. Most clinical studies are conducted with n-3 supplements, but few clinical studies assessing consumption of seafood as such have been conducted. Nevertheless, health effects are more pronounced in studies assessing seafood compared to n-3 supplements. The precise physiological mechanisms behind the beneficial effects are not fully elucidated. Additionally, beneficial effects on other diseases than CVD have become more evident in recent years. Further documentation on health benefits and the mechanisms behind for all relevant diseases and conditions will fortify the status of seafood as a healthy food choice.

Outcomes

- Human clinical trials where health effects of seafood intake is evaluated against n-3 supplements
- Establishing by which physiological mechanisms seafood components act to promote human health
- Further documentation on CVD, metabolic syndrome, type2 diabetes, brain health, inflammatory diseases, etc

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b. Health effects beyond the LC n-3 PUFAs

There is more to seafood than LC n-3 PUFAs, and identifying and documenting benefits of seafood derived components beyond the n-3 will strengthen the already existing data that supplements cannot fully replace seafood as a source for important nutrients.

Outcomes

- Identifying bioactive components
- Documenting health effects of bioactive components

c. Understanding species diversity

Seafood has a large variety in terms of species and the nutritional content. This applies to both farmed and wild, fresh-water and salt-water species, and cold-water and warm-water species. With the increasing competition from, and growth in production of low-cost species such as tilapia and pangasius, it will be necessary to differentiate between species in terms of health promoting effects. Moreover any given species can be farmed in regions where controls maybe less stringent than in Europe and marketed as authentic European products. The nutritional profile of all species, or of a given species but cultivated under different environmental conditions, do not need to have the characteristics that are considered to be health beneficial.

Outcomes

- Documenting the health effects of cultivated seafood depending on their native water temperature and salinity
- Documenting health effects of lean vs. fatty cultivated seafood
- Documentation of the origin of production of farmed products

d. Optimising the nutritional content of aquaculture products

The industry has gained experience and acquired in-depth knowledge on how to feed and grow their products. Aquaculture allows the potential to increase and optimize the nutritional contents of seafood, but such an approach must be balanced against cost, sustainability, quality and other important factors. Assuming that it is economically viable and that physiology permits, nutrients such as vitamin D and B12, selenium and iodide amongst the minerals and taurine amongst the bioactive components, may be enhanced. Post harvest processing influence nutritional content in aquaculture products, and means to reduce losses during processing should be investigated.

Outcomes

- Maintaining or improving health benefits from aquaculture products through alternative feed formulations and feeding regimes, with the potential of product enhancement.
- Understand how feed formulations will affect the presence of bioactive components in various species.
- Understand the effect of post harvest processing on nutritional profile – minimising losses of nutrients
- Develop models on how breeding conditions affect content of nutrient and bioactive compounds

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e. Alternative sources for LC n-3 PUFAs and marine proteins

LC n-3 PUFAs including EPA, DPA, DHA, and marine proteins for use in fish feed are limited resources and there is a growing need to find alternative sources for these nutrients. The sources must be sustainable and affordable. The expected development of transgenic and other genetically modified crops and its potential use in feeds must be evaluated in every aspect.

Crustaceans (arthropods) and seaweed may serve as new natural sources. The use of bioreactors with n-3 producing algae or bacteria needs further development, both regarding biological output and cost-effectiveness, compared to natural sources.

Research into alternative feed sources must be undertaken in cooperation with the thematic area "Sustainable feed production".

Outcomes

- Understand the potential for the utilisation of crustaceans and kelp
- Understand benefits and risks of using genetically modified plant crops
- Evaluated and developed bioreactors

f. Bespoke seafood products

A new trend in the food industry is bespoke food products, i.e. development of products targeted to specific market segments or consumers that are perceived to benefit the most. There are emerging markets for high quality farmed fish using novel feeds and specific growing conditions but the effects of these on product flavour and texture is not fully understood. In the future the emerging technologies within the study of how diet, health and genetics intersect and interact – "nutrigenomics" – may be perceived as an opportunity for the industry. This demonstrates how personalized nutrition can get.

Crafting diets for subpopulations of people seems important only to some extent at present. But in the future, creating products for people of given genetic predispositions and other personal and environmental factors will have great effects on quality-of-life indicators and life expectancies

Outcomes

- Consumer research that defines the requirements for specific sectors of the community.
- Specifications for the bespoke products in terms of quality parameters and nutritional profiles.
- Determine the feed specifications and growing conditions required to deliver the targeted product specifications.

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Goal 2:

Highlighting the benefits of eating seafood to the consumer.

Recent risks-benefits analyses have concluded that the benefits of seafood consumption by far outweigh the risks. Aquaculture provides reassurance to the consumer because the feed is controlled and the environment is monitored. If the industry develops and applies more effective methods to identify and manage real and perceived risks, the consumer's attention will more effectively shift onto the benefits of eating aquaculture products.

Major research challenges

a. Perceived existing hazards

Possible risks connected to seafood consumption and methyl-mercury are frequently mentioned in the press. Bacterial contaminations will always be a potential threat, and whereas food borne human parasites are currently not a problem in European aquaculture, the problem may arise with farming of new species or under certain conditions. Shellfish producers experience problems with marine algae toxins, and systems to monitor levels of these algae and deal with the risk should be improved. Where irrefutable evidence exists regarding risk, this should be communicated in a public friendly manner to prevent scare mongering. It is crucial that the scientific community develop common views, and target research to establish these.

Outcomes

- Clarified situation and allayed fears
- Efficient monitor and risk management of marine algae toxins in shellfish
- A mapped virulence of relevant bacterial pathogens, such as *Listeria monocytogenes*, in processed seafood
- Developed new rapid and user-friendly test methods

b. Potential new hazards

Environmental levels of dioxins, PCBs and PCB-like dioxins are falling, whereas other environmental contaminants, i.e brominated flame retardants (BFRs) and per- and poly-fluorinated substances (PFAS), levels are increasing in the environment.

At this stage no transgenic fish are in commercial production, but this may occur in the future. Testing procedures must be implemented to ensure public health is not compromised. The introduction of new production methods, including the use of genetically modified ingredients and new materials based on i.e. nanotechnologies and nanomaterials, could result in the formation of new or modified molecules in the edible part of the species. This could create new risks related to allergens, or exacerbate the effect of existing allergens. Any issues should be identified before the product reaches the market to prevent negative PR for such developments and for the industry as a whole.

Outcomes

- Evaluated transgenics both as new production technologies and as ingredients
- Identified any novel allergens
- Identified any mycotoxins in vegetable feed
- Understand risk from contamination with Brominated flame retardants (BFRs)

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c. A traceable and transparent complete production chain

Although the traceability of feed is established from a capture fishery perspective there are still risks in the aquaculture supply chain in developing countries. It will be essential to raise customer confidence in the integrity of the supply chain. This can be achieved by the implementation of systems with accurate and reliable product labelling, for instance to identify authentic European aquaculture products, or products grown under specific production controls.

Outcomes

- New and improved transparent systems to trace feed ingredients and farmed products.
- Avoid fraud / falsification by new methods and application of existing methods to identify provenance
- Common and simple standards for labelling.

d. Risk assessment on residues

Residues can be incorporated into aquaculture products from different sources. These can be through permitted treatments with controlled residue levels, as contaminants from the environment and/ or feed and through substances used or developed during growth or processing (legal & illegal). As new detection systems develop, the level at which these residues can be picked up becomes lower. These new technologies can also lead to false positives. While advancements in technology should be welcomed especially if they are in the public interest we must be aware of the often significant impact these 'news' stories can have on the industry.

Outcomes

- A protocol for management of false positive analysis results

Goal 3: "A high reputation"

A key challenge for the industry is to strengthen its reputation amongst the general public. There exist some myths and fears about aquaculture in general, but European aquaculture complies with strict regulations and is produced responsibly. The industry has to improve the communication with the public to transmit this information, in particular regarding issues on health benefits, seafood safety and responsible production practices.

Major research challenges

a. Clear recommendations and guidelines

The public should be further enlightened about the benefits of eating seafood, and clear recommendations and guidelines should be developed.

Outcomes

- Clear and simple recommendations applicable to everyone
- Held information programs and campaigns to inform consumers about health benefits of seafood consumption.
- A strategy to target specific groups who can benefit most from increased fish consumption
- A coherent, easy to understand, "traffic light" labelling system which inform consumers about the nutrition and healthiness of products, and that they are sustainable and responsibly farmed

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b. Overturning the prejudices

The industry and its allies must actively work on overturning the prejudices of farmed seafood. The risk of consuming fish farmed to European standards is negligible, and this message must be forwarded to the public in multiple ways. We must attempt to create 'clear blue water' between well controlled aquaculture products and products that are not as stringently controlled. Create an environment where safe / healthy aquaculture products are recognised and valued by the consumer.

Outcomes

- Overturn the prejudices against farmed seafood

c. Raising confidence in European farmed seafood.

Food safety issues for aquaculture products are in general infrequent. Nevertheless, food scares have a significant influence on consumption, and the subsequent sales recovery is slow. The reaction of the consumer is often disproportionate to the risk, and the industry must become more confident in terms of what constitutes a risk, and deal with issues in a timely and professional manner should they occur.

Outcomes

- A 'brain bank' of nominated scientific experts / opinion formers who can provide accurate information to the industry when inaccurate negative stories are published

d. Perception of food safety and risks

Consumer attitudes and perceived risks are constantly changing, and it is important for the industry to have updated and detailed knowledge about what the consumers know, what they desire and what innovations they will accept.

Outcomes

- Consumer studies

Goal 4: "Product quality"

This research area has the potential to be very broad and detailed, but it is imperative that the definition of quality is the consumer's definition and not that of the industry or academics.

Major research challenges

The major challenge here is to ensure that any development really is in the best interests of the consumer. Thus, systems must be in place to independently police the industry, while cost saving developments must not compromise the quality or nutritional integrity of the products. Attempts at product differentiation must deliver quantifiable improvements., which is essential for the industry to retain its credibility. The consumer looks to us to look after their best interests and it is essential that we do so.

a. Texture and quality as affected by farming conditions

Amendments to breeding programmes, feeding regimes, feed composition & processing techniques, providing commercial advantage will have been developed to have a minimum impact on quality characteristics which can be measured by processors. These same developments can have a significant effect on texture & appearance key sensory characteristics used by the consumer or even nutrient content / bioactive compound content which impacts the broader issue of human health.

Outcomes

- A quality standard for each farmed fish species to act as a benchmark, to be used as a guide ensuring that any production led developments do not result in a deterioration of product quality below the established standard.

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b. Consumer Sensory studies

There is limited understanding in terms of what the consumer wants. It is possible to invest heavily in a concept which is beyond the comprehension of anyone but a trained food scientist

Outcomes

- Establish what the consumer perceives in terms of product quality for each aquaculture species and type of product, be it colour, texture flavour, fat content. Establish the customer's tolerance on these issues e.g. what level of change would be considered significant & develop a scoring system. This information can then be used to develop product differentiation (good, better, best) or product improvements.

c. New products based on farmed seafood

The traditional image of farmed fish is not stimulating the consumers to increase the consumption. Thus, the development of new products, not compromising the quality or nutritional value, especially ready to cook or ready-to-eat products could be a challenge. So, a new generation of fresh or frozen headed, gutted, sliced and filleted products, spiced or not, presented in pouches for families with different sizes may be perceived as an opportunity for industry.

Outcomes

- Set up of a number of products to satisfy the actual consumer's demand, using traditional or emergent fish technologies.

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