European Organic Aquaculture - Science-based recommendations for further development of the EU regulatory framework and to underpin future growth in the sector

Deliverable D3.2

Farm economics and competitiveness of organic aquaculture

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1 Summary

The aim of this study is to improve our understanding of the economics of organic aquaculture production and the competitive position of organic aquaculture products in EU markets. This study builds on former studies on farm economics for organic aquaculture and contains to date extensive calculations on organic aquaculture. Costs and benefits analyses is performed for the farm and chain and how these affect the competitiveness of European organic aquaculture.

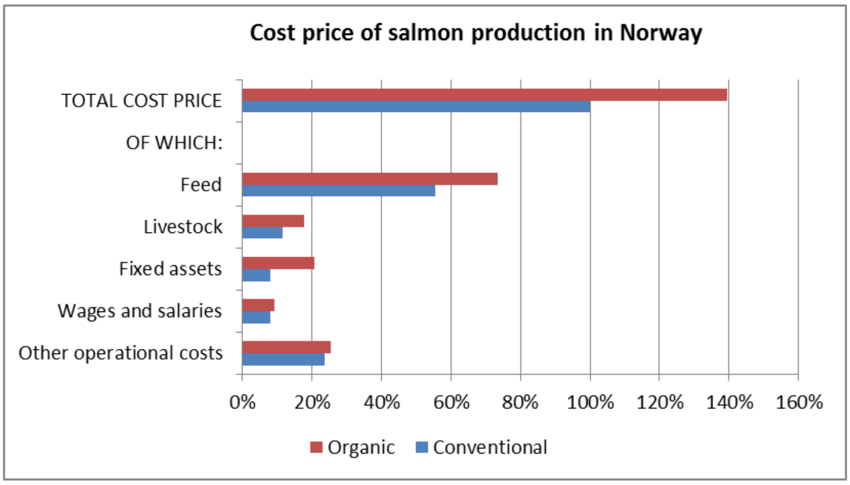
1.1 Literature research

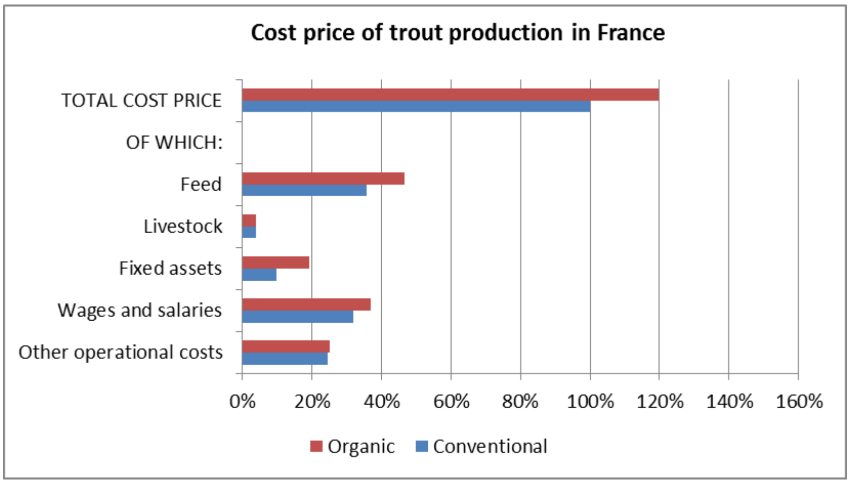
Ample research is available on costs and benefits for organic aquaculture. Only a few studies report quantitative results particularly on the production costs and in particularly feed. These are of course the main issues when changing production to an organic system. More information is available on the qualitative aspects but the costs that will be involved for these issues will be very specific and related to the site, production system, fish species, and country. There is an urgent need of statistics within organic aquaculture production.

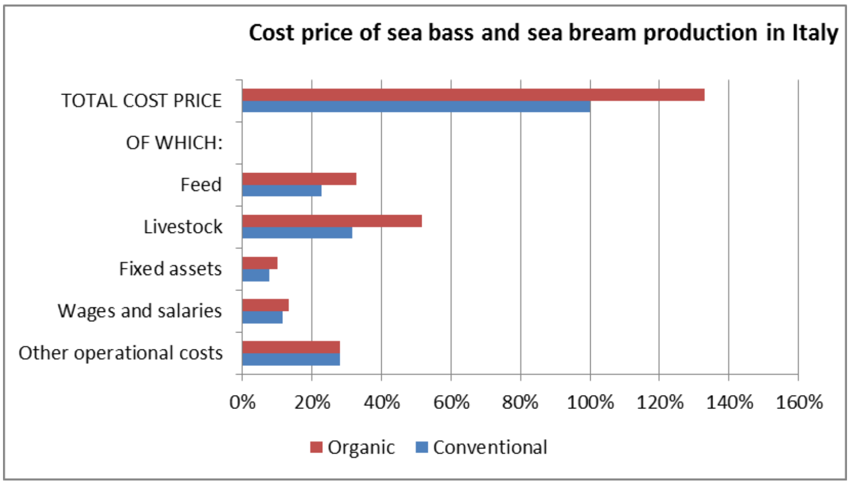
1.2 Farm economics

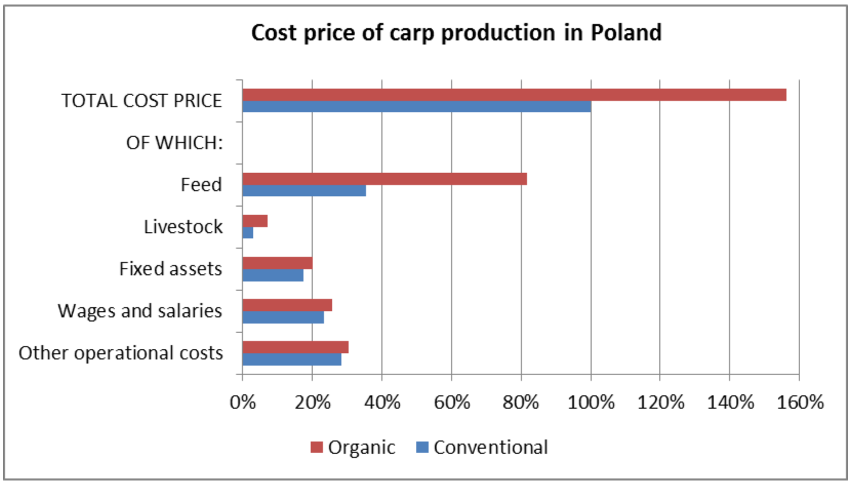
The assessment of farm economics in this report is based on the estimated differences regarding costs between organic and conventional aquaculture. Economic farm data for conventional aquaculture are available from several sources: the STECF database for most species, the Fiskedirektoratet Norge provides data for the Norwegian salmon production, Turkovski and Lirski published the profitability of the Polish carp sector and the Landesfishereiverband Brandenburg provides a model for the carp production in Germany. For the three most important producing countries for each specie (as far as data are available), the transition from conventional to organic aquaculture is simulated. The needed price- and quantity indices are quantified by three kinds of information sources: literature, expert knowledge and workshop results.

The outcomes of the simulation model show that the cost prices for organic aquaculture production will rise by about 20% to 50%, depending on specie and production region. This is illustrated in the figures below, in which an example is given for each studied specie. Generally, the feed costs are responsible for the largest contribution to the higher the cost price of organic production, followed by the costs for juveniles (if available) and the costs for the fixed assets.









1.3 Costs of organic fish production from pond to plate

In order to get insight in the costs in the supply chain, fish processors were interviewed and consumer prices were collected for 18 different retailers in 12 European countries.

The results show that not only the costs of organic fish production on farm level are higher, but also the margins for processing and retailing. The main reasons for these higher margins are:

- Demand and supply do not always match: processors sometimes have to sell salmon as conventional product (and price);
- The relatively much smaller selling volume, which raises the costs per unit;
- The turnover rate in the supermarket is slower;
- (Limited) extra certification costs in the chain.

The found consumer prices for organic fish appear to be about 50% higher compared to conventional farmed fish products.

1.4 Competitiveness of European organic aquaculture

Organic aquaculture entails large challenges to deal with public and private standards, issues involved in feed and production, as well to market these products against premium prices. These are major hurdles that make the threat of new entrants not very likely and development of the branch a more evolutionary process. Especially sourcing organic feed at the national or local level can be a serious obstacle for start-ups in developing countries. Furthermore, local resources are preferred by standard organisations, therefore local knowledge is a necessary asset to deploy organic aquaculture activities. Retailers throughout Europe will play a pivotal role in the development of the market for organic aquaculture products. The extent retailers will be committed to organic aquaculture differs particularly because organic fish is mainly used as an instrument to work on reputation and how it fits with the customer interest. Hence, as the market for certified aquaculture is still developing. Organic standards from outside the EU that have lower security and therefore cost as well as less stringent standards than organic ones are serious competitors as these might fit more in their customers' needs or might be better known.

2 Objectives

The overall aim of WP3 is to collect and review available information on economic, market and consumer related issues, and regulatory and institutional frameworks related to organic aquaculture.

The specific objective of deliverable D3.2 is to improve understanding of the economics of organic aquaculture production and the competitive position of organic aquaculture products in EU markets

This study builds on former studies on farm economics for organic aquaculture. Cost and benefit analyses are performed for the farm and chain and their influence on the competitiveness of European organic aquaculture is assessed.

3 Introduction

3.1 Aim of the deliverable

The aim of D3.2 of the OrAqua project is to improve our understanding of the economics of organic aquaculture production and the competitive position of organic aquaculture products in EU markets. This deliverable contains reviews of reports and scientific articles related to socio-economic issues in organic aquaculture. Additional data were collected to perform the main analyses. The extensive network of the consortium partners was used to collect economic production data for specific production systems. This deliverable consists of four parts:

- A review of the business economic aspects of organic production and expected revenues in the EU. These will include the true costs and benefits of certification initiatives at the level of primary production and in the supply chain, based on previous studies and internal reports of certification initiatives.

- The economic analysis of the competitiveness of the organic aquaculture in the EU based on previous and on-going projects. This will involve analysis of the cost price of aquaculture products structure.
- A review on the extent to which organic certification initiatives compete with other certification initiatives for aquatic products. Particular attention will be paid to the competitive position of European organic aquaculture compared to imported organic aquaculture products (e.g. Asia and South America).
- Results from meetings in the stakeholder workshop in Istanbul to discuss key learning experiences about the impact of organic certification on farming socio-economics.

3.2 Contents of the deliverable

The next chapter will provide a review on business economic aspects of organic production and expected benefits. Chapter 4 summarises the current information about organic farm economics, but it also shows that limited quantitative information is available on farm economics of organic aquaculture. Chapter 5 describes the methodology used in calculating the farm economics. In chapter 6, the model and the model assumptions are presented, together with the relevant outcomes of the expertise found in literature and among the interaction with the consulted experts. Chapter 7 shows the main cost prices for organic aquaculture production with the feed costs responsible for the largest contribution to the higher cost price, followed by the costs for juveniles (if available) and the fixed costs. Chapter 8 provides insight into the retail prices of fish products and the estimated costs and revenues breakdown in the supply chain. Chapter 9 contains a review on competitiveness of European organic aquaculture. The deliverable ends with the key learning experiences and recommendations in chapter 10.

4 Business economic aspects of organic production and expected revenues

4.1 Organic aquaculture management

The challenge for organic aquaculture management is to observe which cost and benefit factors are affected by producing according to organic regulations or switching from conventional standards to organic.

European Union's regulations on organic agriculture, and thus aquaculture, have the following objectives: the establishment of sustainable agriculture systems that sustain and enhance the health of soil, water, plants and animals; contribute to a high level of biological diversity; make responsible use of energy and natural resources; and respect high animal welfare standards, aiming at producing high-quality products by no use of processes harmful to the environment, human, plant or animal health and animal welfare (EU 2007). Moreover, a number of fundamental principles must be followed, including the use of organically produced inputs, the exclusion of GMOs and the compliance with the principle of sustainable exploitation of fisheries, along with more specific principles focusing on the various aspects of organic production. In general, these principles are shared between various certification programmes, although differences may exist (Mente et al., 2011).

Several issues specify higher requirements for species to be eligible for certification under organic aquaculture standards (adapted from Prein et al., 2012):

- A closed life cycle in captivity is required, i.e. the prohibition of catching larvae for stocking from the wild to avoid the collection of seed from the wild. In certain countries or locations with newly established, pioneering organic aquaculture operations, the volumes of hatchery production according to organic criteria have been limited. The additional sourcing of juveniles from conventional hatcheries is therefore permitted under certain conditions. For farmers, the fluctuation of prices of juveniles from certified organic sources have been a challenge. Premiums of between 0 and 24 percent are reported.

- The stocking density of cultured species is limited (e.g. by limiting the number of individuals per unit area or per volume of water) in order to approximate conditions as they would occur in wild/natural conditions and to avoid stress as well as the tendency towards intensification.
- Mechanical aeration is not allowed, some exceptions exits for mechanical mixing and de-stratification of the water column for a limited number of hours per day with a small number of devices.
- Monitoring of effluent quality is required to avoid negative impacts on the surrounding environment.
- Supply of certified organic feed is regarded a major bottleneck for organic aquaculture. Global demand for certified organic feed ingredients for aquaculture and agriculture far outstrips supply, resulting in very high prices and consequently, high production costs.
- For the chain an own set of standards and criteria exist. For the processing facilities specific criteria on the use of detergents and for pest control substances. Anesthetization of vertebrates before slaughter is mandatory. Certain additives are either restricted in use or prohibited (e.g. meta-bisulphites, phosphates, and anticaking agents). Processors also need to undergo a certification process, as the entire production chain requires documentation to ensure full traceability.

Others mention additional requirements, these are:

- Some (private) certification bodies have incorporated standards for fertilisers or use in organic aquaculture, concerning their origin and species-specific application rates (Mente et al., 2011).
- Vitamins and minerals additives are permitted in organic fish diets, and the use of synthetic compounds, such as 'synthetic vitamins identical to natural vitamins for aquaculture animals', may also be allowed. However, specific rules and constrains are applied, and in general the necessity for their use must be shown and the use of natural sources is encouraged, while additional approval for their use may also be needed (EU, 2009; Mente et al., 2011).
- Most certification programmes prohibit the prophylactic use of antibiotics and alternative methods and farming practices for disease prevention are promoted. The use of antibiotics may be permitted in organic aquaculture in cases where despite the prevention measures diseases occur (EU 2009).
- For the manufacturing of organic aqua feeds, several control requirements and regulations have been set and recommended (Mente et al., 2011). In general, additives, processing aids and other substances and ingredients used for processing feed should respect the principles of good manufacturing practice (EU 2008). Operators should take precautionary measures to avoid the risk of contamination by unauthorized substances or products. At parallel feed production locations organic and non-organic the organic operations should continue until the complete run has been dealt with, separated by place or time from similar operations performed on non-organic products (EU 2008). In addition, they should store organic feeds and feeding stuffs, before and after the operations, separately by place or time from non-organic products. Moreover, operators should inform the control authority or control body thereof and keep available an updated register of all operations and quantities processed. They should also take the necessary measures to ensure identification of lots and to avoid mixtures or exchanges with non-organic products. Furthermore, operations on organic feeds should be carried out only after suitable cleaning of the production equipment, while their effectiveness should be monitored and recorded (EU 2008).

4.2 Business economic issues related to organic aquaculture

The International Federation of Organic Agriculture (IFOAM) has established standards for organic aquaculture production, included in the 'IFOAM norms for organic production and processing, Version 2005' (IFOAM 2009). The need for a coherent EU framework and standards for aquaculture products led to the inclusion of these products within the scope of council regulation No 834/2007 for organic production, which came into force in January 2009.

Regarding aquaculture production, Council Regulation (EC) No 834/2007 (EU 2007) and 710/2009 sets a number of guidelines and principles, on the origin of animals, husbandry practices, breeding, feeds and feeding, disease prevention and veterinary treatment. However, for the further growth of the organic aquaculture sector in Europe and globally, specific standards need to be set and there are a number of issues that should be further addressed by detailed rules and guidelines. Specifically, the stocking density shall provide for the comfort and well-being of the animals that, in particular, shall depend on the species, the age of the animals and their behavioural needs.

Limited data on the production volumes of organic aquaculture production are available. Several species, including Atlantic salmon, trout, carp, sea bream and bass, mussels, shrimps and microalgae, are organically produced around the globe, mainly Europe, Asia, Oceania and Latin America. Worldwide production in 2009/2010 was around 12 000 tonnes of organic salmon, 8800 tonnes of organic shrimp, 7200 tonnes of carp, 3000 tonnes of mussel, 2000 tonnes of trout and 1000 tonnes sea bream/sea bass (Prein et al., 2012; Mente et al., 2011; Willer et al., 2008). As organic aquaculture grows, more species are produced under certified programmes and more countries contribute to the total organic production. Production costs for the major species were analysed by Bergleiter et al., (2009), see Figure 1.

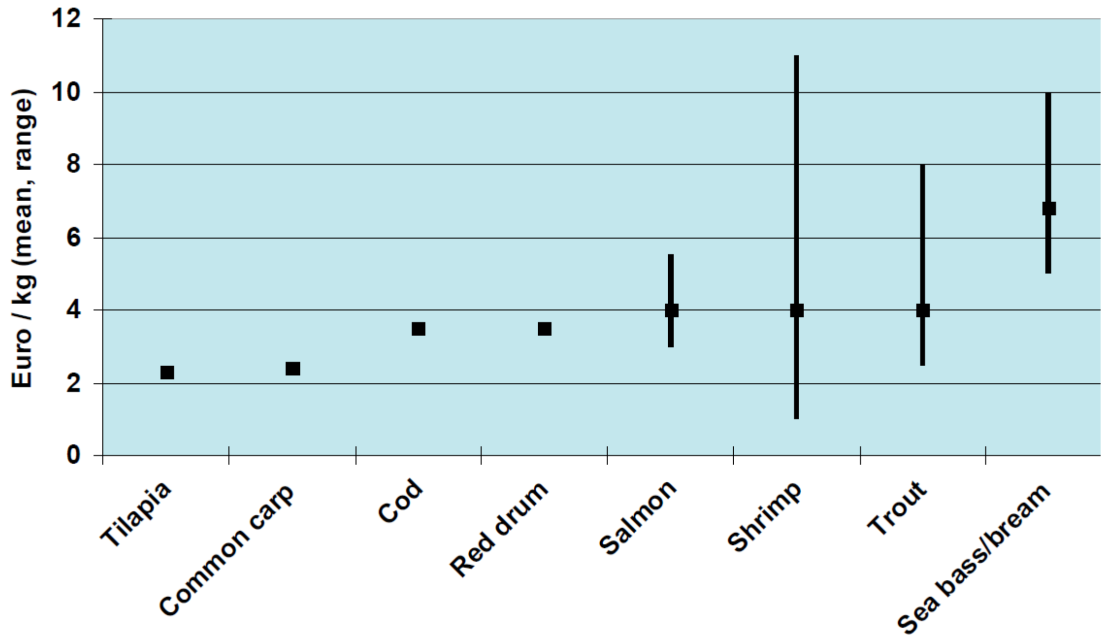


Figure 1 Production costs of organic aquaculture by major species in 2008 (Bergleiter et al., 2009).

Organic farming has the potential to considerably reduce social, environmental and economic risks associated with salmonids farming (Georgakopoulos & Thomson 2005). Examples of economic feasibility studies have been conducted for organic shrimp, freshwater prawn and freshwater fish (INFOFISH, 2011). Comparison studies on conventional versus organic aquaculture have also been performed. Two studies in Asia with a focus on shrimp farming report positive balance for organic. The economic benefits of the conventional and organic shrimp farming systems in China were assessed by calculating net profits. It was found that the organic shrimp farming system was more profitable than the conventional. The higher production costs for the organic system were largely due to differences in feed, labour, housing, electricity, operation, and so forth. However, the cumulative gross receipt can vary depending on several factors, such as shrimp body length, price premium, yields, taste, and quality. The harvested organic shrimp had a mean body length of 11.8 cm, a mean fresh body weight of 15.7 g, and a mean dry body weight of 5.7 g, which are higher than the values for conventional shrimp (mean body length of 10.2 cm, a mean fresh body weight of 12.7 g, and a mean dry weight of 4.6 g) (Xie et al., 2011b). In 2005, an Organic Shrimp Project (OSP) was initiated in Bangladesh by the Swiss Import Promotion Program (SIPPO). This program is authorized by the Swiss government to promote small and medium enterprises (Paul and Vogl, 2012). Accordingly, ninety-one percent of the organic farmers stated that production cost has decreased tremendously, since they do not use fertilizers, additives, supplementary feeds or vitamins any longer. These are self-reported estimations by the farmers; they are not further quantified by a research affiliation.

Some elements related to aquaculture production are of particular relevance and will be covered within the next sections for feed, welfare, production systems, environmental impact, certification, and chain.

4.2.1 Feed (ingredients and sourcing)

Nutrition highly determines the economic viability and sustainability of the business (Mente et al., 2011). In many conventional aquaculture operations, feed accounts for over 50% of the variable operating cost (Rana et al. 2009), while in organic operations a 50% surcharge is assumed for organic certified feeds, although lowering feed conversion ratios can compensate their costs (Bergleiter et al. 2009).

Researchers have been evaluating the biophysical and biochemical characteristics of new alternative sustainable proteins and lipids as replacements for fishmeal and fish oil, to determine their nutrient availability, to assess their efficiency for various life stages of organic aquaculture species, to reduce their environmental impacts and to supply them with low cost (Mente et al., 2011).

An important cost reduction at the farm is that feeding practices should ensure that the environmental impact from the fish production units is minimal and that overfeeding that leads to feed wastage should be avoided (Mente et al., 2011). In addition, when automatic feeding systems are used, these should be kept in good working order (Mente et al., 2011). Moreover, fish could be trained in feeding and could come to the boat or a platform for organic food at an acoustic signal (Lindell et al. 2008).

Organic carp farmers in Europe and extensive giant tiger prawn producers in Southeast Asia have little difficulties to satisfy their modest requirements for external feed. Organic net-cage and semi-intensive pond farms are, on the other hand, facing a drastic increase in feed prices, particularly if organic vegetable feed ingredients (e.g. soy, cereals) have to be sourced from global markets farms (Prein et al., 2012).

Many efforts have been made to reduce feed costs. Manufacturers have progressively decreased fishmeal and fish oil levels, and increasingly rely on the use of a diverse array of alternative plant and terrestrial based feedstuffs (Sarker et al., 2013). The production efficiency for farmed salmonids significantly improved over time due to continued innovations in feed formulations. Sustained efforts are needed continuously to improve feeds and production strategies and to ensure the economic and environmental potential for organic aquaculture (Sarker et al., 2013). These calculations of the conversion efficiency of feed resources were reported for Canadian farmed (non-organic) salmon. It is questionable whether the solutions mentioned by Sarker et al. (2103) are allowed according to EU regulation 710/2009.

Kankainen et al. (2012) found that the feed conversion ratio (FCR) could be improved by up to 10% if farmers were to use demand-feeding systems instead of a fixed feeding regime in the production of cage-reared Atlantic salmon smolts. However, a 10% improvement in FCR would only increase the average company profit margin by 1% (i.e., 10€/kg/0, 1€/kg). This value should be compared against the investment cost effect to estimate the total profitability (Kankainen et al., 2012).

Alternative sustainable proteins and lipids should be evaluated as replacements for fishmeal and fish oil. It is necessary to assess their efficiency for various life stages of organic aquaculture species, to reduce their environmental impacts and to supply them at low cost (Mente et al., 2011). Lunger et al. (2006) fed cobia fish (Rachycentron canadum) for 6 weeks, with an organically certifiable yeast-based protein source diet as a fishmeal replacement and showed that up to 25% fishmeal could be replaced without affecting growth rates, feed efficiency or biological indices, whereas above this level, results decreased performance in all measured parameters.

4.2.2 Welfare (transport, slaughter, health)

Fish can perceive welfare (Lund, Mejdell, Rocklinsberg, Anthony, & Hastein, 2007), therefore organic aquaculture aims to approximate conditions as they would occur in the wild and to avoid stress. Fish welfare related to catch method of cod and salmon can lead to 18% and 10% price premium respectively (Sogn-Grundvåg, Larsen, & Young, 2012). The literature review in OrAqua deliverable D3.1. also confirms that consumers seem to be willing to pay more for products with welfare labels. Organic aquaculture principles aim at reduced instances of disease. Likely, if disease does occur, the use of antibiotics is not prohibited in fish, but in case of more than 1-2 allopathic treatments per year, the treated fish cannot any longer be sold with a label as organically certified. The use of vaccines as well as probiotics is permitted. On the other side, it is also expected that the costs for treatment will be reduced due to the extensive nature of the operations and the expected hardiness of the less-stressed fish (Prein et al., 2012). In case of the reported Organic Shrimp Project (Paul and Vogl, 2012), organic farmers were not affected by shrimp diseases (e.g., white spot and yellow head, etc.). Overall mortality of post larvae in each restocking was decreased due to maintaining of low stocking density. This is why the yield had increased compared with the year before.

In case of disease, private organic aquaculture standards have sometimes more stringent regulations on antibiotics than public regulation. In case of Naturland, antibiotics are not permitted in invertebrates (e.g. shrimp) (Prein et al., 2012).

The use of chemicals for sea-lice treatment is not permitted for organic aquaculture. As a successful remedial measure to treat sea lice, cleaner fish (wrasse) is promoted and has induced the development of own wrasse-farming operations to supply these to the net cage farms (Prein et al., 2012).

For predator control, measures should not harm the predators. Nets over ponds or cages are recommended for control of birds, while for the control of otters and seals non-harmful repellents should be used (Prein et al., 2012).

4.2.3 Production system types (RAS, IMTA...)

Tank systems are permitted only for hatcheries and nurseries but not for grow-out operations on farms. Ponds and cages are most common rearing systems for organic aquaculture. Attention is paid to clusters of net cages as well as the farms themselves, which should not be spaced too closely together (Prein et al., 2012).

In recirculation systems, a large portion of the overall production costs are investment costs. For a recirculation system for (conventional) turbot, Kankainen et al. (2012) hypothesized that investment and capital costs account for about 29% of the total production costs. The remaining production costs include fingerling (13%), feed (20%), labour (13%) and other costs (25%).

Farmers switching to an organic production system have (investments and advisory) costs to adapt to the criteria of the organic standards. In particularly for smallholders these costs are difficult if not impossible to cover. In such group formations, collective arrangements occur, e.g. were the processing or exporting partners often cover the costs (Subasinghe and Phillips, 2010).

4.3 Environmental impact (use, damage)

Fish production, as meat and animal production in general, have a significant impact on environmental resources and biodiversity (Mancini, Lettenmeier, Rohn, & Liedtke, 2012). Biodiversity within and around aquaculture farms (notably shrimp farms) increased significantly after organic certification in comparison to the prior situation when operated under conventional methods, or in comparison to conventionally operated farms (Prein et al., 2012). Biodiversity is managed by regulation on non-destruction of, or even replanting of mangroves in brackish water coastal locations and the planting of pond dikes with local plant species, particularly for control of dike erosion (avoiding siltation, pond turbidity and subsequently maintaining natural productivity) (Prein et al., 2012).

Natural plant extracts are permitted to control for unwanted fish. However, the use of detergents or antifouling chemicals to treat nets of cages is not permitted, as these are considered harmful to the environment as well as to the cultured organisms (Prein et al., 2012).

Xie et al. (2005) assessed the environmental benefits of the two production systems by comparing the total discharged nitrogen and phosphorus quantity. It was shown that the total discharged water quantity during the culture period was lower for the organic system than for the conventional system. The conventional system discharged 34.27 kg of nitrogen and 0.3747 kg phosphorus; some 14.89 kg and 0.3418 kg more than that for the organic system respectively. This indicates that the organic system performed better in terms of nutrient load on the environment (Xie et al., 2005).

4.4 Certification

Organic certification is focused on aquaculture, while eco-labelling is more oriented towards sustainability of capture fisheries and their impact on the ecosystem (FAO 2005). The International Federation of Organic Agriculture (IFOAM) has established standards for organic aquaculture production, included in the 'IFOAM norms for organic production and processing, Version 2005' (IFOAM 2009). The need for a coherent EU framework and standards for aquaculture products led to the inclusion of these products within the scope of council regulation No 834/2007 for organic production, which came into force in January 2009.

Certifying organisations mostly use accredited external offices to monitor on their standards. For instance, the farmers' compliance with the private Naturland scheme is inspected by the Institute of Market Ecology (IMO), an international certification body inspecting and certifying various schemes related to eco-friendly products, accredited by the Swiss Accreditation Service according to EN 45011/ISO 65. This monitoring and accrediting comes of course with costs and the question is who in the chain is responsible for these burdens. These costs of certification has raised many concerns, especially for small-scale aquaculture producers. The distribution of those costs is also problematic in the sense that the compliance costs associated with certification to a private standard scheme are borne disproportionately by those up-stream in the supply chain (i.e. producers, processors) rather than those downstream (i.e. retailers, food services, importing processors) where the demands for certification generate. Yet the most robust evidence of price premiums suggests that they accrue to the retailers who demand certification (Ababouch, 2012). In case of the OSP project the cost of organic certification are paid by the organisation in favor of farmers (Paul and Vogl, 2012).

4.5 Effects for employment on chain level

Organic aquaculture products are often sold to local collectors and processors who have contracts with traders and/or importers. From there, the fish are usually distributed to Western markets like Europe, Japan, US. Ideally, with adequate volumes of production and marketing, processors maintain separate lines for organic products as well as conventional products in their facilities. Some producers have established their own processing facilities, given the unwillingness of local processors to interrupt their processing lines of conventional product and clean the entire system in order to process a batch of organically certified product (Prein et al., 2012).

For the Organic Shrimp Project (Paul and Vogl, 2012) the organic shrimp aquaculture has generated substantial employment for educated people, as well as ensuring several diversified working opportunities. The organic farms have employed women, especially for removing weeds and clearing embankments. Various new types of working opportunities have been generated by the shrimp industry, such as production of bamboo-made screens, traps and baskets, net making, sluice gate building, cock-sheet box supplying, post larvae trading, van pulling, etc. Various industries such as hatcheries, nurseries, ice plants and processing plants have been established, focusing on shrimp cultivation (Paul and Vogl, 2012).

In general, literature gives a general idea of the relevance of each article in the regulation, but hardly any hard figures are found.

4.6 Conclusions

Ample research is available on costs and benefits for organic aquaculture. Only a few studies report quantitative results particularly on the production costs and in particularly feed. These are of course the main issues when changing production to an organic system. More information is available on the qualitative aspects but the costs that will be involved for these issues will be very specific and related to the site, production system, fish species, and country. There is an urgent need of statistics within organic aquaculture production.

5 Methodological background for calculating farm economics

5.1 Research process

In order to provide further answers to the questions about the economic impacts of EU-regulation 710/2009, the research process followed is shown in Table 1. All the mentioned steps contribute to the calculation of the economic impacts on farm level.

Table 1 Overview of the research process to calculate the economic impacts of EU-regulation 710/2009 on farm level

Step	Action	Result	Place in this report
Studying text of relevant regulations	Unravelling the text of regulations into relevant issues	List of issues mentioned in the regulations	Appendix 1
Literature	Literature search for relations between the regulation	relations between regulation and fields of impact	Ch. 4 and Appendix 1
Impact matrix	Categorising the regulation issues into impacts categories	Matrix of regulation issues on one hand and impacts for production systems, output, operational costs and investments on the other hand	Appendix 2
Model selection	Finding an adequate model for calculating the effects of the regulation on the cost price of organic aquaculture	Preliminary model selection	5.3
Review	Reviewing the selected model for scientific robustness	Definitive model selection	5.3
Data collection	Looking for available data	Database selection	5.4
Survey of field experts	Asking experts for supplementary information	Necessary qualitative and quantitative information, additional to literature and databases	5.5
Preliminary results	Filling the model with the available exogenous information from literature, databases and field experts	Preliminary model results	Not published
Stakeholders meeting in Istanbul	Interactive discussing of the preliminary results with experts visiting the stakeholders meeting in October 2015 in Istanbul	Improved model input	Appendix 3, 4, 5 and 6
Definitive results on farm level	Improving the model by adding the information from the stakeholders meeting	Definitive model results of economic impacts of organic aquaculture on farm level	Ch. 6 and 7
Consequences for consumer prices	Data collection and analyses	Consumer prices and margin in the chain	Ch. 8
Competitive analyses	Review on previous projects	Competitiveness European organic aquaculture	Ch. 9

5.2 Impact of organic regulation on farm economics

This paragraph gives the conclusions of the literature search in relation to the issues mentioned in regulation 710/2009. In appendix 1, the impact of the regulation is described to specific fields of organic aquaculture production. In general, literature gives a general idea of the relevance of each article in the regulation, but hardly any hard figures are found. Looking for effects of e.g. feed quality and quantity much scientific literature can be found. However, almost all literature is based on results of tests in experimental circumstances. It discusses e.g. the influence of different protein compositions in fish feed on growth and food conversion rate, but no scientific information is available how organic fish feed is actually composed. In general, some trends can be derived, but the available literature is insufficient to give an answer on the effects of organic aquaculture in practical circumstances. Based on the literature search the focus on the effects of transition is directed to:

- farm size,
- labour required,

- density rate,
- daily growth,
- feed conversion rate,
- mortality rate,
- costs for health prevention/care/medicines,
- livestock costs,
- energy costs,
- costs of certification and investment in a sustainability plan

5.3 Model selection

Hardly any direct information was found about the economic impact of the regulation on organic aquaculture from the literature search. Consequently, the impact had to be calculated in this project.

The researchers formulated the requirements for a calculation model as follows:

- Availability of results both on detailed and on general level
- Possibility to calculate the cost price (i.e. the net total costs per unit of production)
- Possibility to compare the results with the economics of conventional aquaculture
- Flexibility regarding the input in case input is derived from several sources
- Preferably it is used before in similar studies
- Scientifically reviewed

In general, two mainstreams are used in this type of calculation models:

a. Simulation models are models in which relatively much exogenous input is required and less endogenous calculations are made. These models are relatively straightforward. They are flexible, do not calculate an optimal situation, but give the results of a certain input set. Several different farm designs can be put into the model.
b. Optimization models (like Linear Programming) are able to calculate an optimal situation from a set of relations and restrictions. It is possible to calculate the lowest cost price of aquaculture, depending on sets of input/output relations and prices, given a certain farm design. Optimization models are usually more complex.

As many relations are complex and not directly available in literature for this problem, preference was given for a simulation model.

LEI Wageningen UR used a simulation model for a similar question in aquaculture (Rothuis et al, 2012). The model is built in the Microsoft Excel environment and contains the following components:

- Input module: this can be characteristics of conventional aquaculture. The input fits to general farm economic issues.
- Expertise module: In this module, the transfer from conventional to organic aquaculture is defined. Both volume indexes as well as price indexes can be added to the relevant cost categories
- Calculation module
- Output module in table format
- Output module in graphic form

The model provides the difference in costs per kg fish between organic and conventional aquaculture in the relevant member states. The model is scientifically reviewed by Lan Ge (LEI Wageningen UR). Her advices, which were both on general level and in detail with the used database (par. 5.4), were followed.

In figure 2 (p.23) a scheme of this model is presented. It describes the cost structure of organic aquaculture on farm level. The figure shows that the main data origin from a database with data of conventional fish farms. The costs are divided in relevant categories. For all the cost categories, exogenous price and quantity indices are subsequently added to the model. These indices indicate the relative differences between organic and conventional aquaculture. They have to be found from other sources, like available literature, expert judgement or results from the more technical work packages within ORAQUA.

Multiplying the distinguished cost categories by their price and quantity indices generates the cost structure for organic fish farming. To calculate the cost price per kg fish the total costs are divided by the total production.

5.4 The database

5.4.1 Introduction

The European Commission has established Scientific, Technical and Economic Committee for Fisheries (STECF). The STECF shall be consulted at regular intervals on matters pertaining to the conservation and management of living aquatic resources, including biological, economic, environmental, social and technical considerations.

Among other tasks, the STECF draws up an annual report on the European Aquaculture. In order to fulfil its task the STEFC asks the member states to deliver economic data of fish farms. These data are put into an extended database, containing much economical and technical information of many fish farms all over Europe.

For several reasons the STECF-database was chosen as the base for the model:

- good availability and accessibility;
- The data are available for several years;
- built on authority of the EU;
- contains almost all data needed for the model;
- contains data from several EU member states;
- contains data for several species, environments and production methods;
- standardized approach for different species and countries and
- the database is up to date.

Some disadvantages of this database are:

- not all combinations of member states and specie are available, not even of important combinations (like carp in Poland, Germany and the Czech Republic);
- the database does not contain Norwegian data;
- not all species required in this study are available (shrimp, sea weed);
- sea bass and sea bream are not separated;
- the density rate is not available and
- not all variables are actually filled in.

In some case alternative databases are used (see paragraph 5.4.3)

5.4.2 Available data

The relevant available data in the STEFC database is shown in Table 2. Data are provided for farm outputs as well as for farms inputs. For some important issues (sales, livestock, feed and labour) also the volumes are available.

Table 2 Available data STEFC database.

Categories	Units	Variables
Farm outputs	Euro	Turnover Subsidies Other income
Farm inputs	Euro	Raw material costs: Livestock costs Raw material costs: Feed costs Other operational costs Wages and salaries Imputed value of unpaid labour Repair and maintenance Depreciation of capital Financial costs, net Energy costs Extraordinary costs, net
Farm income	Euro	Total income
Employees	Number	Total employees Male employees Female employees
Employees	FTE	Total employees Male employees Female employees
Volumes	Kg	Total sales volume Raw material volume: Livestock Raw material volume: Feed
Balance sheet	Euro	Total value of assets Net Investments Debt
Enterprises by size	Number	Number of enterprises Number of enterprises <=5 employees Number of enterprises 6-10 employees Number of enterprises >10 employees

5.4.3 Available data member states, species and years

The available data in the STECF database for the OrAqua species are provided in Table 3. Besides these species, the database also contains data for the species clam, mussel, oyster, other fresh water fish, other salt-water fish, and other shellfish.

Some important combinations of species and production regions are missing, such as carp production in Poland and Czech Republic and salmon production in Norway. When possible, other data sources are used for these cases. The Fiskedirektoratet Norge provides data for the Norwegian salmon production; Turkovski and Lirski published the profitability of the Polish carp sector and the Landesfishereiverband Brandenburg provides a model for the carp production in Germany. These data are manually incorporated in the STECF database.

Table 3 Availability of data for member states, species and years

	Salmon	Trout (fresh water)	Sea bass/Sea bream	Carp
Bulgaria		2008-2012		2012
Croatia		2011-2012	2011-2012	2011-2012
Cyprus			2008-2012	
Denmark		2008-2012		
Estonia		2008-2012		
Finland		2008-2012		
France		2008-2012	2008-2012	
Germany				2012[2)]
Greece	2008	2008-2012	2008-2012	
Ireland	2008-2012	2008-2012		
Italy		2008-2012	2008-2012	
Norway	2008-2012[1)]			
Poland	2009-2012			2008-2012[3)]
Portugal		2008-2012	2008-2012	
Romania		2009-2012		2009-2012
Spain	2011-2012	2008-2012	2008-2012	2008-2012
Sweden		2009-2012		
UK	2012	2012		2012

1) source: Fiskeridirektoratet Norge
2) source: Landesfischereiverband Brandenburg/Berlin
3) source: Turkovski and Lirski, 2013

5.4.4 Used member state/specie combinations in the model

For every specie, the data of maximal three member states are selected as input for the model. The criteria for this selection are:

1 The size of the sector for that particular specie in the member state
2 The availability of data

The chosen combinations of producing countries and species are presented in Table 4.

Table 4   Overview of the chosen combinations of member state and specie for the model

Specie	Most important available producers			Remarks
Salmon	Norway	United Kingdom	Ireland	
Trout	Italy	France	Denmark	Mainly fresh water rainbow trout.
Sea bass & sea bream	France	Italy	Spain	Sea bass and sea bream are not separated in the database. Sea bass is mainly cultivated in Greece, followed by Spain; sea bream is important in Italy. Unfortunately the Greek data were insufficient, so French data are used
Carp	Poland	Germany	Romania	Poland and Germany from other sources

5.5 Quantity and price indices for transition to organic aquaculture

5.5.1 Introduction

Transition from conventional to organic aquaculture is a complex matter. For almost all farm characteristics, changes in cost have to be expected.

Three kinds of information sources are used to quantify the indices: Literature, expert knowledge and workshop results. In the following paragraphs, these three sources are discussed.

5.5.2 Expert judgment

For the items found in the literature study experts were approached (Table 5), beginning with relevant partners, working on other OrAqua work packages. Often they referred to field experts, such as feed providers, system-building industry, veterinarians, fish traders and processors and some organic fish farmers.

Table 5   Overview of consulted experts

	Salmon	Trout	Sea bass Sea bream	Carp
System information	Nofima DTU	Dansk aqua kultur DTU	Ifremer Coispa Culmarex	University Vodnany Czech Fish Farmers Association
Feed - Composition - Daily dose - FCR - Growth	Ewos Nofima Biomar	Dansk aqua kultur Biomar Ifremer	Legouessant Culmarex Gloria maris Kefalonia	University Vodnany
Health items	DTU	Reseau cristal Ifremer	Gloria maris Reseau cristal	
Economy	Nofima		Gloria maris Kefalonia	University Poland Czech Fish Farmers Association

At first, the experts were consulted by telephone or mail. After interpretation of the results of this consultation by LEI Wageningen UR the interviewees were asked for feedback. Together with the (scarce) information from literature, this procedure produced the preliminary results.

5.5.3 Expertise collection and review during the workshop in Istanbul

In October 2014, a stakeholder meeting of the ORAQUA-project was organised in Istanbul. During the meeting, mini workshops with the present experts were held. In these workshops, the experts were able to discuss the preliminary results on an interactive base. The discussion generated much information, both for the project and for the participants of the workshops. From each workshop, a report was made and reviewed by the participants.

The results from the workshops contributed significantly to the quality of the indices and thereby to the quality of the results of the model.

Table 6 Participants for each mini workshop.

Salmon	**Trout**	**Sea bass, sea bream**	**Carp**
J. Carmichael (UK) Biomar	P. Fortin (FR) Le Gouessant	F. Papageorgiou (GR) Kefalonia	Z. Adamek (CZ) University Vodnany
C. McManus (IRL) Marine Harvest	M. Fuselli (IT) fish farmer	M. Lopez (ES) Culmarex	M. Moessmer (AT) Biofish, fish farmer
D. Knowler (CA) Simon Fraser University	M. Norrelykke (DK) Aller-Aqua	E. Franzolini (IT) Naturaleva	D. Gal (HU) fish farmer
		S. Bergleiter (D) Naturland	

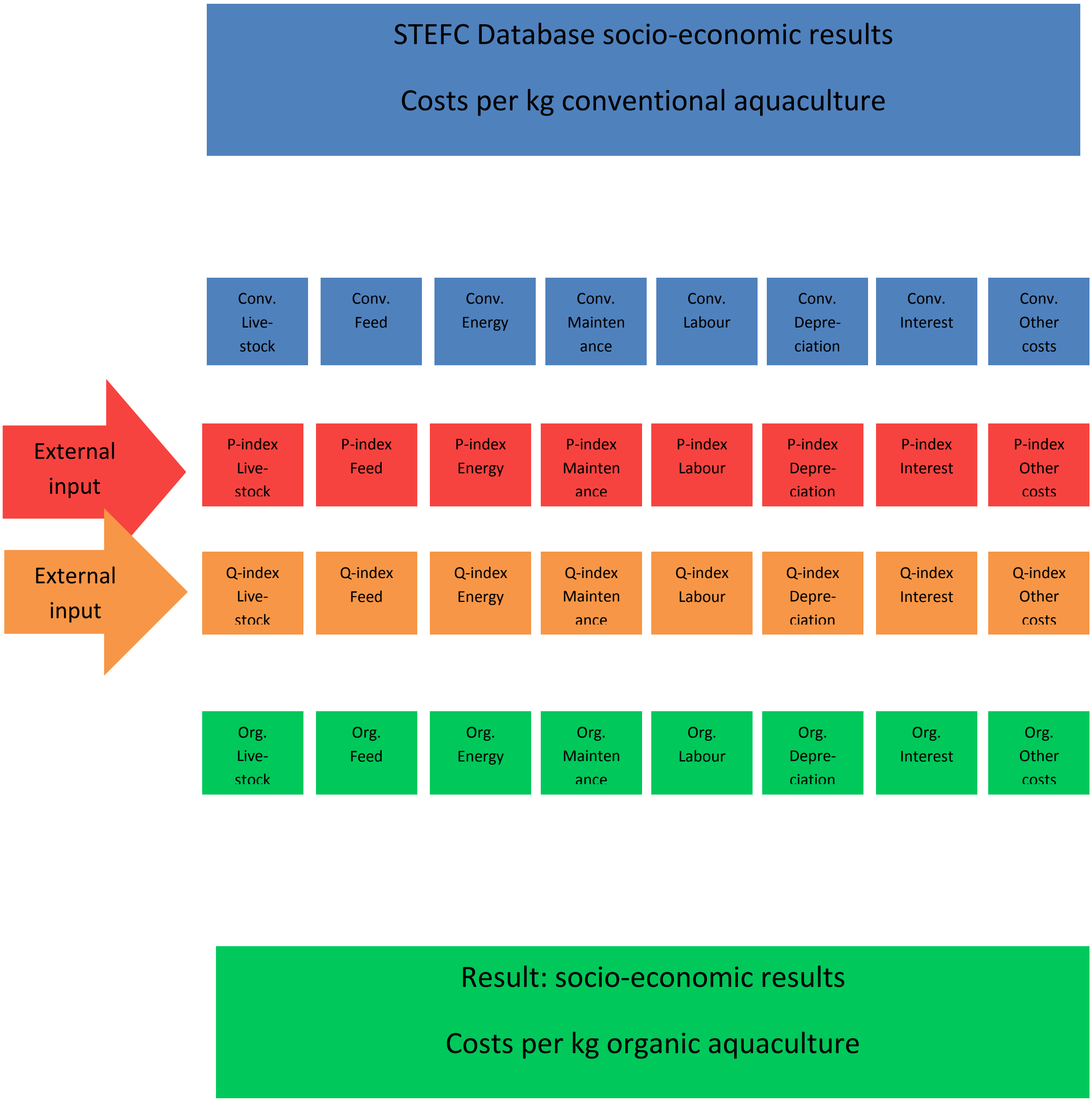


Figure 2 Structure of the calculation model

6 Model assumptions

This chapter presents the relevant outcomes of the expertise found in literature and from the interaction with the consulted experts. They can be seen as intermediate results as input for the economic modelling.

6.1 Production systems

As far as possible, the calculations are based on present systems that can be used for organic production without big changes in buildings, cages and installations. In the database, choices can be made between production systems.

Table 7 shows the average stocking rate for the relevant species in conventional aquaculture, the maximum stocking range for organic aquaculture and implicated reduction.

In most cases, the compulsory maximum stoking rate has a significant impact on the system and has consequently an increasing effect on the cost price of organically produced farmed fish. On farm level, different solutions are possible how to react on this legal obligation. The consultation of experts leads to the conclusion that the solutions options and the extent of impact will vary for the different species.

According to the consulted experts, the usual density rate for salmon in conventional systems is 15 to 20 kg/m3. Due to the EU regulation 710/2009, the stocking density for organic salmon production should be reduced to maximum 10 kg/m3. For salmon, the lower stocking range will usually be set off by building extra production capacity. In the calculations, it is assumed that the production capacity will be extended to the level that the total production in kg salmon will be equal after the transition.

For trout, the usual density in conventional systems is about 30 kg/m3, for organic production the maximum allowed density is 25 kg/m3. For trout farms, it is generally hardly possible to increase the production capacity. Consequently, the trout production quantity will decrease significantly.

For conventional sea bass and sea bream, very different systems are used. In intensive systems, the fish are raised in tanks with recirculation, in which the density can increase up to 100 kg fish/m3 and more. In the calculations, we started from an extensive system, in which the fish are raised in cages. The density in such systems is about 12 to 20 kg/m3, depending on the local circumstances. The maximum allowed density rate in organic systems is 15 kg/m3 , but this density is not always attainable. Experts expect the average density to decrease by 15%. It is assumed that no extra production capacity will be built in order to compensate the lower stocking density. Consequently, the fish production volume will be reduced after transition.

Carp is raised in ponds. The maximum density for organic carp production is 1.500 kg per ha. The usual conventional production is less intensive than this maximum, so no changes are needed for the on-growing stage.

Table 7 Reduction of the stocking rate due to EU regulation 710-2009

	Salmon	Trout (fresh water)	Sea bass/Sea bream	Carp
Density rate conventional systems	15 to 20 kg/m^3	30 kg/m^3	12 to 20 kg/m^3	<1.500 kg/ha
Density rate organic systems	10 kg/m^3	25 kg/m^3	10-15 kg/m^3	<1.500 kg/ha
Reduction	-40%	-15%	-15%	Equal

6.2 Feed

According to the interviewees and the workshop participants the developments due to Regulation 710/2009 regarding feed supply, protein content, conversion rate, daily growth and feed price will vary considerably between the different studied species (Table 8).

For salmon, a lower feed consumption is assumed, in order to improve a robust system and to facilitate the health control. Moreover, the nutritional value of the feed is lower because it is difficult to produce high protein feed under organic conditions for a reasonable price. The combination of a lower feed consumption and a lower nutritional value leads to approximately 35% reduction of the daily growth. The price of organic feed is about 12.5% higher compared to conventional feed.

For trout, the experts do not expect a lower feed supply. The decrease of the density is expected to ensure a robust production system. The organic trout feed is of a comparable quality than conventional trout feed. The feed price however is about 30% higher.

For sea bream and sea bass, some specific effects are expected. During the on-growing period, the feed supply is about equal to conventional systems, but the protein content is substantially lower. Therefore, the daily growth will stay behind. The daily feed dose in kg does not differ from conventional fish farming, but the lower protein content lowers the FCR by about 10%. This would imply a lower growth of about 10%, but the length of the production period will even extend this percentage. At first look, the lower growth causes a longer production period of 10%. However, there is an additional negative effect: usually the production period lasts about 18 months. An extra 10% would imply a production period of 20 month. This period compels an extra winter period for the fish. In the winter, the fish do not grow, but they are fed. The risk for an extra winter period causes an extra negative effect on the length of the production period. A lower growth of 20% is assumed.

In carp production, a moderate feed regime is practised in order to keep the system robust. The feed consists mainly of cereals. The nutritional value of organic produced cereals is about equal to conventional cereals, but the price is about 100% higher. Due to several problems during the juvenile production an extra year of growing and extra predation are calculated. This leads to a higher overall feed conversion rate of 15%.

Table 8 Differences in feed supply, feed conversion rate, daily growth and feed price in organic systems compared to conventional systems

	Salmon	Trout (fresh water)	Sea bass/Sea bream	Carp
Feed supply	-15%	Equal	Equal	-10%
Feed conversion rate	+17.5	Equal	+10%	+15%
Daily growth	-35%	Equal	-20%	-10%
Feed price	+12.5%	+30%	+50%	+100%

6.3 Livestock

In this paragraph, the juvenile supply is discussed.

The price of juveniles is hard to value because of the lack of availability for some species.

For salmon, an equal price is assumed. In the UK, no organic smolt is available, so in general conventional smolt is still used. It is not likely that this situation will change soon. In Ireland Marine Harvest produces its own juveniles, which are completely organic. These smolts are also used for the conventional production, because the scale is too small to invest in separate production lines. Besides that, there is only a small difference in feed costs between organic and conventional smolt.

For trout, an extra price for organic juveniles is unknown as they are not available. Therefore, conventional juveniles are used.

The sea bass and sea bream sector has made progress, although the requirements of EU regulation 710/2009 cannot be fully met yet. Due to the absence of organically raised parent animals, the eggs are not of organic origin. It is not likely that this situation will change soon. The reason is that no breeder will invest in organic brood stock production as long as the sector is so small and so vulnerable. The feed in the hatchery though is organic. The price of the fries is about 50% higher as conventional fries.

For carp, the organic juvenile production is very expensive. The sector is working hard to produce them under the conditions of the EU regulation. There are many problems to be solved:

- No hormones allowed. This leads to less spawning and less juveniles per parent animal
- No fishmeal allowed. This leads to (much) less growth, less strong juveniles, higher mortality.
- The lower growth rate in the juvenile stage compels an extra year of growing, more pond surface and more predation.
- The health control is more complicated. In the juvenile stage this leads to much more labour needed
- The health risks are much higher compared to conventional carp farming.

According to a carp producer, double the area of juvenile production to produce enough juveniles for the production is necessary. Extra juveniles are needed because of the extra predation during the extra raising year. For Germany and Poland 100% more juveniles are needed; in Romania generally older juveniles are bought, so here the extra need for juveniles is estimated on 50%. The extra costs for feed, labour, energy, production capacity, repair and maintenance are ranged under the appropriate cost categories (Table 9).

Table 9 Differences in costs for juveniles in organic systems compared to conventional systems

	Salmon	Trout (fresh water)	Sea bass/Sea bream	Carp
Quantity	Equal	Equal	Equal	+100%
Price	Equal	Equal	+50%	Equal

6.4 Labour

For several reasons, more labour is required per kg production in organic aquaculture.

The market of organic aquaculture products requires high quality in order to be distinguished from conventional aquaculture on one hand and wild caught fish on the other. To achieve this high quality product, extra management is needed. This is even more important taking into account the particular restrictions in organic aquaculture. For instance, the limited correction possibilities to control animal health and parasite plagues during the production period requires more physical monitoring and management.

The assumed smaller production size in organic trout, carp, sea bass and sea bream farming implies negative scale effects. All kinds of general activities, like maintenance, administration, trading, will weigh relatively heavier per kg fish production. In the salmon production, it is assumed that the production will not shrink. The lower density will be met by building extra production capacity. The extra cages will require of course extra work as well for control and maintenance.

Due to several problems during the juvenile production in the carp sector an extra year of growing and extra predation are calculated. This leads to an extra labour requirement per kg fish production.
The presumed extra labour input in organic aquaculture is given in table 10. The hourly wages are not changed.

Table 10 Differences in labour requirements in organic systems compared to conventional systems

	Salmon	Trout (fresh water)	Sea bass/Sea bream	Carp
Hours/kg fish	+15%	+15%	+15%	+10%

6.5 Welfare

EU Regulation 710/2009 limits the density rate for organic aquaculture, which highly affects the costs of organic fish production. This implies either a lower production on farm level or extra investments to enlarge the production capacity. Paragraph 6.2 discusses the direct economic consequences of the obliged lower density rate. Indirect effects, like influences on the robustness of the system regarding health issues are discussed in the appropriate paragraphs.

Generally in organic systems, fewer possibilities for health and parasite control and for treatment in case of problems are available. On the other hand, the organic system is more robust because of lower density rate and lower feed supply. Expert information confirms that both the mortality rate and the costs or health care in organic aquaculture are much the same as in conventional aquaculture. For this reason, an equal mortality is assumed for all species (Table 11). Sometimes more labour input is needed for prevention and extra health control. Any extra labour costs are included in table 10.

In the regulation, some articles are entered in which some conditions occur during the transport and slaughtering process. Although the costs of transport and slaughtering are usually paid by the slaughterhouse this could of course potentially influence the cost price of the slaughtered product. Upon inquiry, however, it appeared that these restrictions do not have significant consequences for the costs of transport or slaughter.

Table 11 Differences in mortality and prices of juveniles in organic systems compared to conventional systems

	Salmon	Trout (fresh water)	Sea bass/Sea bream	Carp
Mortality rate	Equal	Equal	Equal	Equal
Health costs	Equal	Equal	Equal	Equal

6.6 Environmental costs

The specific economic impacts of the EU regulation 710/2009 regarding environmental issues are for the greater part already incorporated in the costs discussed above. To be mentioned are:

- Feed should be originating from sustainable sources. The extra costs are included in the feed price as discussed in paragraph 6.3
- The costs for mentioned effluent treatment are supposed to be equal to conventional systems
- The costs of the sustainable management plan are entered in the "other costs" and presented in table 12
- The costs of certification are ranged in table 12.

6.7 Other costs

In general, the other costs contain the costs for:

- Depreciation on buildings, installations and machinery
- Maintenance and repair on buildings, installations and machinery
- Financial costs, like interest, rent and leasing
- Energy
- Certification
- Management plan

For salmon, the assumption is made that in case of transition from conventional to organic aquaculture the farm production quantity will not change. However, the density and the daily growth are both much lower. To achieve the same production quantity expansion of the production capacity is needed. The costs of such an expansion are calculated in terms of more depreciation, repair and maintenance, and financial costs. Within the existing production unit, the fish production of only 40% of the conventional production can be achieved. The total capacity should be 100%, so an extra capacity is of 150% is needed.

The energy costs are assumed to be equal per kg fish production. Certification costs of 3.000 euro yearly were mentioned in the workshop. No extra costs for a management plan are needed, for they are already obliged for conventional systems.

The production capacity for trout, sea bass and sea bream is not supposed to change, so the costs will not change. The yearly certification costs are estimated on 600 euro yearly and the management plan on 2.000 euro once. In the workshop no objections were made.

As discussed in paragraph 6.4 extra production capacity is needed for the juvenile raising of carp. The extra pond area and the corresponding costs are estimated on 7%.

Table 12 Differences in other costs in organic systems compared to conventional systems

	Salmon	Trout (fresh water)	Sea bass/Sea bream	Carp
Depreciation on farm level	+150%	Equal	Equal	+7%
Repair and maintenance on farm level	+150%	Equal	Equal	+7%
Financial costs on farm level	+150%	Equal	Equal	+7%
Energy per kg fish	Equal	Equal	Equal	+7%
Costs for certification on farm level	+3.000 euro/year	+600 euro/year	+600 euro/year	+600 euro/year
Investment for the management plan on farm level	Equal	2.000 euro once	2.0 euro once	2.0 euro once

7 Cost price of organic aquaculture

In this chapter, the economic consequences for the cost price on farm level are presented. They are calculated by the economic model, based on the databases indicated in 5.4 and the indexes discussed in chapter 6.

7.1 Salmon

Figure 3 and table 13 show the cost price for conventionally and organic produced salmon.

The total costs on farm level per kg organic produced salmon are in all three considered member states substantially higher than for salmon produced conventionally.

Between countries, differences occur between the extents of these extra costs.

In Norway, the cost price of organic salmon is about 0.96 euro/kg (40%) higher (table 7). In Ireland, the extra costs are calculated on 1.74 euro/kg (30%) higher; in the United Kingdom this difference turn out to be about 0.71 euro/kg (25%).

The reasons for these differences are:

- Different levels of costs for conventional fish
- Differences in the cost structure

The higher production costs are for 35% caused by the feed costs, for 40% by the costs for new production capacity, and for 13% by the costs for smolt and for 12% by other costs.

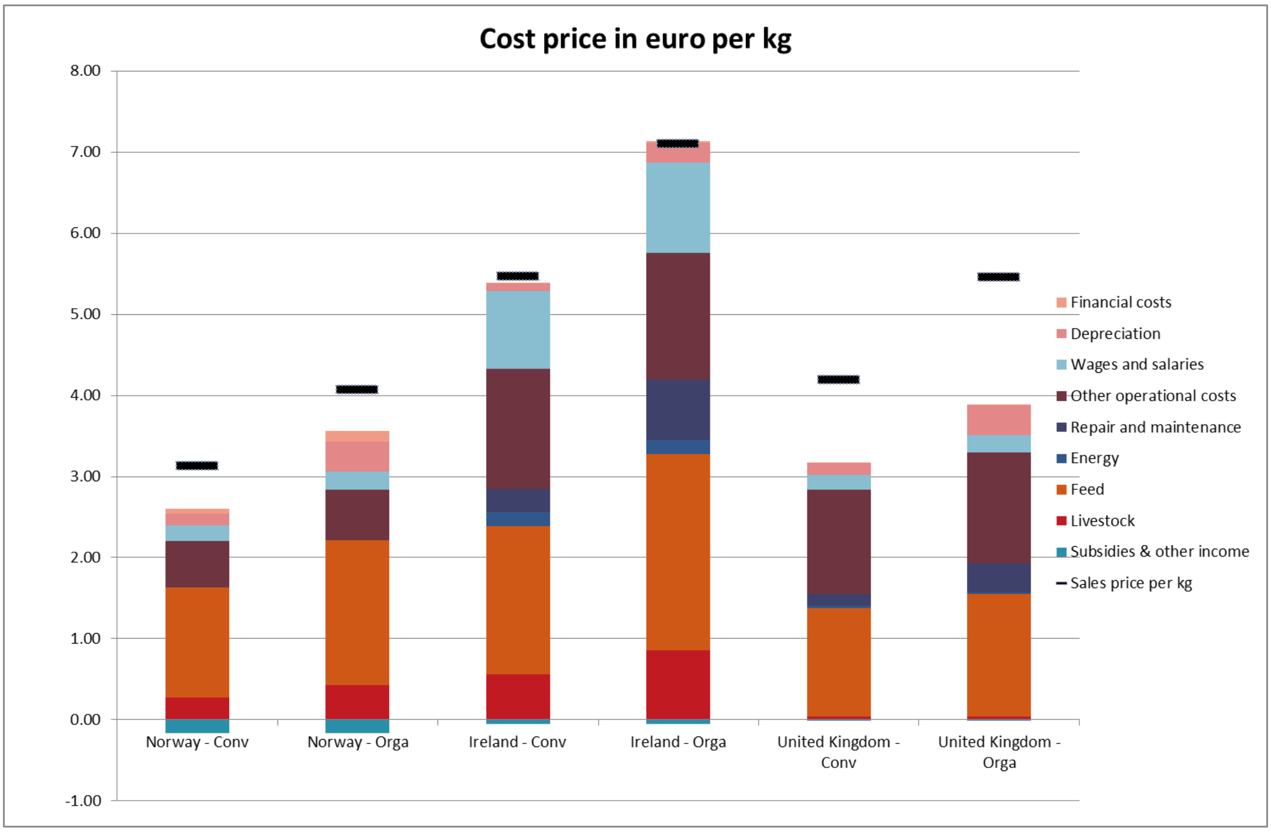


Figure 3 Costs of salmon production in Norway, Ireland and the United Kingdom under conventional and organic growing conditions (in euro/kg)

Table 13 Calculation of the extra cost price of organic salmon production compared to conventional production in Norway, Ireland and the United Kingdom (in euro/kg)

Cost price per kg	**Norway - Conv**	**Norway - Orga**	**Ireland - Conv**	**Ireland - Orga**	**United Kingdom - Conv**	**United Kingdom - Orga**
Subsidies & other income	-0.16	-0.16	-0.05	-0.05	-0.01	-0.01
Livestock	0.28	0.43	0.56	0.86	0.04	0.04
Feed	1.35	1.79	1.83	2.42	1.34	1.51
Energy	0.00	0.00	0.17	0.17	0.03	0.03
Repair and maintenance	0.00	0.00	0.29	0.75	0.14	0.36
Other operational costs	0.58	0.62	1.47	1.57	1.29	1.36
Wages and salaries	0.19	0.22	0.97	1.11	0.19	0.22
Depreciation	0.14	0.37	0.09	0.24	0.14	0.37
Financial costs	0.05	0.14	0.01	0.02	0.00	0.01
Sales price per kg	**3.13**	**4.07**	**5.46**	**7.10**	**4.19**	**5.45**
Cost price per kg	2.44	3.40	5.34	7.08	3.16	3.88
Difference		0.96		1.74		0.71
		+40%		+33%		+23%

7.2 Trout

Figure 4 and table 14 show the cost price for conventionally and organic produced trout.

The total costs on farm level per kg organic produced trout are in all three considered member states substantially higher than for trout produced conventionally.

Between countries, differences occur between the extents of these extra costs.

According to table 8 in Denmark the cost price of organic trout is 0.41 euro/kg (15%) higher. In France the extra costs are calculated on 0.58 euro/kg (15%) higher; in Italy this turns out to be about 0.35 euro/kg (20%).

The reasons for these differences are:

- Different levels of costs for conventional fish
- Differences in the cost structure

The higher production costs are for 65% caused by the feed costs, for 20% by the costs for labour costs and for 15% by the other costs.

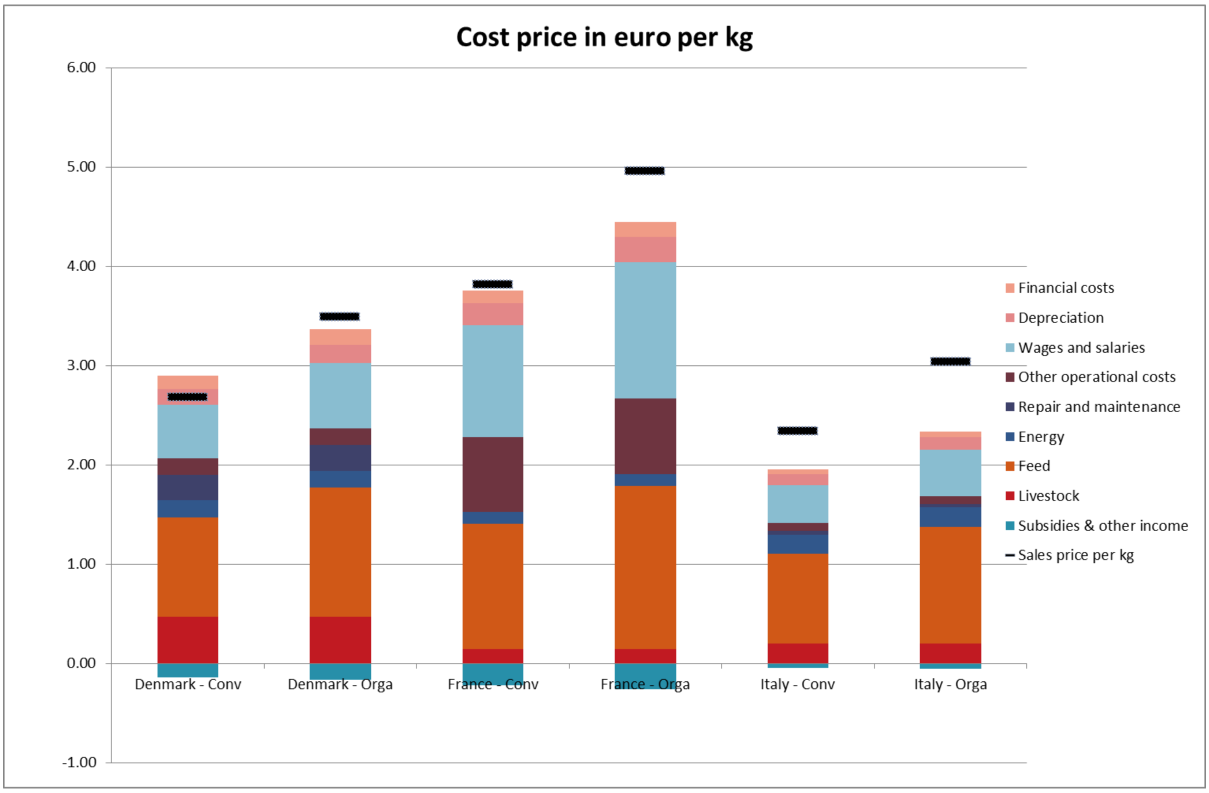


Figure 4 Costs of trout production in Denmark, France and Italy under conventional and organic growing conditions (in euro/kg)

Table 14 Calculation of the extra cost price of organic trout production compared to conventional production in Denmark, France and Italy (in euro/kg)

Cost price per kg	**Denmark - Conv**	**Denmark - Orga**	**France - Conv**	**France - Orga**	**Italy - Conv**	**Italy - Orga**
Subsidies & other income	-0.14	-0.17	-0.22	-0.26	-0.05	-0.06
Livestock	0.47	0.47	0.14	0.14	0.20	0.20
Feed	1.00	1.30	1.27	1.65	0.91	1.18
Energy	0.17	0.17	0.12	0.12	0.19	0.19
Repair and maintenance	0.26	0.26	0.00	0.00	0.04	0.04
Other operational costs	0.16	0.17	0.75	0.76	0.08	0.08
Wages and salaries	0.54	0.62	1.13	1.30	0.38	0.44
Depreciation	0.16	0.19	0.22	0.26	0.11	0.13
Financial costs	0.13	0.15	0.13	0.15	0.05	0.05
Sales price per kg	2.68	3.49	3.81	4.96	2.34	3.04
Cost price per kg	2.76	3.17	3.54	4.12	1.90	2.25
Difference		0.41		0.58		0.35
		+15%		+16%		+18%

7.3 Sea bass and sea bream

Figure 5 and table 15 show the cost price for conventionally and organic produced sea bass and sea bream.

The total costs on farm level per kg organic produced fish are in all three considered member states substantial higher than for conventionally produced fish.

Between countries, differences occur between the extents of these extra costs.

In France, the cost price of organic sea bass and sea bream is about 1.83 euro/100 kg (30%) higher (table 9). In Italy the extra costs are calculated on 2.46 euro/kg (=30%) higher; in Spain this difference turns out to be about 2.29 euro/kg (40%).

The reasons for these differences between production locations are:

- Different levels of costs for conventional fish
- Differences in the cost structure

The higher production costs are for 50% caused by the feed costs, for 35% by the costs for livestock and for 15% by the other costs.

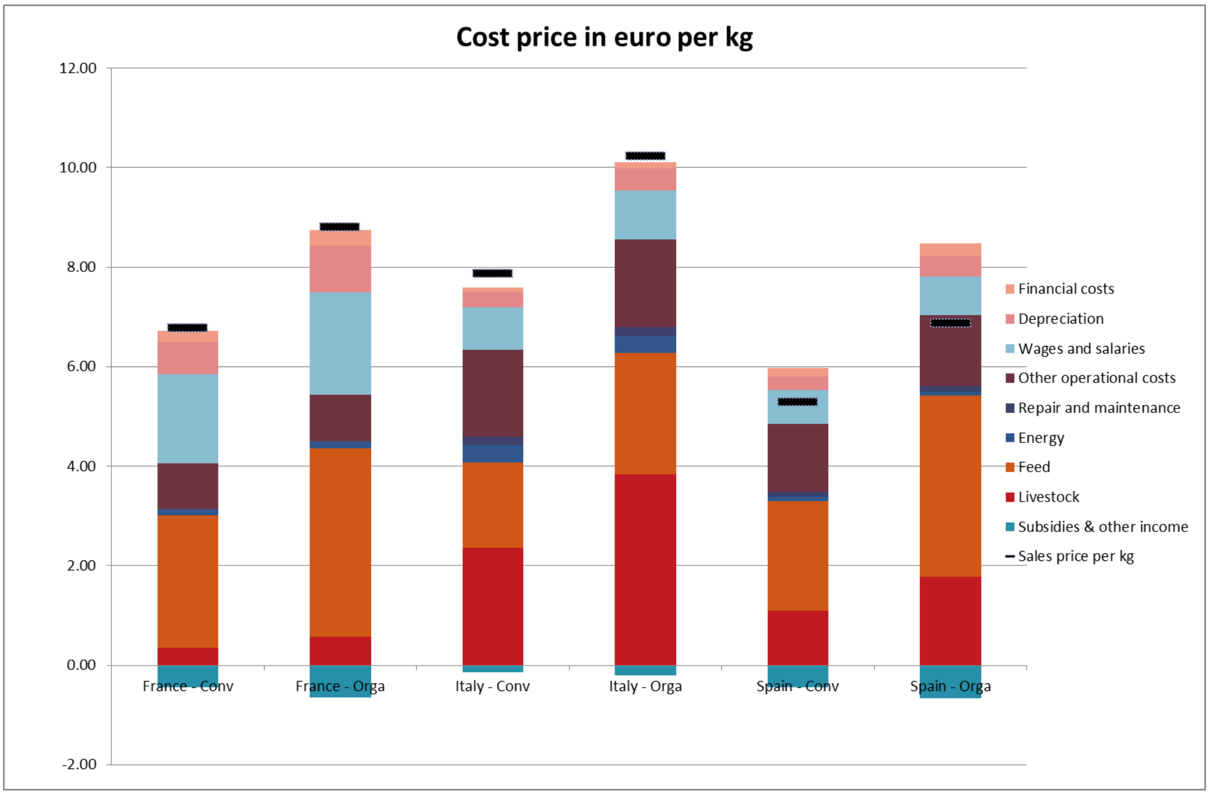


Figure 5 Costs of sea bass and sea bream production in France, Italy and Spain under conventional and organic growing conditions (in euro/kg)

Table 15 Calculation of the extra cost price of organic sea bass and sea bream production compared to conventional production in France, Italy and Spain (in euro/kg)

Cost price per kg	**France - Conv**	**France - Orga**	**Italy - Conv**	**Italy - Orga**	**Spain - Conv**	**Spain - Orga**
Subsidies & other income	-0.44	-0.65	-0.14	-0.20	-0.45	-0.66
Livestock	0.35	0.66	2.36	4.43	1.09	2.04
Feed	2.65	4.38	1.70	2.81	2.21	3.65
Energy	0.14	0.14	0.35	0.35	0.08	0.08
Repair and maintenance	0.00	0.00	0.18	0.18	0.11	0.11
Other operational costs	0.92	0.93	1.74	1.75	1.36	1.43
Wages and salaries	1.79	2.06	0.86	0.99	0.68	0.78
Depreciation	0.64	0.93	0.30	0.44	0.28	0.41
Financial costs	0.22	0.32	0.09	0.13	0.17	0.25
Sales price per kg	**6.78**	**8.81**	**7.87**	**10.23**	**5.28**	**6.87**
Cost price per kg	6.27	8.10	7.44	9.91	5.52	7.81
Difference		1.83		2.46		2.29
		+29%		+33%		+42%

7.4 Carp

Figure 6 and table 16 show the cost price for conventionally and organic produced carp.

The total costs on farm level per kg organic produced fish are in all three considered member states substantially higher than for conventionally produced fish.

Between countries, differences occur between the extents of these extra costs.

In Romania the cost price of organic carp is 0.83 euro/kg (80%) higher. In Poland the extra costs are calculated on 0.89euro/kg (45%) higher; in Germany this difference turns out to be about 0.67 euro/kg (30%).

The reasons for these differences are:

- Different levels of costs for conventional fish
- Differences in the cost structure

The higher production costs are for 65% caused by the feed costs, for 20% by the costs for juvenile purchases and for 15% by the other costs.

Figure 6 Costs of carp production in Romania, Poland and Germany under conventional and organic growing conditions (in euro/kg)

Table 16 Calculation of the extra cost price of organic carp production compared to conventional production in Romania, Poland and Germany (in euro/kg)

Cost price per kg	**Romania - Conv**	**Romania - Orga**	**Poland - Conv**	**Poland - Orga**	**Germany - Conv**	**Germany - Orga**
Subsidies & other income	-1.22	-1.36	-0.15	-0.16	-1.57	-1.74
Livestock	0.46	0.77	0.06	0.14	0.03	0.06
Feed	0.48	0.96	0.69	1.38	0.33	0.75
Energy	0.06	0.07	0.13	0.14	0.09	0.09
Repair and maintenance	0.08	0.08	0.10	0.10	0.54	0.58
Other operational costs	0.14	0.17	0.42	0.45	0.64	0.71
Wages and salaries	0.69	0.75	0.45	0.50	1.45	1.59
Depreciation	0.28	0.33	0.14	0.16	0.66	0.78
Financial costs	0.06	0.07	0.10	0.12	0.00	0.00
Sales price per kg	**1.87**	**2.43**	**2.16**	**2.81**	**2.41**	**3.13**
Cost price per kg	1.02	1.85	1.95	2.84	2.16	2.82
Difference		0.83		0.89		0.67
		+81%		+46%		+31%

8 Costs of organic fish production from pond to plate

In this chapter, insight is given into the retail prices of fish products and the estimated costs and revenues breakdown in the supply chain. The calculations refer to the fish types, presentation and preservation state as follows:

- salmon - fresh/frozen
- salmon - smoked
- trout - fresh/frozen
- trout - whole
- sea bass and sea bream - fresh/frozen
- sea bass and sea bream - whole
- carp - fresh/frozen
- carp – whole
-

The calculations refer to both conventional and organic products.

8.1 Calculation model

In order to analyse the revenues break-down in the supply chain, a supply chain calculation model has been set up, taking into account farmer prices, processing costs, transport costs, efficiency figures (yields and losses), revenues for non-edible parts, and sales prices. This has been done both for conventional and organic products, as for conventional products this information is more available than for organic and processes are similar (e.g. slaughter costs and yield are basically the same for conventional and organic fish).

As farmers' and retail prices are given (collected), lacking information (esp. in the organic supply chain) has been estimated, based on the costs and margins in the conventional supply chain and if necessary, based on the other fish.

As there is hardly any information on the organic trout, sea bass/sea bream and carp products, the cost-breakdown of these products is less robust than for organic salmon products.

All calculations are excluding VAT. Retail prices have been recalculated to prices without VAT; VAT rates on food per country are given in appendix 7. Prices and margins in the tables below are rounded to one decimal.

Assumptions on slaughtering efficiency are given in Appendix 9. The other edible products are assumed to be sold at a price of € 2 per kg product, as an ingredient for fish products like sticks or minced fish. By-products are sold for € 0.15/kg (source: one interviewee). These prices are assumed to be the same both for conventional and organic fish.

Due to the limited quantitative information on processor and retailer margins, these margins are only split for salmon; for the other fish types they are taken together.

8.2 Retail prices collection

In order to collect retail prices of the fish products, a selection of larger retailers in the typical countries per fish type has been set up. Retail prices for different fish products were collected from 18 different retailers in 12 European countries. Then prices of fish products have been collected from the retailers' web shops or published price listings. Not only prices have been collected, but also package size (product weight), presentation (whole, fillet) and preservation state (frozen, fresh, smoked). Incidental special offers are not taken into account.

Information has been collected on 10th and 12th of March, 2015. Package prices have been calculated to prices in Euro per kg product. Multiple price observations have simply been averaged per retailer (see tables below) and consequently simply been averaged (without weighing). It is found that retail prices for organic trout, sea bass/sea bream and carp products are hardly available.

8.3 Salmon

8.3.1 Farmers' prices

For conventional salmon the average farmers prices over the years 2008-2012 was 3.13 euro per kg live weight (source: Fiskeridirektoratet Norge). This price is compared to the Norwegian spot price as published by Fish Pool ASA (http://fishpool.eu/). The average spot price in 2008-2014 was 4.20 euro/kg (head off and gutted). Taken into account the weight loss (10%) and the costs for slaughter (0.60 euro/kg) these two prices match very well.

Based on the extra costs of organic salmon (30-40%) and the found price premiums by Bergleiter et al (2009) the farmers' price for organic salmon is estimated at 4.00 euro/kg (+30%).

8.3.2 Consumer prices

Table 17 shows the results of the collected consumer prices for salmon products. The average (unweighed) consumer price for fresh or frozen conventional salmon (mainly salmon fillets) amounts to € 20/kg. On average, the consumer price for organic salmon comes to € 30/kg, which is 50% higher than conventional salmon. Eroski in Spain did not sell organic salmon fillet.

For smoked salmon, a similar procedure has been followed. Only five out of the nine retailers sold smoked salmon products. The average price for conventional smoked salmon is €40/kg. The average price of smoked organic salmon is about 40% higher and amounts to €57/kg; prices here show a very high variety between retailers.

Table 17 Consumer prices for salmon products (Euro/kg)

		Frozen/fresh		**Smoked**	
Retailer	Country	Conv.	Org.	Conv.	Org.
Albert Hein	NL	22.9	30.2	28.3	47.2
Jumbo	NL	20.8	28.3		
Delhaize	BE	18.5	25.4		
Carrefour	FR	19.1	32.2	40.5	56.8
Eroski	ES	16.0			
Tesco	GB	21.6	33.8	26.7	40.0
Picard	FR	21.2	32.9	44.5	56.3
Rewe	DE	21.7	27.6		
Nemlig	DK			59.0	85.8
Average		**20.0**	**30.0**	**40.0**	**57.0**

Sources: retailers' web sites, 10 March, 2015

8.3.3 Revenues break-down in the supply chain

In table 18 the added value of salmon in the chain is reconstructed. The farmers' price of salmon is derived from the FCA price for Norwegian salmon, head-on gutted (HOG). From the website mysalmon.no, a price of 35 NOK/kg (~€4.1/kg) was estimated, based on the average price in the years 2011-2013. The actual price in March 2015 was higher and close to € 5/kg. From this HOG price, the farmers' price was calculated, taking into account transport and gutting costs (€ 0.6/kg) and 10% weight loss. The extra costs for organic production at farmer level are assumed to be 30% higher (Source: this report).

Table 18 Revenue break-down in the supply chain for fresh/frozen salmon and for smoked salmon (€/kg product)

	Fresh/frozen fillets		Smoked salmon	
	Conv.	Org.	Conv.	Org.
Farmers' price	3.10	4.00	3.10	4.00
Price gutted fish	4.10	5.20	4.10	5.20
Value of the fillet	7.60	9.70	7.60	9.70
Processing, trade and retail margin	12.40	20.30	32.40	47.30
Consumer price	20.00	30.00	40.00	57.00

8.3.4 Conclusions

- The farmers' price for organic salmon is about 30% higher than the conventional salmon.
- The consumer prices for organic salmon products are approximately 50% higher.
- In absolute terms, the margins for organic salmon in the value chain are much higher than for conventional salmon.
- Organic salmon is a so-called service product for conventional processors: it is sold parallel to conventional products.
- This higher margins are caused by:
    - Demand and supply do not always match: processors sometimes have to sell salmon as conventional product (and price)
    - The relatively much smaller selling volume, which rises the costs per unit.
    - The turnover rate in the supermarket is slower.
    - Extra certification costs in the chain are limited.
- Organic salmon products are sold at a very high price, as a luxury product. Margins therefore are higher at all stages of the supply chain.

8.4 Trout

8.4.1 Farmers' prices

The farmers' price for conventional trout is estimated to 3.20 euro per kg live weight (source STEFC, Denmark and France, 2008-2012).

For organic trout, a surplus is assumed of 30% adding up the live weight farmers' price to 4.10 euro/kg.

8.4.2 Consumer prices

Collected consumer prices for trout products are given in Table 19. The average (unweighed) consumer price for fresh or frozen conventional trout amounts to € 17.5/kg. Whole trout was priced at € 7.5 for conventional and € 15.0 per kg for organic. Not all retailers sold organic whole trout. Those that do, show a price difference of about 50-60%.

Large price differences were found between retailers. The low prices of the two Polish supermarkets is remarkable. Apparently, the margins in the whole chain are smaller in Poland than in the mentioned western European countries.

Price observations of organic trout are very scarce. Only two prices were found, both for whole fish. Sales prices of organic trout are clearly higher than of conventional trout whole fish, because it is only sold on stores with a higher sales price of conventional trout whole fish. For the calculations, the consumer price of organic trout products (frozen/fresh) is assumed to be 50% higher than for the conventional product.

Table 19 Consumer prices for trout products (Euro/kg)

		Frozen/fresh		**Whole trout**	
Retailer	Country	Conv.	Org.	Conv.	Org.
Rewe	DE	-	-	7.5	-
Skleprybny	PL	7.9	-	4.9	-
Tesco	PL	14.4	-	4.9	-
Delhaize	BE	-	-	10.4	15.1
Tesco	GB	16.9	-	8.8	-
Fiskehus	DK	19.1	-	8.8	14.7
Picard	FR	28.4	-	-	-
Average		**17.5**	**-**	**7.5**	**15.0**

Sources: retailers' web sites, 12 March, 2015

8.4.3 Revenues break-down in the supply chain

The farmers' price of conventional trout is based on the outcomes of the STECF database. The price for gutted trout is higher, due to transport and gutting costs (€ 0.60/kg) and 10% weight loss. The extra costs for organic production at farmer level are assumed to be 30% higher (Source: this report). Due to lacking information, margins for processing, trade and retail are taken together. Table 20 shows the revenue breakdown for trout and trout products.

Table 20 Revenue break-down in the supply chain for fresh/frozen trout fillets and for whole trout (Euro/kg)

	Fresh/frozen fillets		**Whole trout**	
	Conv.	Org.	Conv.	Org.
Farmers' price	3.20	4.10	3.20	4.10
Price gutted fish	4.20	5.30	4.20	5.30
Value of the fillet	7.80	9.90		
Processing, trade and retail margin	9.70	16.30	3.30	9.70
Consumer price	17.50	26.30	7.50	15.00

8.4.4 Conclusions

The farmers' price for organic trout is about 30% higher than the conventional trout.
The consumer prices for organic trout products are approximately 50% higher and 100% for whole trout; however, whole organic trout is only sold at limited number of retailers, where conventional whole trout is also sold on a higher price. For these retailers the sales price for organic whole trout is about 50-60% higher than for conventional.

8.5 Sea bass and sea bream

8.5.1 Farmers' prices

According to the STEFC database, the average farmers' price in France, Italy and Spain for sea bass and sea bream in 2008 until 2012 was 6.40 euro per kg live weight. For organic sea bass and sea bream, a price of 8.60 euro per kg is calculated (+35%).

8.5.2 Consumer prices

Table 21 shows the collected sales prices of sea bass and sea bream products and whole fish at several retailers.

The average consumer price for fresh or frozen conventional sea bass / sea bream fillets amounts to €25.50/kg and for whole conventional fish to €13.00/kg.

No sales were observed for organic sea bass and sea bream products or whole fish. Based on price differences with the other fish types, organic sea bass and sea bream was assumed to be sold at a 50% higher price.

Table 21 Consumer prices for sea bass and sea bream products (Euro/kg)

		Frozen/fresh		**Whole fish**	
Retailer	Country	Conv.	Org.	Conv.	Org.
Carrefour	FR	38.7	-	-	-
Eroski	ES	24.8	-	-	-
Tesco	GB	25.7	-	13.5	-
Picard	FR	11.8	-	-	-
Rewe	DE	-	-	13.9	-
Rewe	DE	-	-	10.0	-
Sunmarket	IT	-	-	15.9	-
Coop	IT	-	-	7.7	-
Carrefour	GR	-	-	11.5	-
Average		**25.5**	**-**	**13.5**	**-**

Sources: retailers' web sites, 12 March, 2015

8.5.3 Revenues break-down in the supply chain

In table 22, the revenues breakdown in the supply chain of sea bass and sea bream fillet and whole fish is presented.

The farmers' price of conventional sea bass and sea bream is based on the outcomes of the STECF database. The price for gutted sea bass and sea bream is higher, due to transport and gutting costs and 15% weight loss. The extra costs for organic production at farmer level are assumed to be 35% higher (Source: this report).

Table 22 Revenue break-down in the supply chain for fresh/frozen sea bass/sea bream fillets and for whole sea bass/sea bream

	Fresh/frozen fillets		**Whole sea bass and sea bream**	
	Conv.	Org.	Conv.	Org.
Farmers' price	6.40	8.60	6.40	8.60
Price gutted fish	7.80	10.30	7.80	10.30
Value of the fillet	18.50	24.90		
Processing, trade and retail margin	7.00	13.40	5.70	10.00
Consumer price	25.50	38.30	13.50	20.30

8.5.4 Conclusions

- The farmers' price for organic sea bass/sea bream is about 35% higher than the conventional fish.
- The consumer prices for organic sea bass/sea bream products and whole fish are estimated to be 50% higher than their conventional opposites; however, this is an assumption, based on the other fish types, as there were no sales observed.

8.6 Carp

8.6.1 Farmers' prices

For conventional carp, the average farmers' price is 1.90 euro/kg live weight. A surplus for organic production is assumed to be 30%, adding up to a farmers' price of 2.50 euro/kg.

8.6.2 Consumer prices

Consumer prices of carp have been collected at retailers in Poland and Czech Republic, as consumers in these countries typically consume carp. Table 23 shows the price observations. The average consumer price for fresh or frozen conventional carp fillets is € 7/kg and € 4.5 for whole carp.

Price observations of organic carp are missing. Based on price differences with the other fish types, organic carp was assumed to be sold at a 50% higher price.

Table 23 Consumer prices for carp products (Euro/kg)

		Frozen/fresh		**Whole fish**	
Retailer	Country	Conv.	Org.	Conv.	Org.
A.pl	PL	9.2	-	-	-
Skleprybny	PL	7.3	-	4.7	-
Tesco	CZ	5.7	-	4.8	-
Lidl	CZ	6.0	-	-	-
Average		**7.0**	**-**	**4.5**	**-**

Sources: retailers' web sites, 12 March, 2015

8.6.3 Revenues break-down in the supply chain of carp

Table 24 shows the revenues breakdown in the supply chain of carp. The farmers' price of carp is based on analysis of the STECF database. The price for gutted carp is higher, due to transport and gutting costs and 15% weight loss. The extra costs for organic production at farmer level are assumed to be 30% higher (Source: this report).

Table 24 Revenue break-down in the supply chain for fresh/frozen carp fillets and for whole carp

	Fresh/frozen fillets		**Whole carp**	
	Conv.	Org.	Conv.	Org.
Farmers' price	1.90	2.50	1.90	2.50
Price gutted fish	2.60	3.30	2.60	3.30
Value of the fillet	6.00	7.90		
Processing, trade and retail margin	1.00	2.60	1.90	3.50
Consumer price	7.00	10.50	4.50	6.80

8.6.4 Conclusions

- The farmers' price for organic sea bass/sea bream is 30% higher than the conventional fish.
- The consumer prices for organic carp products and whole fish are estimated to be 50% higher than their conventional products and whole fish; however, this is an assumption, based on the other fish types, as there were no sales observed.
- Processing, trade and retail margins are very low, compared to other fish types. This is probably related to the typical point of sales: in Eastern European countries.

8.7 General remarks

Due to the very limited information and even missing observation of organic sales of sea bass/sea bream and carp, the value of the calculations is to give insight, rather than to show realized margins in the supply chain. The calculations for the salmon supply chain are likely to be the most reliable compared to the other fish types; however, even for salmon not all information was available or given and partly based on the actual market situation.

Besides, prices for farmers were partly calculated (based on cost of production) and partly estimated from time series, and may change. Retailer prices were even based on single observations, which is a rather weak source. On the other hand, retailer prices tend not to fluctuate very much over time. To prevent pretended accuracy, margins for the processor, trader and retailer were presented together, except for salmon.

Still some other findings can be derived.

Retail prices for different fish products were collected from 18 different retailers in 12 European countries. These countries and retailers were selected as being important outlets for specific fish types. Carp is typically consumed in Eastern European countries, whereas for salmon countries were chosen along the western seacoast (from Spain to Denmark).

Sea bass/sea bream is sold at the highest retail prices, followed by salmon and trout. Carp is typically sold at low prices and no organic carp is found here. This might be because consumers, who are prosperous enough to afford organic fish, prefer other organic fish. The very low sales prices of carp mean that margins are very small, which suits to a short supply chain with processing at low prices and sales as basic product.

Fish is not only sold at supermarkets. For reasons of quick collection of prices and for optimal product comparability, prices were only observed at supermarket. However, substantial volumes are sold for out-of-home consumption like in restaurants, hospitals etc. Sales prices and margins have not been surveyed. In the mix of sales, this might influence margins for sale at supermarkets, as it is conceivable that margins for out-of-home consumption are different from for sales at supermarkets. This work falls however outside the scope of this project.

Processor margins are about 5€/kg for salmon, which is probably more or less equal for trout and sea bass/sea bream; for carp however, these are substantially lower. Sales prices of carp fillet are much lower than of the other fish types. It is not known whether processing costs are indeed lower, or that processor margins are lower due to the limited sales price.

9 Competitiveness European Organic Aquaculture

9.1 Introduction

A Porter Five Forces analysis has been performed for EU organic aquaculture. This exercise assesses the level of competition within the industry and allows for business strategy development. It draws upon industrial organization (IO) economics to describe the forces that determine the competitive intensity and, therefore, suitability of the product for a market. This analytical work is related to its principal innovator, Dr Michael E. Porter of Harvard University (Porter, 1985). The five forces are Bargaining power of suppliers, bargaining power of buyers/customers, new entrants, Substitute products and Intensity of competitive rivalry. All these factors together determine the competitiveness of any product on a given market.

9.2 Threat of New Entrants: medium to low pressure

The chances for large-scale entries for organic aquaculture management are very low. Organic aquaculture entails large challenges to deal with public and private standards, issues involved in feed and production, as well to market these products against premium prices. These are major hurdles that make the threat of new entrants not very likely, but development of organic aquaculture more an evolutionary practice. This follows also production estimates made by other researchers that have predicted evolutionary growth (e.g. Bergleiter, 2009; Prein et al., 2012). Despite that the organic aquaculture sector lacks recent market information among production figures, no experts interviewed during the research process indicated new large production facilities.

The EU is the pioneer in public legislation for organic farming and a legislative framework for organic aquaculture was introduced in 2009 (EC, 2009). In addition, private legislation goes sometimes beyond this legislation. An important production regulation is that it is not permitted to commit a new introduction of a species into a country or location in which it previously did not exist specifically for the purpose of organic aquaculture. However, if the introduction occurred at least several years prior to the certification of the farm and the species is considered to be established naturally in the environment and is environmentally benign, then organic certification is permitted (Prein et al., 2012). Therefore, it is not likely that production volumes will expand quickly at places that had no production before. This is among other production issues such as the aim to achieve a closed life cycle and to avoid collection of seed from the wild.

In the Organic Shrimp Project (Paul and Vogl, 2012) illustrates other hurdles. The case shows that the standard set by Naturland promotes use of local resources therefore local knowledge is a necessary asset to deploy organic aquaculture activities. Furthermore, it may not be possible to export organic shrimp from Bangladesh to different countries applying similar standards, until multiple inspection and certification bodies work together creating one standard for all.

Production of feed is an existing bottleneck in organic aquaculture. Producers are facing a drastic increase in feed prices, particularly if organic vegetable feed ingredients (e.g. soy, cereals) have to be sourced from global markets. Especially sourcing at the national or local level can be a serious obstacle for start-ups, notably in developing countries. The establishment of the first local organic aquaculture feed mill is a challenging process or getting cooperation from regular feed mills especially in countries with little organic farms (Prein et al., 2012). First promising projects of this kind have developed in Brazil, India and Bangladesh. However, sometimes locally produced aquaculture products can be produced organic because of the characteristics of the produce. For example in Lithuania, one third of all produced carp is organic, which is in general domestically consumed (Prein et al., 2012).

To date, around 80 different organic aquaculture standards exist, of which there are 18 in the countries of the European Union (EU) (Bergleiter et al., 2009; Xie et al., 2013). They vary considerably from country to country, from certifier to certifier and species to species. Regional differences in standards and certification for organic aquaculture production and processing are often justifiable and even desirable due to diverse geography agronomic conditions, culture and stage of development throughout the world. Thus, when an aquaculture producer wants to comply with the organic standards of (one of) its national certification authorities, it depends on the stringency of this authority how feasible organic aquaculture production is (Fransen, 2015).

The past decade has seen a rise in demand for organic aquaculture products, notably in Europe, North America and Japan. A large proportion of organically certified aquaculture products are produced in developing countries then processed and shipped to these markets. This implies that the organic aquaculture chain should be governed and in place when entering organic aquaculture production. The regulatory requirements make certification more difficult as well as expensive, especially in developing markets and for export certification.

In sum, large hurdles exist and do not seem to solve at the short term that make large scale entry of organic aquaculture very likely. Just recently, one of the largest producers of organic salmon, Villa Organic AS in Norway ceased operations for organic and switched to produce ASC-certified salmon, being certified previously by the Norwegian organic label Debio. It illustrates that hurdles exist for well know European producers in organic aquaculture business.

9.3 Buyer Power: high pressure for certification, medium for organic

Marketing of seafood in general and of organically certified seafood in particular is characterized by a diverse set of marketing channels, as is the case with other foods. These can range from sales at the farm gate or in small, specialized organic food shops to supermarkets and discounters. Most growth in sales of organic seafood is manifest at the large retailers in Europe and is expected to grow further the coming years. Therefore, the supermarket should have the focus in marketing organic fish.

For ease of sourcing and reducing risks, large retailers need reliable systems to verify and manage the fish production supply chain. In addition to the range of public regulatory frameworks for food safety and quality and for the protection of the environment from potential negative impacts of aquaculture, a range of related standards have been introduced by the private sector (e.g. processors, retailers) or by non-governmental organizations (NGOs). Where organic standards represent a high level of requirements but with relative low levels in volume, a whole set of standards have been developed between organic and minimum regulation with lower requirements but with higher volumes see e.g. Ababouch (2012) or Xie (2013) for an overview of the different standards in aquaculture. Some retailers are now buying direct from aquaculture producers and therefore communicating specifications directly to them. Many have their own audit and inspection requirements. For example, Carrefour, the world’s second largest retailer, buys shrimp directly from farmers in Thailand, which involves sending their own inspectors to verify that products and farming practices meet their own standards. Since these retailers have the procurement power, adoption of a certain label or organic production depends on them. As there are few large international players on the market, this makes aquaculture producers in a very dependent position (Fransen, 2015).

These standards, referred to as private standards and the related certification are becoming significant features of international fish trade and marketing for large supermarket chains. In practice, an independent audit assessment is often required by retailers and other customers as a prerequisite to supply in order to find farms best equipped to comply with standards that are often externally defined. Results monitoring is used to establish who can participate and who cannot (Vellema and Van den Bosch, 2004). This is becoming an increasingly common practice both inside and outside the EU (Ingenbleek and Immink, 2010). In this way, retailers and food service expand their decision making backward in the channel to include products, food safety, animal welfare and sustainability. Their influence has increased and their sourcing criteria are formulated in these standards. If a producer wants to supply an organisation that has adopted the sourcing criteria, it must comply with these standards. When retailers and food services adopt organic fish, this can therefore become an essential element of customers’ requirements and part of 'the licence to deliver' for retailers, or a contribution to corporate social responsibility.

While retailers increasingly focus on costs and low prices, they also aim to distinguish themselves and organic might be an opportunity for supermarkets to fill in a unique position. There has been increased recognition of the importance of more sustainable and environmentally friendly fishing and aquaculture methods. The growing importance of these products has resulted in increasing interest by major world retailers. They relate to a range of objectives, including sustainability of fish stocks, environmental protection, food safety and quality, as well as to aspects such as animal health and welfare and socio-economic considerations. They are increasingly linked to the private firms' corporate social responsibility strategies. As large retail chains in Europe dominate the market and decide what standards are required for aquaculture products, producers experience high pressure from buyers. Retail chains prescribe (especially their suppliers from outside Europe) what certification their products should have and by which organization their production should be done (Ababouch, 2012). Adherence to these and other private standards (related to environmental protection, animal health and social development) usually forms part of firms' corporate social responsibility (CSR) strategies, which are marketed both to other businesses as well as to consumers, to enhance the firm's overall reputation. It also helps them tap into and grow consumer demand for ethical products (Ababouch, 2012).

The extent retailers are commit to CSR differs. Working on CSR reputation for a retailer sometimes implies showing commitment to the highest available standards like organic. Where others choose to offer choice to consumers and offer both the highest as well to in-between standards like ASC among others. For other retailers the organic levels might be a step to far from their positioning and they will stick to ASC products. So depending on their customers and positioning, organic is an instrument for reputation management for retailers. Hence, as the market for certified aquaculture is still developing, less stringent standards than organic ones are serious competitors. According to Fransen (2015), ASC leaves some requirements out of the program for certification since these are not achievable yet.

Buyers of organic aquaculture products take considerable risks when procuring them. When procuring outside Europe, security of organic standards is lower and might be a potential threat on its reputation (Fransen interview, 2015). Because selling organic fish is mainly about reputation and not so much on volume, retailers will be very keen on the production process and chain. Preferably, they will work with commitment from an NGO that is familiar also by their end-customers (Ingenbleek and Immink, 2010). Therefore, the motives to sell organic fish might be much different from for selling other fish. The latter is likely sold because of volumes, margins. Whereas organic offers opportunities to distinguish the retail formula.

9.4 Threat of Substitution: high pressure

Seafood from traditional fisheries and seafood from organic aquaculture compete. For organic, marine products might be seen as an important substitute product as wild catch fish might be considered to be organic by end consumers. As shown in OrAqua deliverable D3.1, Consumers are often confused that wild fish is not organic and it takes a large amount of effort to educate consumers on this aspect to change their perception. Whereas for ASC and MSC this difference is much clearer what might benefit both labels, whereas for organic the confusion remains and put these in a disadvantage.

Another substitute for organic fish is on the fact that is has a certified label. Hence, unfamiliarity and ignorance of consumers are issues with respect to labelling of fishery and aquaculture products. Thus, pure on the fact that labels might be the distinguishing device without exactly knowing the difference between labels like organic from the EU, Naturland, BioSuisse among other labels like ASC. Hence, retailers who want to distinguish themselves by offering certified aquaculture products might want to do this at first by more common or well-known labels. As organic aquaculture is not a commonly known label yet, investments in organic production and certification might be a too high a threshold at this moment for retailers to invest (Fransen, 2015). The survey in OrAqua (deliverable

3.1) also found that consumers are not aware of the EU organic label, while local (private) labels were more known.

Organic should distinguish itself from the low price segment but also has to deal with it but the pressure in the market is high. With a recession and many consumers that are price focused, and an aquaculture industry, that has been increasingly targeting a number of new market segments with higher-volume rather than higher price segments with e.g. tilapia and pangasius. This will affect the price perception of organic and most likely negatively. On the other side, consumers might also get more aware about the circumstances and quality of low priced fish. Other consumers might have motives not to buy low priced fish that might benefit organic in the long term.

9.5 Supplier Power: medium pressure

Organic aquaculture producers have low power for entering the shelves of retail chains. Hence, it is for producers of organic aquaculture to seek for retailers who want to distinguish themselves by offering organic aquaculture products.

Quality expressed in price is dominant in marketing channels. Differentiation in consumer quality perception based on production requirements beyond minimum legislation restricts market opportunities because a relatively small group of consumers actively looks for a welfare product. This will require an additional step in increasing consumer awareness for organic fish in the production practice when making choices, e.g. by advertising and labelling products with higher production standards. A special segment in retailers and food service gives local markets such as specialty restaurants, local supermarkets or franchise supermarket stores wanting to distinguish themselves from the mainstream the opportunity of offering an organic segment. These parties also use labels but sales are often based on the intrinsic quality of the product. When organic aquaculture implies a better product, in particular taste, they would not specifically communicate the production practice but the quality. Often the production is the focus and not the consumer preferences therefore the market power of producers of organic aquaculture is limited.

Organic producers are vulnerable, and this limits their market power in the supply chain. With the market size for organic fish being limited, and the difficulty in gaining market share, prices will decline rapidly as increased supply are forcing a movement down along the demand schedule (Ashe et al., 2009). This fact makes a more governed growth of organic sector necessary, for example with market arrangements with supply chain partners about volumes and prices. Numerous successful examples show that joint ventures or long-term contractual arrangements between retailers and producers contain supporting arrangements and create incentives (Prein et al., 2012). This way a more evolutionary growth is possible and prevent declining prices for producers.

When suppliers gain a higher degree of control of the production process and the main hurdles for switching to organic, they will gain influence. Control of the production process is the most important factor in the growth of aquaculture (Asche et al., 2009). Market arrangements will be easier to achieve with chain parties, therefore control of the production process also allows better logistics and marketing.

The main production area for organic seafood is Asia. For many of these products there is no local market, but production is aimed for the Western market. The production facilities may even be established by these countries to supply their market with organic cultured fish like the organic shrimp project. Organic shrimp has no local market in Bangladesh. Farmers depend on exports and marketing of organic shrimp is a big concern for farmers. The major market for certified organic shrimp is limited to western countries like North America, Europe, Australia and Japan (Paul and Vogl, 2012).

9.6 Competitive Rivalry: high pressure

Globally, the demand of organic products is increasing robustly and sales have increased to over five billion US$ Willer et al., 2008). Several countries have formulated national standards and strategies for up scaling of organic aquaculture, for example, Thailand (Ruangpan, 2007), which reflects government commitment and support to the growth of the sector (Prein et al., 2012). With respect to aquaculture, a large share of products are imported in the EU (EUMOFA, 2014). Hence, aquaculture products have much more competition at a global level. Hence, the global aspect should be taken into consideration when evaluating organic standards. Especially South-East Asia and Latin America is a major supplier for Europe. This corresponds with the fact that the major share of production certified by ASC is outside Europe (Fransen, 2015). Hence, production in these regions is or is being certified since procurement by European retailers demands a label. Reasons for procurement in these regions of the world lie mainly in a price difference. Amongst others the climate and other regulations make that aquaculture farms are able to produce for a lower price than in Europe (Fransen, 2015). All these arguments hold for European organic aquaculture as well placing itself therefore at a less competitive position globally. Organic aquaculture in Asia and Latin America might benefit when they get the supply chain organized and compete against European organic producers, since Europe's more stringent certification is connected with more costs.

10 Key learning experiences on socio-economics of organic aquaculture

10.1 Farm level

Transfer to organic aquaculture has a large impact on farm structure, farm management and cost price.

In all discussed cases the cost price rises; the extend of the increase varies from 15% for the Danish trout production up to 80% for carp production in Romania.

Generally, the feed costs are responsible for the largest contribution to the raising of the cost price, followed by the costs for juveniles (if available) and the fixed costs. The high fixed costs are caused by the required lower stocking density. The reason is that costs for buildings, installations and machinery (like depreciation, maintenance, and repair financial costs) for instance must be spread over a less production volume.

On the production side, a lower daily growth causes for some species a higher cost price. This is in particular the case for sea bass and sea bream. The consequence is longer production period, which can lead to an extra winter period which hardly any growth.

Bergleiter et al (2009) published **cost prices** of organic aquaculture on farm level. Unfortunately no context is given, so no comparison with conventional aquaculture is possible. In table 25, the relevant results of Bergleiter et al. are placed next to the results as found in this report.

- It appears that in most cases no big differences are found.
- The production costs of salmon in Ireland as calculated in our report are significantly higher than indicated by Bergleiter et al.
- The production costs of sea bass and sea bream in Italy as calculated in our report are significantly lower than indicated by Bergleiter et al (2009).

The reasons for this difference are not retraceable as Bergleiter et al. (2009) do not publish the underlying cost categories.

Table 25 Cost price of organic salmon, trout, sea bass and sea bream and carp according to Bergleiter et al. and the results in this report (in euro/kg)

	Bergleiter e.a.	This report	
Salmon	4.0 (3.0 to 5.5)	Norway	3.4
		Ireland	7.1
		UK	3.9
Trout	4.0	Denmark	3.2
		France	4.1
		Italy	2.3
Sea bass and sea bream	6.8 (5.0 to 10.0)	France	8.1
		Italy	9.9
		Spain	7.8
Carp	2.4	Romania	1.9
		Poland	2.8
		Germany	2.8

Bergleiter et al. (2009) published **price premiums** for organic aquaculture on farm level. Relevant results are given in Table 26 the mentioned premiums do globally correspond with the higher cost price, found in this report.

Bergleiter et al. indicate that this premium could not always be realized by the farmers. In the workshops, this was confirmed by participants in the sea bass and sea bream sector and in the carp sector.

The interviewed processors and traders stated that due to temporally mismatches of supply and demand organically produced fish is frequently sold on the conventional market.

Table 26 Price premiums for organic aquaculture on farm level (Bergleiter et al., 2009)

	2006	2007	2008
Salmon	32%	32%	33%
Trout	37%	31%	30%
Sea bass and sea bream	30%	40%	45%
Carp	38%	30%	40%

10.2 Chain and consumer level

The higher costs on farm level have their consequences for the prices in the chain and for the consumer.

The higher costs are assumed to affect directly the farmers' selling price for organic fish. This assumption is made based on the following arguments:

- The economic law says that the long-term costs and returns for a sector are in balance. If this is not the case, the market will adjust by changing supply or demand volumes.
- Bergleiter et al (2009) found price premiums for organic aquaculture of about 30%
- Personal information from salmon traders and processors in particular confirms this level of premium for organic or other special labels.

In the OrAqua workshops, however, it was mentioned that sufficient premiums for organic sea bass, sea bream and carp are hard to realize.

In the salmon chain the margins for organic products are – relatively seen – about same as for conventional product. In absolute terms, this means a higher margin.

According to the processors, this higher margin is needed. The main reason is that it is hard to balance supply and demand on the short term. The consequence is that organically produced fish is often sold conventionally. So for a substantial part of the fish products produced and processed under organic circumstances no price supplement is realized.

The found consumer prices for organic fish appear to be about 30% higher compared to conventional farmed fish products.

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Appendices

APPENDIX 1 List of issues mentioned in the regulations and possible impact

	Regulation text	Impact?	Field of impact
1	(4) The aquatic growing area for organic seaweed and aquaculture animals is of utmost importance for growing both safe and high quality products with minimal impact on the aquatic environment. Community legislation on quality of waters and contaminants in food, including Directive 2000/60/EC of the European Parliament and of the Council of 23 October 2000 establishing a framework for Community action in the field of water policy (4), Directive 2008/56/EC of the European Parliament and of the Council of 17 June 2008 establishing a framework for community action in the field of marine environmental policy (Marine Strategy Framework Directive) (5), Commission Regulation (EC) No 1881/2006 of 19 December 2006 setting maximum levels for certain contaminants in foodstuffs (6), and Regulations (EC) No 852/2004 (7), (EC) No 853/2004 (8) and (EC) No 854/2004 (9) of the European Parliament and of the Council provide for environmental objectives for water and ensures high food quality. It is therefore appropriate to draw up a sustainable management plan for seaweed and aquaculture production specifying measures, such as waste reduction.	Yes	Sustainable Management Plan
	(5) Council Directive 85/337/EEC of 27 June 1985 on the assessment of the effects of certain public and private projects on the environment (10), Council Directive 92/43/EEC of 21 May 1992 on the conservation of natural habitats and of wild fauna and flora (11) and Council Directive 79/409/EEC of 2 April 1979 on the conservation of wild birds (12) should ensure proper interaction with the environment while taking into account the impact of these activities on the environmental objectives for water set out in application of Directives 2000/60/EC and 2008/56/EC. Provisions should be made for drawing up an environmental assessment covering best adaptation to the surrounding environment and mitigation of possible negative effects. There should be consideration that such assessments should ensure that organic production of seaweed and aquaculture animals which is a relative new activity in comparison with organic agriculture is not only environmentally acceptable, but relative to other options, most in accord with broad public interests and both environmentally suitable and sustainable.	Yes	Environmental Impact Assessment
2	(6) The specific soluble medium of water requires organic and non-organic aquaculture production units to be adequately separated; appropriate separation measures should be laid down. Given the variability of situations regarding both freshwater and marine environments throughout the Community it is preferable that adequate separation distances are set at Member States level, as Member States are best equipped to deal with	Maybe	Location Selection and/or separation measures of water of organic and non-organic aquaculture Production

	Regulation text	Impact?	Field of impact
	separation given the heterogeneous nature of such aquatic environments.		
	(7) The cultivation of seaweed can have a beneficial effect in some respects such as nutrient removal and can facilitate polyculture. Care needs to be taken not to over-harvest wild seaweed beds to permit their regeneration and to ensure that production does not cause a significant impact on the state of the aquatic environment.	No	Not overharvesting wild seaweed as it can have a positive effect on the production system
	(8) Member States faces increasing shortages in the supply of organic protein crops. At the same time the imports of organic protein feed have been insufficient to meet requirements. The total cultivation area of organic protein crops is not large enough to meet the need for organic protein; therefore protein feed derived from parcels in their first year of conversion should be allowed to be fed under certain conditions.	No	Protein from parcels that are in their first year of conversion may be used as feed
	(9) Given the early stage of organic aquaculture animal production organic broodstock is not available in sufficient quantities. Provision should be made for the introduction of non-organic broodstock and juveniles under certain conditions.	Yes	If non-organic broodstock is not available, non-organic broodstock should be allowed under certain conditions.
	(10) Organic aquaculture animal production should ensure that species-specific needs of animals are met. In this regard husbandry practices, management systems and containment systems should satisfy the welfare needs of animals. Provisions on the appropriate construction of cages and net pens at sea as well as for rearing systems on land should be made. To minimise pests and parasites and for the reason of high animal welfare and health, maximum stocking densities should be laid down. Taking account of the broad variation of species with particular needs, specific provisions should be laid down.	yes	species specific needs of animals should be met to ensure animal welfare needs (SPECIES SPECIFIC DEMANDS IN ANNEX)
	(11) Recent technical development has led to increasing use of closed recirculation systems for aquaculture production, such systems depend on external input and high energy but permit reduction of waste discharges and prevention of escapes. Due to the principle that organic production should be as close as possible to nature the use of such systems should not be allowed for organic production until further knowledge is available. Exceptional use should be possible only for the specific production situation of hatcheries and nurseries.	No	RAS is not certifiable except hatcheries and nurseries in certain cases
	(12) The overall principles for organic production, as provided for in Article 4 and 5 of Regulation (EC) No 834/2007, shall be based on an appropriate design and management of biological processes, based on ecological systems using natural resources which are internal to the system by methods that, in particular practice aquaculture complying with the principle of sustainable exploitation	Yes	Use of hormones is prohibited: HAS AN IMPACT ON Growth Rates,

	Regulation text	Impact?	Field of impact
	of fisheries. They provide also for the principle that the biodiversity of natural aquatic ecosystems has to be maintained in aquaculture production. These principles are otherwise based on risk assessment, and the use of precautionary and preventive measures, when appropriate. To this end, it should be clarified that artificial induction of the reproduction of aquaculture animals through hormones and hormones derivatives is incompatible with the concept of organic production and consumer perception of organic aquaculture products and that such substances should therefore not be used in organic aquaculture.		
	(13) Feed for aquaculture animals should meet the nutritional needs and is also required to meet the health requirement that feed coming from a species is not fed to the same species as laid down in Regulation (EC) No 999/2001 of the European Parliament and of the Council of 22 May 2001 laying down rules for the prevention, control and eradication of certain transmissible spongiform encephalopathies (1). It is therefore appropriate to lay down specific provisions for carnivorous and non-carnivorous aquaculture animals.	No	Specific rules for carnivorous and non-carnivorous species.
	(14) The raw materials for feeding organic carnivorous fish and crustaceans should preferably be derived from sustainable exploitation of fisheries as referred to in Article 5(o) of Regulation (EC) No 834/2007 and defined in Article 3(e) of Council Regulation (EC) No 2371/2002 of 20 December 2002 on the conservation and sustainable exploitation of fisheries resources under the Common Fisheries Policy (2) or organic feed derived from organic aquaculture sources. Given the early stage of organic aquaculture and sustainable fisheries shortages of organic feed or feed from sustainable fisheries may occur, provisions should be made for the use of nonorganic feed and be based on Regulation (EC) No 1774/2002 of the European Parliament and of the Council (3), which sets the health rules for material of fish origin which may be used in aquaculture and provides for a ban on the feeding of certain materials derived from farmed fish to farmed fish of the same species.	Yes	Raw material for carnivorous fish should come from sustainable fisheries (CFP) or organic aquaculture. (Only If Available)
	(15) For the purpose of organic aquaculture animal and seaweed production, the use of certain non-organic feed materials, feed additives and processing aids is allowed under well-defined conditions. New materials in question should be authorised according to Article 16(1) of Regulation (EC) No 834/2007. Based on the recommendation of an ad-hoc expert group (1) on 'Fish feed and cleaning materials in organic aquaculture' which concluded that such substances already listed in Annex V and Annex VI to Regulation (EC) No 889/2008 and authorised for organic livestock production should be allowed also for organic aquaculture and concluding that certain substances are essential for particular fish species, such substances should be added to Annex VI	Yes	For certain species certain non-organic feed materials may be allowed (for list see Annex)

	Regulation text	Impact?	Field of impact
	to that Regulation.		
3	(16) The cultivation of filter feeding bivalve molluscs can have a beneficial effect on coastal water quality via the removal of nutrients and their use can also facilitate polyculture. Specific rules for molluscs should be laid down by taking into account that supplementary feeding is not required and that the environmental impact could be consequently lower than other branches of aquaculture in this respect.	No	Specific rules for bivalves
	(17) Animal health management should be primarily based on the prevention of disease. The measures provided for in this Regulation should be without prejudice to Council Directive 2006/88/EC of 24 October 2006 on animal health requirements for aquaculture animals and products thereof, and on the prevention and control of certain diseases in aquatic animals (2) in case of veterinary treatment. Certain substances for cleaning, antifouling treatment and disinfection of production equipment and facilities should be allowed under defined conditions. In the presence of live animals the use of disinfection substances requires particular care and measures to ensure that the application is not harmful. Such substances should be authorised according to Article 16(1) of Regulation (EC) No 834/2007. Based on the recommendation of an ad-hoc expert group such substances should be listed in the Annex.	Yes	Health Management --> mortality rates
	(18) Specific rules for veterinary treatment should be laid down ranking the different types of treatments and limiting the frequency of use in the case of allopathic treatments.	Yes	Veterinary treatments --> Mortality rates
	(19) Precaution should be taken during the handling and transport of live fish so as to meet their physiological needs.	Yes	Specific requirements for handling and transport live fish
	(20) The conversion to the organic production method requires the adaptation of all means to the organic method for a given period. Depending on the previous production systems specific conversion periods should be laid down.	Yes	Conversion Period - Delay of impact
	(21) It appeared that certain Annexes of Regulation (EC) No 889/2007 contain mistakes; Provisions to correct these mistakes should be taken.	No	
	(22) Provisions for specific control requirements which take account of the specificities of aquaculture should be laid down.	No	
	(23) To facilitate the conversion of holdings already producing organically under national or private standards to the new Community rules certain transitional measures should be laid down.	No	
	(24) Organic aquaculture is a relatively new field of organic production compared to organic agriculture, where long experience exists at the farm level. Given consumers' growing interest in organic aquaculture products further growth in the conversion of aquaculture units to organic	No	

	Regulation text	Impact?	Field of impact
	production is likely. This will soon lead to increased experience and technical knowledge. Moreover, planned research is expected to result in new knowledge in particular on containment systems, the need of nonorganic feed ingredients, or stocking densities for certain species. New knowledge and technical development, which would lead to an improvement in organic aquaculture, should be reflected in the production rules. Therefore provision should be made to review the present legislation with a view to modifying it where appropriate.		
	(25) Regulation (EC) No 889/2008 should therefore be amended accordingly.	No	
	(26) The measures provided for in this Regulation are in accordance with the opinion of the regulatory Committee on organic production,	No	
	HAS ADOPTED THIS REGULATION: Article 1 Regulation (EC) No 889/2008 is amended as follows: 1. In Article 1, paragraph 2 is replaced by the following: '2. This Regulation shall not apply to: (a) livestock species other than those referred to in Article 7; and (b) to aquaculture animals other than those referred to in Article 25a.	No	
	However, Title II, Title III and Title IV shall apply mutatis mutandis to such products until detailed production rules for those products are laid down on the basis of Regulation (EC) No 834/2007.'	No	
4	2. Article 2 is amended as follows: (a) point (f) is replaced by the following:		
	'(f) "production unit" means all assets to be used for a production sector such as production premises, land parcels, pasturages, open air areas, livestock buildings, fish ponds, containment systems for seaweed or aquaculture animals, shore or seabed concessions, the premises for the storage of crops, crop products, seaweed products, animal products, raw materials and any other input relevant for this specific production sector;'	No	Just Definition
	(b) after point (i) the following points are added: '(j) "closed recirculation aquaculture facility" means a facility where aquaculture takes place within an enclosed environment on land or on a vessel involving the recirculation of water, and depending on permanent external energy input to stabilize the environment for the aquaculture animals;	No	Just Definition
	(k) "energy from renewable sources" means renewable non-fossil energy sources: wind, solar, geothermal, wave, tidal, hydropower, landfill gas, sewage treatment plant gas and biogases;	No	Just Definition
	(l) "hatchery" means a place of breeding, hatching and rearing through the early life stages of aquaculture	No	Just definition

	Regulation text	Impact?	Field of impact
	animals, finfish and shellfish in particular;		
	(m) “nursery” means a place where an intermediate farming system, between the hatchery and grow-out stages is applied. The nursery stage is completed within the first third of the production cycle with the exception of species undergoing a smoltification process;	No	Just Definition
	(n) “pollution” in the framework of aquaculture and seaweed production means the direct or indirect introduction into the aquatic environment of substances or energy as defined in Directive 2008/56/EC of the European Parliament and of the Council (*) and in Directive 2000/60/EC of the European Parliament and of the Council (**), in the waters where they respectively apply;	No	Just Definition
	(o) “polyculture” in the framework of aquaculture and seaweed production, means the rearing of two or more species usually from different trophic levels in the same culture unit;	No	Just Definition
	(p) “production cycle” in the framework of aquaculture and seaweed production, means the lifespan of an aquaculture animal or seaweed from the earliest life stage to harvesting;	No	Just Definition
	(q) “locally grown species” in the framework of aquaculture and seaweed production, means those which are neither alien nor locally absent species under Council Regulation (EC) No 708/2007 (***). Those species listed in Annex IV of Regulation (EC) No 708/2007 may be considered as locally grown species.	No	Just Definition
	(r) “stocking density” in the framework of aquaculture, means the live weight of animals per cubic metre of water at any time during the grow-out phase and in the case of flatfish and shrimp the weight per square metre of surface.	No	Just Definition
	3. In Title II, the following Chapter 1a is inserted: ‘CHAPTER 1a Seaweed production		
	Article 6a Scope This Chapter lays down detailed production rules for the collection and farming of seaweed. It applies mutatis mutandis to the production of all multi-cellular marine algae or phytoplankton and micro-algae for further use as feed for aquaculture animals.	No	Specifics for seaweed
	Article 6b Suitability of aquatic medium and sustainable management plan		
	1. Operations shall be situated in locations that are not subject to contamination by products or substances not authorised for organic production, or pollutants that would compromise the organic nature of the products.	No	Location of the farm

	Regulation text	Impact?	Field of impact
	2. Organic and non-organic production units shall be separated adequately. Such separation measures shall be based on the natural situation, separate water distribution systems, distances, the tidal flow, the upstream and the downstream location of the organic production unit. Member State authorities may designate locations or areas which they consider to be unsuitable for organic aquaculture or seaweed harvesting and may also set up minimum separation distances between organic and nonorganic production units. Where minimum separation distances are set Member States shall provide this information to operators, other Member States and the Commission.	?	Location of the farm. Maybe for water distribution cost factor
5	3. An environmental assessment proportionate to the production unit shall be required for all new operations applying for organic production and producing more than 20 tonnes of aquaculture products per year to ascertain the conditions of the production unit and its immediate environment and likely effects of its operation. The operator shall provide the environmental assessment to the control body or control authority. The content of the environmental assessment shall be based on Annex IV to Council Directive 85/337/EEC (*). If the unit has already been subject to an equivalent assessment, then its use shall be permitted for this purpose.	Yes	Environmental Impact Assessment
	4. The operator shall provide a sustainable management plan proportionate to the production unit for aquaculture and seaweed harvesting. The plan shall be updated annually and shall detail the environmental effects of the operation, the environmental monitoring to be undertaken, and list measures to be taken to minimise negative impacts on the surrounding aquatic and terrestrial environments, including, where applicable, nutrient discharge into the environment per production cycle or per annum. The plan shall record the surveillance and repair of technical equipment.	Yes	Sustainable Management Plan
	5. Aquaculture and seaweed business operators shall by preference use renewable energy sources and re-cycle materials and shall draw up as part of the sustainable management plan a waste reduction schedule to be put in place at the commencement of operations. Where possible, the use of residual heat shall be limited to energy from renewable sources.	Yes	Use Renewable energy sources and waste reduction
	6. For seaweed harvesting a once-off biomass estimate shall be undertaken at the outset. Article 6c Sustainable harvesting of wild seaweed	No	Seaweed Only
	1. Documentary accounts shall be maintained in the unit or premises and shall enable the operator to identify and the control authority or control body to verify that the harvesters have supplied only wild seaweed produced in accordance with Regulation (EC) No 834/2007.	No	Seaweed Only
	2. Harvesting shall be carried out in such a way that the amounts harvested do not cause a significant impact on the	No	Seaweed Only

	Regulation text	Impact?	Field of impact
	state of the aquatic environment. Measures shall be taken to ensure that seaweed can regenerate, such as harvest technique, minimum sizes, ages, reproductive cycles or size of remaining seaweed.		
	3. If seaweed is harvested from a shared or common harvest area, documentary evidence shall be available that the total harvest complies with this Regulation.	No	Seaweed Only
	4. With respect to Article 73b(2)(b) and (c), these records must provide evidence of sustainable management and of no long-term impact on the harvesting areas.	No	Seaweed Only
	Article 6d Seaweed Cultivation		
	1. Seaweed culture at sea shall only utilise nutrients naturally occurring in the environment, or from organic aquaculture animal production, preferably located nearby as part of a polyculture system.	No	Seaweed Only
	2. In facilities on land where external nutrient sources are used the nutrient levels in the effluent water shall be verifiably the same, or lower, than the inflowing water. Only nutrients of plant or mineral origin and as listed in Annex I may be used.	No	Seaweed Only
	3. Culture density or operational intensity shall be recorded and shall maintain the integrity of the aquatic environment by ensuring that the maximum quantity of seaweed which can be supported without negative effects on the environment is not exceeded.	No	Seaweed Only
	4. Ropes and other equipment used for growing seaweed shall be re-used or recycled where possible.	No	Seaweed Only
	Article 6e Antifouling measures and cleaning of production equipment and facilities		
	1. Bio-fouling organisms shall be removed only by physical means or by hand and where appropriate returned to the sea at a distance from the farm.	Yes	Removal of Bio-fouling organisms
	2. Cleaning of equipment and facilities shall be carried out by physical or mechanical measures. Where this is not satisfactory only substances as listed in Annex VII, Section 2 may be used.	No	Cleaning of equipment and facilities
6	(*) OJ L 175, 5.7.1985, p. 40.'		
	4. In Article 21, paragraph 2 is replaced by the following:		
	'2. Up to 20 % of the total average amount of feedstuffs fed to livestock may originate from the grazing or harvesting of permanent pastures, perennial forage parcels or protein crops, sown under organic management on lands in their first year of conversion, provided that they are part of the holding itself and have not been part of an organic production unit of that holding in the last five years. When both in-conversion feedstuffs and feedstuffs from parcels in their first year of conversion are being used, the total combined percentage of such feedstuffs shall not exceed the maximum percentages fixed in paragraph 1.'	No	Only impact on conversion, period and feed
	5. In Title II, the following Chapter 2a is inserted: 'CHAPTER 2a		

FP7-KBBE. 2013.1.2-11 Assessment of organic aquaculture for further development of European regulatory framework
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	Regulation text	Impact?	Field of impact
	Aquaculture animal production S e c t i o n 1 G e n e r a l r u l e s Article 25a Scope This Chapter lays down detailed production rules for species of fish, crustaceans, echinoderms and molluscs as covered by Annex XIIIa. It applies mutatis mutandis to zooplankton, micro-crustaceans, rotifers, worms and other aquatic feed animals. Article 25b Suitability of aquatic medium and sustainable management plan 1. The provisions of Article 6b(1) to (5) shall apply to this Chapter.		
	2. Defensive and preventive measures taken against predators under Council Directive 92/43/EEC (*) and national rules shall be recorded in the sustainable management plan.	No	Defensive and preventive measures against predators have already been taken
	3. Verifiable coordination shall take place with the neighbouring operators in drawing up their management plans where applicable.	Yes	Management plan coordination
	4. For aquaculture animal production in fishponds, tanks or raceways, farms shall be equipped with either natural filter beds, settlement ponds, biological filters or mechanical filters to collect waste nutrients or use seaweeds and/or animals (bivalves and algae) which contribute to improving the quality of the effluent. Effluent monitoring shall be carried out at regular intervals where appropriate.	Yes	Affluent Treatment
	Article 25c Simultaneous production of organic and non-organic aquaculture animals		
	1. The competent authority may permit hatcheries and nurseries to rear both organic and non-organic juveniles in the same holding provided there is clear physical separation between the units and a separate water distribution system exists.	No	Simultaneous production of organic and non organic juveniles
	2. In case of grow-out production, the competent authority may permit organic and non-organic aquaculture animal production units on the same holding provided Article 6b(2) of this Regulation is complied with and where different production phases and different handling periods of the aquaculture animals are involved.	No	Simultaneous production of organic and non organic grow out
	3. Operators shall keep documentary evidence of the use of provisions referred to in this Article.		
	S e c t i o n 2 O r i g i n o f a q u a c u l t u r e a n i m a l s		
	Article 25d Origin of organic aquaculture animals 1. Locally grown species shall be used and breeding shall aim to give strains which are more adapted to farming	No	Use of local species

	Regulation text	Impact?	Field of impact
	conditions, good health and good utilisation of feed resources. Documentary evidence of their origin and treatment shall be provided for the control body or control authority.		
	2. Species shall be chosen which can be farmed without causing significant damage to wild stocks.	No	Species that do not depend on wild stocks
	Article 25e Origin and management of non-organic aquaculture animals		
	1. For breeding purposes or for improving genetic stock and when organic aquaculture animals are not available, wild caught or non-organic aquaculture animals may be brought into a holding. Such animals shall be kept under organic management for at least three months before they may be used for breeding.	Yes	Organic Management of broodstock
	2. For on-growing purposes and when organic aquaculture juvenile animals are not available non-organic aquaculture juveniles may be brought into a holding. At least the latter two thirds of the duration of the production cycle shall be managed under organic management.	Yes	Latter two stages of production cycle need to be under organic management
7	3. The maximum percentage of non-organic aquaculture juveniles introduced to the farm shall be: 80 % by 31 December 2011, 50 % by 31 December 2013 and 0 % by 31 December 2015.	Yes	Origin of juveniles organic hatcheries (transitional)
	4. For on-growing purposes the collection of wild aquaculture juveniles is specifically restricted to the following cases: (a) natural influx of fish or crustacean larvae and juveniles when filling ponds, containment systems and enclosures; (b) European glass eel, provided that an approved eel management plan is in place for the location and artificial reproduction of eel remains unsolved.	Yes	Natural influx is allowed (trap and hold systems)
	S e c t i o n 3 A q u a c u l t u r e H u s b a n d r y p r a c t i c e s Article 25f General aquaculture husbandry rules		
	1. The husbandry environment of the aquaculture animals shall be designed in such a way that, in accordance with their species specific needs, the aquaculture animals shall: (a) have sufficient space for their wellbeing; (b) be kept in water of good quality with sufficient oxygen levels, and (c) be kept in temperature and light conditions in accordance with the requirements of the species and having regard to the geographic location; (d) in the case of freshwater fish the bottom type shall be as close as possible to natural conditions; (e) in the case of carp the bottom shall be natural earth.	Yes	Infrastructure of farm needs to be as close as possible to natural environment
	2. Stocking density is set out in Annex XIIIa by species or group of species. In considering the effects of stocking density on the welfare of farmed fish, the condition of the	Yes	Stocking densities

	Regulation text	Impact?	Field of impact
	fish (such as fin damage, other injuries, growth rate, behaviour expressed and overall health) and the water quality shall be monitored.		
	3. The design and construction of aquatic containment systems shall provide flow rates and physiochemical parameters that safeguard the animals' health and welfare and provide for their behavioural needs.	No	
	4. Containment systems shall be designed, located and operated to minimize the risk of escape incidents.	No	
	5. If fish or crustaceans escape, appropriate action must be taken to reduce the impact on the local ecosystem, including recapture, where appropriate. Documentary evidence shall be maintained.	No	
	Article 25g Specific rules for aquatic containment systems		
	1. Closed recirculation aquaculture animal production facilities are prohibited, with the exception of hatcheries and nurseries or for the production of species used for organic feed organisms.	No	RAS prohibited
	2. Rearing units on land shall meet the following conditions: (a) for flow-through systems it shall be possible to monitor and control the flow rate and water quality of both inflowing and out-flowing water; (b) at least five percent of the perimeter ("land-water interface") area shall have natural vegetation.	Yes	Cover at least 5 % of land-water interface with natural vegetation and water management
	3. Containment systems at sea shall: (a) be located where water flow, depth and water-body exchange rates are adequate to minimize the impact on the seabed and the surrounding water body; (b) shall have suitable cage design, construction and maintenance with regard to their exposure to the operating environment.	No	Only impact on location
	4. Artificial heating or cooling of water shall only be permitted in hatcheries and nurseries. Natural borehole water may be used to heat or cool water at all stages of production.	???	Artificial heating or cooling of water shall only be permitted in hatcheries and nurseries
	6.8.2009 EN Official Journal of the European Union L 204/21		
	Article 25h Management of aquaculture animals		
8	1. Handling of aquaculture animals shall be minimised, undertaken with the greatest care and proper equipment and protocols used to avoid stress and physical damage associated with handling procedures. Broodstock shall be handled in a manner to minimize physical damage and stress and under anaesthesia where appropriate. Grading operations shall be kept to a minimum and as required to ensure fish welfare.	No	Handling of aquaculture animals
	2. The following restrictions shall apply to the use of artificial light: (a) for prolonging natural day-length it shall not exceed a maximum that respects the ethological needs,	???	Use of artificial light

	Regulation text	Impact?	Field of impact
	geographical conditions and general health of farmed animals, this maximum shall not exceed 16 hours per day, except for reproductive purposes; (b) Abrupt changes in light intensity shall be avoided at the changeover time by the use of dimmable lights or background lighting.		
	3. Aeration is permitted to ensure animal welfare and health, under the condition that mechanical aerators are preferably powered by renewable energy sources. All such use is to be recorded in the aquaculture production record.	Yes	Aeration need to use renewable energy
	4. The use of oxygen is only permitted for uses linked to animal health requirements and critical periods of production or transport, in the following cases: (a) exceptional cases of temperature rise or drop in atmospheric pressure or accidental pollution, (b) occasional stock management procedures such as sampling and sorting, (c) in order to assure the survival of the farm stock. Documentary evidence shall be maintained.	???	Limited use of Oxygen
	5. Slaughter techniques shall render fish immediately unconscious and insensible to pain. Differences in harvesting sizes, species, and production sites must be taken into account when considering optimal slaughtering methods.	Yes	Slaughter methods
	S e c t i o n 4 B r e e d i n g		
	Article 25i Prohibition of hormones The use of hormones and hormone derivates is prohibited. S e c t i o n 5 F e e d f o r f i s h , c r u s t a c e a n s a n d e c h i n o d e r m e s Article 25j General rules on feeds Feeding regimes shall be designed with the following priorities: (a) animal health; (b) high product quality, including the nutritional composition which shall ensure high quality of the final edible product; (c) low environmental impact. Article 25k Specific rules on feeds for carnivorous aquaculture animals	Yes	Prohibition of hormones
	1. Feed for carnivorous aquaculture animals shall be sourced with the following priorities: (a) organic feed products of aquaculture origin; (b) fish meal and fish oil from organic aquaculture trimmings;	Yes	Source of feed ingredients
	(c) fish meal and fish oil and ingredients of fish origin derived from trimmings of fish already caught for human consumption in sustainable fisheries; (d) organic feed materials of plant origin and of animal origin as listed in Annex V and the restriction laid down therein are complied with.		

	Regulation text	Impact?	Field of impact
	(c) fish meal and fish oil and ingredients of fish origin derived from trimmings of fish already caught for human consumption in sustainable fisheries; (d) organic feed materials of plant origin and of animal origin as listed in Annex V and the restriction laid down therein are complied with. 2. If feed mentioned under paragraph 1 is not available, fishmeal and fish oil from non-organic aquaculture trimmings, or trimmings of fish caught for human consumption may be used for a transitional period until 31 December 2014. Such feed material shall not exceed 30 % of the daily ration.	Yes	Source of feed ingredients
	3. The feed ration may comprise a maximum of 60 % organic plant products.	Yes	Composition of feed
	4. Astaxanthin derived primarily from organic sources, such as organic crustacean shells may be used in the feed ration for salmon and trout within the limit of their physiological needs. If organic sources are not available natural sources of astaxanthin (such as Phaffia yeast) may be used.	Yes	Composition of feed
9	Article 25l Specific rules on feeds for certain aquaculture animals		
	1. Aquaculture animals as referred to in Annex XIIIa, Section 6, Section 7 and Section 9 shall be fed with feed naturally available in ponds and lakes.	Yes	Species specific --> no use of additional feed
	1. Aquaculture animals as referred to in Annex XIIIa, Section 6, Section 7 and Section 9 shall be fed with feed naturally available in ponds and lakes. 2. Where natural feed resources are not available in sufficient quantities as referred to in paragraph 1, organic feed of plant origin, preferably grown on the farm itself or seaweed may be used. Operators shall keep documentary evidence of the need to use additional feed.	Yes Yes	Carp family (Cyprinidae) and other associated species in the context of pike, catfish, coregonids, sturgeon. Shrimp and fresh water prawn, milkfish (Chanos chanos), tilapia (Oreochromis spp.), siamese catfish (Pangasius spp.): If not sufficient natural feed is available, organic feed of plant origin or seaweed may be used Origin of fishmeal and oil
	3. Where natural feed is supplemented according to paragraph 2 the feed ration of species as mentioned in section 7 and of siamese catfish (Pangasius spp.) as mentioned in section 9 may comprise a maximum of 10 % fishmeal or fish oil derived from sustainable fisheries.	Yes	

	Regulation text	Impact?	Field of impact
	Article 25m Products and substances as referred to in Article 15(1)(d)(iii) of Regulation (EC) No 834/2007		Composition of feed
	1. Feed materials of animal and mineral origin may be used in organic aquaculture, only if listed in Annex V.	???	Use of feed additives
	2. Feed additives, certain products used in animal nutrition and processing aids may be used if listed in Annex VI and the restrictions laid down therein are complied with.	???	
	S e c t i o n 6 S p e c i f i c r u l e s f o r m o l l u s c s Article 25n Growing area		Mollusc only
	1. Bivalve mollusc farming may be carried out in the same area of water as organic finfish and seaweed farming in a polyculture system to be documented in the sustainable management plan. Bivalve molluscs may also be grown together with gastropod molluscs, such as periwinkles, in polyculture.	No	Mollusc only
	2. Organic bivalve mollusc production shall take place within areas delimited by posts, floats or other clear markers and shall, as appropriate, be restrained by net bags, cages or other man made means.	No	Mollusc only
	3. Organic shellfish farms shall minimise risks to species of conservation interest. If predator nets are used their design shall not permit diving birds to be harmed.	No	
	Article 25o Sourcing of seed		Mollusc only
	1. Provided that there is no significant damage to the environment and if permitted by local legislation, wild seed from outside the boundaries of the production unit can be used in the case of bivalve shellfish provided it comes from: (a) settlement beds which are unlikely to survive winter weather or are surplus to requirements, or (b) natural settlement of shellfish seed on collectors. Records shall be kept of how, where and when wild seed was collected to allow traceability back to the collection area. However, seed from non-organic bivalve shellfish hatcheries may be introduced to the organic production units with the following maximum percentages: 80 % by 31 December 2011, 50 % by 31 December 2013 and 0 % by 31 December 2015.	no	Mollusc only
	2. For the cupped oyster, Crassostrea gigas, preference shall be given to stock which is selectively bred to reduce spawning in the wild.	no	
	Article 25p Management		Mollusc only
	1. Production shall use a stocking density not in excess of that used for non-organic shellfish in the locality. Sorting, thinning and stocking density adjustments shall be made according to the biomass and to ensure animal welfare and high product quality.	no	Mollusc only
	2. Biofouling organisms shall be removed by physical	No	Mollusc only

	Regulation text	Impact?	Field of impact
	means or by hand and where appropriate returned to the sea away from shellfish farms. Shellfish may be treated once during the production cycle with a lime solution to control competing fouling organisms.		
	Article 25q Cultivation rules 1. Cultivation on mussel ropes and other methods listed in Annex XIIIa, Section 8 may be eligible for organic production.	No	Mollusc only
	2. Bottom cultivation of molluscs is only permitted where no significant environmental impact is caused at the collection and growing sites. The evidence of minimal environmental impact shall be supported by a survey and report on the exploited area to be provided by the operator to the control body or control authority. The report shall be added as a separate chapter to the sustainable management plan.	No	Mollusc only
10	Article 25r Specific cultivation rules for oysters Cultivation in bags on trestles is permitted. These or other structures in which the oysters are contained shall be set out so as to avoid the formation of a total barrier along the shoreline. Stock shall be positioned carefully on the beds in relation to tidal flow to optimise production. Production shall meet the criteria listed in the Annex XIIIa, Section 8.	No	
	Section 7 Disease prevention and veterinary treatment Article 25s General rules on disease prevention		Specific demands health management plan and services
	1. The animal health management plan in conformity with Article 9 of Directive 2006/88/EC shall detail biosecurity and disease prevention practices including a written agreement for health counselling, proportionate to the production unit, with qualified aquaculture animal health services who shall visit the farm at a frequency of not less than once per year and not less than once every two years in the case of bivalve shellfish.	Yes	
	2. Holding systems, equipment and utensils shall be properly cleaned and disinfected. Only products listed in Annex VII, Sections 2.1 to 2.2 may be used.	No	What is fallowing???
	3. With regard to fallowing: (a) The competent authority shall determine whether fallowing is necessary and the appropriate duration which shall be applied and documented after each production cycle in open water containment systems at sea. Fallowing is also recommended for other production methods using tanks, fishponds, and cages; (b) it shall not be mandatory for bivalve mollusc cultivation; (c) during fallowing the cage or other structure used for aquaculture animal production is emptied, disinfected and left empty before being used again.	???	Waste removal

	Regulation text	Impact?	Field of impact
	4. Where appropriate, uneaten fish-feed, faeces and dead animals shall be removed promptly to avoid any risk of significant environmental damage as regards water status quality, minimize disease risks, and to avoid attracting insects or rodents.	No	The use of ultraviolet light and ozone
	5. Ultraviolet light and ozone may be used only in hatcheries and nurseries.	???	
	6. For biological control of ectoparasites preference shall be given to the use of cleaner fish.	No	
	Article 25t Veterinary treatments		The use of veterinary treatments has effect on survival rates etc.?
	1. When despite preventive measures to ensure animal health, according to Article 15(1)(f)(i) of Regulation (EC) No 834/2007, a health problem arises, veterinary treatments may be used in the following order of preference: (a) substances from plants, animals or minerals in a homoeopathic dilution; (b) plants and their extracts not having anaesthetic effects, and (c) substances such as: trace elements, metals, natural immunostimulants or authorised probiotics.	???	Allopathic treatments have impact on survival rates etc.?
	2. The use of allopathic treatments is limited to two courses of treatment per year, with the exception of vaccinations and compulsory eradication schemes. However, in the cases of a production cycle of less than a year a limit of one allopathic treatment applies. If the mentioned limits for allopathic treatments are exceeded the concerned aquaculture animals can not be sold as organic products.	???	Limited use of parasite treatments have impact on survival rates etc.?
	3. The use of parasite treatments, not including compulsory control schemes operated by Member States, shall be limited to twice per year or once per year where the production cycle is less than 18 months.	???	
	4. The withdrawal period for allopathic veterinary treatments and parasite treatments according to paragraph 3 including treatments under compulsory control and eradication schemes shall be twice the legal withdrawal period as referred to in Article 11 of Directive 2001/82/EC or in a case in which this period in not specified 48 hours. L 204/24 EN Official Journal of the European Union 6.8.2009	No	Use of veterinary products effects potential to sell as organic....
	5. Whenever veterinary medicinal products are used, such use is to be declared to the control body or the control authority before the animals are marketed as organic. Treated stock shall be clearly identifiable.	???	
11	(*) OJ L 206, 22.7.1992, p. 7'.		Seaweed only
	6. In Chapter 3 of Title II, the following Article 29a is inserted after Article 29: 'Article 29a Specific provisions for seaweed 1. If the final product is fresh seaweed, flushing of freshly harvested seaweed shall use seawater. If the final product is dehydrated seaweed, potable water	No	Logistic costs

	Regulation text	Impact?	Field of impact
	may also be used for flushing. Salt may be used for removal of moisture. 2. The use of direct flames which come in direct contact with the seaweed shall be prohibited for drying. If ropes or other equipment are used in the drying process they shall be free of anti-fouling treatments and cleaning or disinfection substances except where a product is listed in Annex VII for this use.'		
	7. In Chapter 4 of Title II, the following Article 32a is inserted: 'Article 32a Transport of live fish 1. Live fish shall be transported in suitable tanks with clean water which meets their physiological needs in terms of temperature and dissolved oxygen. 2. Before transport of organic fish and fish products, tanks shall be thoroughly cleaned, disinfected and rinsed. 3. Precautions shall be taken to reduce stress. During transport, the density shall not reach a level which is detrimental to the species. 4. Documentary evidence shall be maintained for paragraphs 1 to 3.'	Yes	
	8. In Article 35, paragraphs 2 and 3 are replaced by the following: '2. In case of organic plant, seaweed, livestock and aquaculture animal production units, storage of input products other than those authorised under this Regulation is prohibited in the production unit. 3. The storage of allopathic veterinary medicinal products and antibiotics is permitted on holdings provided that they have been prescribed by a veterinarian in connection with treatment as referred to in Articles 14(1)(e)(ii) or 15(1)(f)(ii) of Regulation (EC) No 834/2007, that they are stored in a supervised location and that they are entered in the livestock record as referred to in Article 76 of this Regulation, or as appropriate, in the aquaculture production records as referred to in Article 79b of this Regulation.'	No	Seaweed specific
	9. In Chapter 5 of Title II, the following Article 36a is inserted: 'Article 36a Seaweed 1. The conversion period for a seaweed harvesting site shall be six months. 2. The conversion period for a seaweed cultivation unit shall be the longer of six months or one full production cycle.'	No	Conversion periods
	10. In Chapter 5 of Title II, the following Article 38a is inserted after Article 38: 'Article 38a Aquaculture animal production 1. The following conversion periods for aquaculture production units shall apply for the following types of aquaculture facilities including the existing aquaculture	Yes	

	Regulation text	Impact?	Field of impact
	animals: (a) for facilities that cannot be drained, cleaned and disinfected, a conversion period of 24 months; (b) for facilities that have been drained, or fallowed, a conversion period of 12 months; (c) for facilities that have been drained, cleaned and disinfected a conversion period of six months; (d) for open water facilities including those farming bivalve molluscs, a three month conversion period. 2. The competent authority may decide to recognize retroactively as being part of the conversion period any previously documented period in which the facilities were not treated or exposed to products not authorized for organic production.'		
	11. The heading of Article 43 is replaced by the following: 'Use of non-organic feed of plant and animal origin for livestock';	No	
12	12. Article 59, paragraph 1 is replaced by the following: 'This Chapter shall not apply to pet food and feed for fur animals.'	No	
	13. Article 60, paragraph 1(a) is replaced by the following: '(a) the processed feed complies with the provisions of Regulation (EC) No 834/2007 and in particular with Article 14(1)(d)(iv) and (v) for livestock or with Article 15(1)(d) for aquaculture animals and Article 18 thereof;'	No	Seaweed specific
	14. In Title IV, the following Chapter 2a is inserted: 'CHAPTER 2a Specific control requirements for seaweed Article 73a Control arrangements for seaweed When the control system applying specifically to seaweed is first implemented, the full description of the site referred to in Article 63(1)(a) shall include: (a) a full description of the installations on land and at sea; (b) the environmental assessment as outlined in Article 6b(3) where applicable; (c) the sustainable management plan as outlined in Article 6b(4) where applicable; (d) for wild seaweed a full description and a map of shore and sea collection areas and land areas where post collection activities take place shall be drawn up. Article 73b Seaweed Production Records 1. Seaweed production records shall be compiled in the form of a register by the operator and kept available for the control authorities or control bodies at all times at the premises of the holding. It shall provide at least the following information: (a) list of species, date and quantity harvested; (b) date of application, type and amount of fertiliser used. 2. For collection of wild seaweeds the register shall also contain: (a) history of harvesting activity for each species in named	No	

	Regulation text	Impact?	Field of impact
	beds; (b) harvest estimate (volumes) per season; (c) sources of possible pollution for harvest beds; (d) sustainable annual yield for each bed.’		
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	Article 6b(4) where applicable; (d) in the case of molluscs a summary of the special chapter of the sustainable management plan as		Specific for molluscs

	Regulation text	Impact?	Field of impact
	required by Article 25q(2). Article 79b Aquaculture animal production records The following information shall be provided by the operator in the form of a register which shall be kept up to date and made available for the control authorities or control bodies at all times at the premises of the holding (a) the origin, date of arrival and conversion period of animals arriving at the holding: (b) the number of lots, the age, weight and destination of animals leaving the holding; (c) records of escapes of fish; (d) for fish the type and quantity of feed and in the case of carp and related species a documentary record of the use additional feed; (e) veterinary treatments giving details of the purpose, date of application, method of application, type of product and withdrawal period; (f) disease prevention measures giving details of fallowing, cleaning and water treatment.		
13	Article 6b(4) where applicable; (d) in the case of molluscs a summary of the special chapter of the sustainable management plan as required by Article 25q(2). Article 79b Aquaculture animal production records The following information shall be provided by the operator in the form of a register which shall be kept up to date and made available for the control authorities or control bodies at all times at the premises of the holding (a) the origin, date of arrival and conversion period of animals arriving at the holding: (b) the number of lots, the age, weight and destination of animals leaving the holding; (c) records of escapes of fish; (d) for fish the type and quantity of feed and in the case of carp and related species a documentary record of the use additional feed; (e) veterinary treatments giving details of the purpose, date of application, method of application, type of product and withdrawal period; (f) disease prevention measures giving details of fallowing, cleaning and water treatment. Article 79c Specific control visits for bivalve molluscs For bivalve mollusc production inspection visits shall take place before and during maximum biomass production.	No	Specific for molluscs Control Requirements
	Article 79d Several production units run by the same operator When an operator manages several production units as provided for in Articles 25c, the units which produce non-organic aquaculture animals shall also be subject to the control system as laid down in Chapter 1and this Chapter.’	Yes	

	Regulation text	Impact?	Field of impact
	16. The heading of Chapter 4 of Title IV is replaced by the following: 'Control requirements for units for preparation of plant, seaweed, livestock and aquaculture animal products and foodstuffs composed thereof'	No	
	17. The heading of Chapter 5of Title IV is replaced by the following: 'Control requirements for imports of organic products from third countries'	No	
	18. In paragraph 2 of Article 93, the following points are added: '(e) the number of organic aquaculture animal production units, (f) the volume of organic aquaculture animal production, (g) optionally, the number of organic seaweed units and the volume of organic seaweed production.'	No	
	19. In Article 95, paragraph 6 is replaced by the following: '6. For the purpose of Article 12(1)(j) of Regulation (EC) No 834/2007 and pending the inclusion of specific substances according to Article 16(1)(f) of that Regulation, only products authorised by the competent authority may be used.'	No	
	20. In Article 95, the following paragraph is added: '11. The competent authority may authorise for a period expiring on 1 July 2013, those aquaculture animal and seaweed production units which are established and produce under nationally accepted organic rules before entry into force of this Regulation, to keep their organic status while adapting to the rules of this Regulation, provided there is no undue pollution of the waters with substances not allowed in organic production. Operators benefiting from this measure shall notify the facilities, fishponds, cages or seaweed lots which are concerned to the competent authority'.	No	
	21. The Annexes are amended in accordance with the Annex to this Regulation. Article 2 This Regulation shall enter into force on the third day following that of its publication in the Official Journal of the European Union. It shall apply as from 1 July 2010, with the following exceptions: (a) point 4 of Article 1 shall apply the day of entry into force of this Regulation. (b) corrective measures as provided for in point 19 of Article 1 and points 1(b) and (c) of the Annex shall apply from the entry into application of Regulation (EC) No 889/2008. This Regulation may be revised on the basis of relevant proposals from Member States, which are accompanied by a duly justified motivation, with a view of the modification of	No	
	this Regulation from 1 July 2013. This Regulation shall be binding in its entirety and directly applicable in all Member States.		

APPENDIX 2a Possible impact of issues in Regulation 710/2009 on production system characteristics

	Regulation article	Production system characteristics							
		Location	Land / water surface	Water Depth	Water Use	Stocking Density	FCR	Mortality Rates	Grow out period
1	(4) sustainable management plan								
1	(5) Environmental assessment								
2	(6) Water Separation measures								
2	(9) Organic vs Non-organic PL (post larvae)								
2	(10) Species specific needs of animals need to be met					X	?	?	?
2	(12) Use of hormones is prohibited								X
2	(14) feed should come from sustainable or organic sources						?	?	?
3	(15) Use of feed additives etc. from non-organic sources restricted						?	?	?
3	(17) Health Management						?	X	?
3	(18) Veterinary treatments						?	X	?
3	(19) Handling and transport of life fish								
3	(20) conversion Period								
5	(6b2) Distribution of water				?				
5	(6b3) Environmental Assessment								
5	(6b4) Sustainable Management Plan								
5	(6b5) Use of renewable energy and waste reduction								
5	(6e1) Removal of Bio-fouling organisms								
6	(25b3) Management plan coordination with neighbours								
6	(25b4) Effluent treatment		X						
6 and 7	(25e1/2/3) Use of organic PL								
7	(25e4) Natural influx of fingerlings/PL allowed							?	
7	(25f1) Husbandry practices, close to natural situation				?				
7	(25f2) Stocking densities (see species specific Annex)					X	X	X	X
7	(25g2) Natural vegetation and water quality								
8	(25h3) Aeration need to use renewable energy								
8	(25h5) Slaughter methods								
8	(25i) No hormones permitted						?	?	?
8	(25k1) Source of feed ingredients priorities								
8	(25k2) Source of feed ingredients (transitional period)								

	Regulation article	Production system characteristics							
		Location	Land / water surface	Water Depth	Water Use	Stocking Density	FCR	Mortality Rates	Grow out period
8	(25k3) Feed ration organic plant max 60%						X		?
9	(25k4) Source and use of Astaxanthin						?		
9	(25l1) For specific species only natural feed (herbivora)						X		?
9	(25l2) If natural feed is not available, organic plant feed may be used (herbivora)						X		?
9	(25l3) If additional feed is used max 10% fishmeal/oil is allowed (herbivora)						X		?
10	(25s1) Health plan and management								
11	(32a) Logistics for live fish sales								
12	(79a) Control and monitoring requirements								
13	(79d) Control and monitoring requirements								

FP7-KBBE. 2013.1.2-11 Assessment of organic aquaculture for further development of European regulatory framework
Coordinator: Åsa Maria Espmark. Funded by the EC **(Grant No: 613547)**
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APPENDIX 2b Possible impact of issues in Regulation 710/2009 on farm output

	Regulation article	Output			
		Productivity (tonnes/ha/crop)	Size (grams)	Harvest frequency (#/year)	Price per kg
1	(4) sustainable management plan				
1	(5) Environmental assessment				
2	(6) Water Separation measures				
2	(9) Organic vs Non-organic PL (post larvae)				
2	(10) Species specific needs of animals need to be met	X		?	
2	(12) Use of hormones is prohibited			X	
2	(14) feed should come from sustainable or organic sources	?			
3	(15) Use of feed additives etc. from non-organic sources restricted	?			
3	(17) Health Management	?			
3	(18) Veterinary treatments	?			
3	(19) Handling and transport of life fish				
3	(20) conversion Period				
5	(6b2) Distribution of water				
5	(6b3) Environmental Assessment				
5	(6b4) Sustainable Management Plan				
5	(6b5) Use of renewable energy and waste reduction				
5	(6e1) Removal of Bio-fouling organisms				
6	(25b3) Management plan coordination with neighbours				
6	(25b4) Effluent treatment				
6 and 7	(25e1/2/3) Use of organic PL				
7	(25e4) Natural influx of fingerlings/PL allowed	X			
7	(25f1) Husbandry practices, close to natural situation				
7	(25f2) Stocking densities (see species specific Annex)	X	X		
7	(25g2) Natural vegetation and water quality				
8	(25h3) Aeration need to use renewable energy				
8	(25h5) Slaughter methods				
8	(25i) No hormones permitted	?			
8	(25k1) Source of feed ingredients priorities				
8	(25k2) Source of feed ingredients (transitional period)				
8	(25k3) Feed ration organic plant max 60%	X	?		
9	(25k4) Source and use of Astaxanthin				

	Regulation article	Output			
		Productivity (tonnes/ha/crop)	Size (grams)	Harvest frequency (#/year)	Price per kg
9	(25l1) For specific species only natural feed (herbivora)	?	?		
9	(25l2) If natural feed is not available, organic plant feed may be used (herbivora)	?	?		
9	(25l3) If additional feed is used max 10% fishmeal/oil is allowed (herbivora)	?	?		
10	(25s1) Health plan and management				
11	(32a) Logistics for live fish sales				
12	(79a) Control and monitoring requirements				
13	(79d) Control and monitoring requirements				

APPENDIX 2c Possible impact of issues in Regulation 710/2009 on operational costs

	Regulation article	**Operational cost**													
		Feed price/kg	**Fingerling price**	**Labour low**	**Labour middle**	**labour high**	**harvesting**	**logistics**	**medication**	**diesel**	**Electricity**	**Capital costs (interest rate)**	**Third party health checks**	**Fiscal advantages**	**Subsidies**
1	(4) sustainable management plan					X									
1	(5) Environmental assessment														
2	(6) Water Separation measures														
2	(9) Organic vs Non-organic PL (post larvae)		X												
2	(10) Species specific needs of animals need to be met														
2	(12) Use of hormones is prohibited														
2	(14) feed should come from sustainable or organic sources	X						?							
3	(15) Use of feed additives etc. from non-organic sources restricted	X													
3	(17) Health Management														
3	(18) Veterinary treatments														
3	(19) Handling and transport of life fish							X							
3	(20) conversion Period														
5	(6b2) Distribution of water														
5	(6b3) Environmental Assessment														
5	(6b4) Sustainable Management Plan					X									
5	(6b5) Use of renewable energy and waste reduction									X	X				
5	(6e1) Removal of Bio-fouling organisms			X											
6	(25b3) Management plan coordination with neighbours					X									
6	(25b4) Effluent treatment														
6 and 7	(25e1/2/3) Use of organic PL		X												
7	(25e4) Natural influx of fingerlings/PL allowed														
7	(25f1) Husbandry practices, close to natural situation														

	Regulation article	Operational cost													
		Feed price/kg	Fingerling price	Labour low	Labour middle	labour high	harvesting	logistics	medication	diesel	Electricity	Capital costs (interest rate)	Third party health checks	Fiscal advantages	Subsidies
7	(25f2) Stocking densities (see species specific Annex)														
7	(25g2) Natural vegetation and water quality				X										
8	(25h3) Aeration need to use renewable energy									X	X				
8	(25h5) Slaughter methods						X	X							
8	(25i) No hormones permitted														
8	(25k1) Source of feed ingredients priorities	X													
8	(25k2) Source of feed ingredients (transitional period)	X													
8	(25k3) Feed ration organic plant max 60%	X													
9	(25k4) Source and use of Astaxanthin	X													
9	(25l1) For specific species only natural feed (herbivora)	X													
9	(25l2) If natural feed is not available, organic plant feed may be used (herbivora)	X													
9	(25l3) If additional feed is used max 10% fishmeal/oil is allowed (herbivora)	X													
10	(25s1) Health plan and management					X							X		
11	(32a) Logistics for live fish sales							X							
12	(79a) Control and monitoring requirements					X									
13	(79d) Control and monitoring requirements					X									

APPENDIX 2d Possible impact of issues in Regulation 710/2009 on investments

		Investment costs							
		land and/or water lease	Permits / licenses Costs /year	Certification costs	Environmental impact assessment	Sustainable management plan	Insurence cost	Affluent treatment	Infrastructure
1	(4) sustainable management plan					X			
1	(5) Environmental assessment				X				
2	(6) Water Separation measures								X
2	(9) Organic vs Non-organic PL (post larvae)								
2	(10) Species specific needs of animals need to be met								X
2	(12) Use of hormones is prohibited								
2	(14) feed should come from sustainable or organic sources								
3	(15) Use of feed additives etc. from non-organic sources restricted								
3	(17) Health Management								
3	(18) Veterinary treatments								
3	(19) Handling and transport of life fish								
3	(20) conversion Period								
5	(6b2) Distribution of water								?
5	(6b3) Environmental Assessment				X				
5	(6b4) Sustainable Management Plan					X			
5	(6b5) Use of renewable energy and waste reduction								
5	(6e1) Removal of Bio-fouling organisms								
6	(25b3) Management plan coordination with neighbours					X			
6	(25b4) Effluent treatment	X						X	?
6 and 7	(25e1/2/3) Use of organic PL								
7	(25e4) Natural influx of fingerlings/PL allowed								
7	(25f1) Husbandry practices, close to natural situation								X
7	(25f2) Stocking densities (see species specific Annex)								
7	(25g2) Natural vegetation and water quality								X
8	(25h3) Aeration need to use renewable energy								
8	(25h5) Slaughter methods								X
8	(25i) No hormones permitted								
8	(25k1) Source of feed ingredients priorities								

		Investment costs							
		land and/or water lease	Permits / licenses Costs /year	Certification costs	Environmental impact assessment	Sustainable management plan	Insurence cost	Affluent treatment	Infrastructure
8	(25k2) Source of feed ingredients (transitional period)								
8	(25k3) Feed ration organic plant max 60%								
9	(25k4) Source and use of Astaxanthin								
9	(25l1) For specific species only natural feed (herbivora)								
9	(25l2) If natural feed is not available, organic plant feed may be used (herbivora)								
9	(25l3) If additional feed is used max 10% fishmeal/oil is allowed (herbivora)								
10	(25s1) Health plan and management								
11	(32a) Logistics for live fish sales								
12	(79a) Control and monitoring requirements								
13	(79d) Control and monitoring requirements								

APPENDIX 3 Results of expert workshops “Economic aspects in organic salmon farming” (D3.2.4)

App 3.1 Composition of the workshop

Participants:

- John Carmichael (UK), Biomar, jcarmichael@biomar.co.uk
- Catherine McManus (IRL), Marine Harvest, catherine.mcmanus@marineharvest.com
- Duncan Knowler (CA), Simon Fraser University, djk@sfu.ca
- Absent Jan Vidar Olsen (NO), Salmar, jan.vidar.olsen@salmar.no

Discussion leader: Rob Stokkers (NL)

App 3.2 Stocking density

In conventional aquaculture the stocking density of salmon varies on average from 15 kg/m^3 in the UK tot 20 kg/m^3 in Ireland. The density in Norway is unknown. The regulation for organic production allows a density of maximum 10 kg/m^3.

Assumption:

- *Stocking density --> -40% (quantity index is 60%)*

App 3.3 Feed composition, dose, price

According to the experts the energy content of organic fish feed is slightly lower than of conventional fish feed. In Ireland the price of organic feed is about 12,5 higher as of conventional feed.

Assumptions:

- *Feed composition --> lower energy content*
- *Price --> +12,5% (price index is 112,5%)*

App 3.4 Feed conversion rate and growth

The growing period, growth rate and feed conversion in the three countries are different, as depending amongst others on the start weight and feed composition. This is shown in the table below.

More feed is needed per kg of salmon because of a slightly lower energy content and the fact that hydrogenated vegetable oil is used for pelleting instead of fish oil???

	Conventional	**Organic**	**Organic / Conventional**
Growing period:			**Growth rate**
UK (50gr. ---> 5 kg)	12-13 months	20 months	-30% (quantity index 70%)
Ireland (50gr. ---> 5 kg)	12-13 months	18 months	-37% (quantity index 63%)
Norway (200-250gr. ---> 5 kg)	11 months	17 months	-35% (quantity index 65%)
Feed conversion:			
UK	1.08 – 1.09	1.25 – 1.30	+17,5% (quantity index 117,5%)
Ireland	1.08 – 1.09	1.25 – 1.30	+17,5% (quantity index 117,5%)
Norway	1.10	???	

Assumptions:

- *Growth --> -35% (quantity index is 65%)*
- *FCR --> +17,5% (quantity index is 117,5%)*

App 3.5 Juveniles

In the UK no organic smolt is available, so in general conventional smolt is still used. It is not likely that this situation will change soon.

In Ireland Marine Harvest produces its own juveniles, which are completely organic. These are also used for the conventional production, because the scale is too small to invest in separate production lines. Besides that, there is only a small difference in feed costs between organic and conventional smolt. The production costs of smolt are about € 1,10 per kg

In case commercial suppliers of organic smolt would exist, the price may be expected to be higher.

Assumptions:

- *Price of juveniles --> equal*

App 3.6 Health care and mortality

No changes are expected for health care. In the UK and Ireland no changes in mortality are expected. In Norway the mortality might be slightly lower, because of the higher stocking density in conventional production.

Assumptions:

- *Health care --> equal*
- *Mortality during on growing --> equal*

App 3.7 Labour

At first, the experts said that the volume and price of labour will be exactly the same in conventional and organic salmon farming. This is because of an increase in production capacity, so that the sales volume will remain the same. This means that the same personnel will be used as before. Later they stated that organic production requires more labour because of the increased production capacity and the required extra maintenance. Does this mainly concern marine labour (see table on next page)?

Besides that, due to an increase in scale labour productivity in Ireland and the UK has increased significantly over the past couple of years towards the Norwegian level.

Assumptions:

- *Labour quantity --> equal or +15-20%*
- *Labour price --> equal*

App 3.8 Certification

In Ireland and the UK in conventional salmon production also a sustainability plan is needed to obtain a licence for the production of salmon. The costs for certification in conventional aquaculture are already substantial and the extra costs for certification of organic salmon production amounts to around 3.000 euro on farm level in Ireland and the UK (at a production volume of around 1.000 tons).

Assumptions:

- *Certification --> 3000 euro on farm level (yearly)*
- *Sustainability plan --> equal (non recurrent)*

App 3.8 Other discussions of importance

Extra production capacity

To produce the same volume of salmon, in organic aquaculture more production capacity is needed as compared to conventional aquaculture. So extra investments have to be made in pans.

Recommendation:

- *The model has to be changed to the original setup to account for this change in production capacity.*

Extra production capacity

	Quantity index	**Price index**	**Remarks**
Stocking density	60%		Conventional: 15-20 kg/m3 Organic: 10 kg/m3
Daily growth	65%		The energy content of the feed is lower.
FCR	117,5%	112,5%	The energy content of the feed is lower and the price of organic feed is higher.
Slaughtering weight	100%		
Labour	115%	100%	More labour for extra maintenance is needed, but the personnel remains the same.
Livestock		100%	In reality no difference is made between conventional and organic smolt.
Mortality	100%		The same or even slightly lower.
Certification costs	+€ 3.000		
Sustainabity plan	100%		Also needed in conventional salmon production.

APPENDIX 4 Results of expert workshops "Economic aspects in organic trout farming"

App 4.1 Composition of the workshop

Participants:

- Pierre Fortin (FR), diervoederbedrijf Le Gouessant, pierre.fortin@legouessant.fr
- Marco Fuselli (IT), Rio Fontane, m.fuselli@rio-fontane.191.it
- Mette R. Norrelykke (DK), Aller-Aqua, mrn@aller-aqua.dk
- Absent: Villy Juul Larsen (DK), Dansk Akvakultur villy@danskakvakultur.dk

Discussion leader: Rob Stokkers (NL)

App 4.2 Stocking density

Stocking density of the type of conventional trout farms that will shift to organic is not as high as 50 kg/m^3, but will be much lower in all three countries. For France and Italy it is about 30 kg/m^3, for Denmark ask Villy Juul Larsen.

Assumption:

- *Stocking density --> -15% (quantity index is 85%)*

App 4.3 Feed composition, dose, price

According to the experts, for a good comparison one must keep the feed composition and dose the same. In reality the energy content of organic fish feed will be lower than that of conventional fish feed!

Assumptions:

- *Feed composition --> equal*
- *Price --> +30% (price index is 130%)*

App 4.4 Feed conversion rate and growth

No difference in feed conversion and daily growth is expected, because of a supposedly similar feed supply of the fish in conventional and organic trout farming.

Assumptions:

- *Growth --> equal (quantity index is 100%)*
- *FCR --> equal (quantity index is 100%)*

App 4.5 Juveniles

An extra price for the organic eggs of 30% is correct. The extra price for organic juveniles is unknown as they are not available.

Assumptions:

- *Price of juveniles --> equal*

App 4.6 Health care and mortality

The mortality of organic trout is the same as of conventional trout and might even be slightly lower because of the lower fish density and therefore better water quality.

Assumptions:

- *Health care --> equal*
- *Mortality during on growing --> equal*

App 4.7 Labour

The kind of employees for the regular activities remain the same. Only extra personnel with high qualifications is needed to provide the technical knowledge and set up the "organic administration" on behalf of the organic certification.
The quantity of labour is to a great extent related to the stocking density/sales volume. This means that if stocking density/sales volume is hardly changed, there will be not much difference in the amount of labour required. At low stocking density/sales volume the time invested in general activities like maintenance and administration will be relatively high.

Assumptions:

- *Labour costs --> +15%*

App 4.8 Certification

Assumptions:

- *Certification --> 600 euro on farm level (yearly)*
- *Production plan --> 2000 euro (non recurrent)*

App 4.9 Other discussions of importance

- Method, data and assumptions are clear and OK. Only the organic market price will be a mixture of produce sold as organic and a surplus sold as conventional (80%/20%?).

APPENDIX 5 Results of expert workshops "Economic aspects in organic sea bass and sea bream farming"

App 5.1 Composition of the workshop

Participants:

- Filippos Papageorgiou (GR),
- Marilo Lopez (ES),
- Ernesto Franzolini (IT),
- Stefan Bergleiter (D),
- Rosaria Piseri (Weed grower, IRL)

Discussion leader: Henri Prins (NL)

App 5.2 Density

The density of sea bass growing varies in practice, depending on local circumstances, incidental conditions and farmers individual insight. In conventional aquaculture the stocking density varies from 12 to 20 kg/m3.

The regulation for organic production allows a density of maximum 15 kg/m3. The experts challenge this threshold strongly. They state that welfare and quality of the fish depend

a. on local environmental and hydrographic conditions (depth, currents, oxygen etcetera) in effect determining the 'carrying capacity' of the host water body
b. on the farm management (eg. quality and quantity of feed, feeding schedules, proactive measures for fish welfare).

Density on its own is a secondary parameter which only affect fish in relation to the previous a) and b) points. The experts underline that the maximum density is arbitrary and lacks any scientific evidence.

In the calculations however are based on the EU-regulation, in which densities over 15 kg/m3 are not allowed. This leads to the conclusion that in some cases the density has to be reduced, even though this is unnecessary for the actual welfare and quality of the fish. Due to the regulation the average stocking density has to be reduced with about 15%.

Assumption:

- *Stocking density --> -15%*

App 5.3 Feed composition, dose, price

Due to scarceness of high protein feed of animal origin the protein content in organic fish feed is lower than in conventional fish feed. The experts think the daily feed portion will be equal

The price of the feed is about 30% higher than conventional feed. The Spanish representative states that for Spain organic feed is about 50% more expensive.

Assumptions:

- *Feed composition --> lower protein content*
- *Daily feed --> equal*
- *Price --> +30% (Spain +50%)*

App 5.4 Feed conversion rate and growth

The daily feed dose in kg is though equal, but de lower protein content lowers the FCR by about 10%. This would imply a lower growth of about 10%, but the growth will stay behind even more. The reason is that the lower growth causes a longer production period at first look of 10%. But there is an extra negative effect: usually the production period lasts about 18 month. An extra 10% would imply a production period of 20 month. This period compels an extra winter period for the fish. In winter the fish do not grow, but yet they are feed. The risk for an extra winter period causes an extra negative effect on the length of the production period and the FCR.

Assumptions:

- *Growth --> -20%*
- *FCR --> +5%*

App 5.5 Juveniles

At this moment the sector cannot fully meet the requirements of the regulation, due to the absence of organic raised parent animals. So the eggs are not of organic origin. It is not likely that this situation will change soon. Reason: no breeder will invest in organic broodstock production as long as the sector is so small (lack of critical demand) and so vulnerable. The feed in the hatchery though is organic. The price of the fries is about 30% higher as conventional fries.

Assumptions:

- *Price of juveniles --> +30%*

App 5.6 Health care and mortality

No changes are expected for health care nor morality.

Assumptions:

- *Health care --> equal*
- *Mortality during on growing --> equal*

App 5.7 Labour

Due to the lower production more labour is needed per kg of fish. Some more labour is required for health control

Assumptions:

- *Labour quantity --> +15%*
- *Labour price --> equal*

App 5.8 Certification

Assumptions:

- *Certification --> 600 euro on farm level (yearly)*
- *Production plan --> 2000 euro (non recurrent)*

App 5.9 Other discussions of importance

Demand for organic fish

At this moment a severe overproduction is the case. About 20% of the organic production has to be sold on the conventional market. This fact harms the profitability considerably.

On the short term it is almost impossible to react on the changing market demands for the long production period. A additional problem is the young and hard predictable market. The current overproduction is a result of a too optimistic estimation of the demand.

Recommendation:

- *A reliable market research is needed. Special attention has to be paid to destination, type of selling point, time*

Feed

Looking for possibilities to improve the protein content within the organic legislation. The possibility to use trimmings of sustainable wild catch fish is an example that could be studied. The main current problem is the certification of these trimmings.

Recommendation:

- *Study to find a way to meet this problem*

APPENDIX 6 Results of expert workshops "Economic aspects in organic carp farming"

App 6.1 Composition of the workshop

Participants:

- Zdenek Adamek (CZ),
- Marc Moessmer (AT),
- Denez Gal (HU)

Discussion leader: Henri Prins (NL)

App 6.2 Density

In all three countries practically the production per ha is not limited by the EU-regulation. In far most cases the yearly production is way under the mentioned 1500 kg/ha. In Hungary the production in kg/ha is higher than in Czech Republic and in Austria. Between farms the differences are huge, depending on height, water temperature, soil, and other natural circumstances. The production varies from year to year.

In the on-growing stage no adaptions have to be made to meet the EU-requirements. In the juvenile stage, however more space is needed. The reasons are explained in 3.3.6. This extra space is estimated on a double surface for year 1, corresponding with 7% of the total production area.

Assumption:

- *production per ha --> +7%*

App 6.3 Feed composition, dose, price

Carp is fed by natural feed in the ponds, supplemented by cereals, like barley and wheat. In conventional carp farming often pelleted feed is used.

The price organic barley and wheat is double compared to equivalent conventional cereals.

Since the production/ha, the natural feed supply and the additional feed are all equal, the dose doesn't differ either.

However, in the spring the growing season starts two weeks later. This leads to approximately 10% less feed.

Assumptions:

- *Yearly dose --> -10%*
- *Feed price --> +100%*

App 6.4 Feed conversion rate

No differences in feed conversion rate during the on growing phase are expected, since the energy and protein content of conventional cereals and organic cereals are equal.

In the juvenile stage, however more feed is needed for the reasons explained in 3.3.6. This extra food is estimated on 15%, due to a combination of a longer production period and (far) more predation during the extra year of growth.

Assumption:

- *FCR --> +15%*

App 6.5 Growth

The daily growth is equal, but the growing season starts two weeks. The usual conventional length of the season is about 20 weeks. This leads to about a 10% slower growth on yearly base.

Assumption:

- *growth --> during season equal, but lower start in spring. Total growth -10%*

App 6.6 Juveniles

The costs of juveniles are much higher. The is caused by:

- No hormones allowed. This leads to less spawning and less juveniles per parents
- No fish meal allowed. This leads to (much) less growth, less strong juveniles, more mortality.
- The less growth in the juvenile stage compels an extra year of growing, more pond surface and more predation.
- Also the health control is way more complicated. In the juvenile stage this leads to much more labour needed
- The risks are much higher.

Mr. Moessmer told he needs about 2 ha pond surface extra (on a total area of 70 ha).

We assumed that an extra year will be needed in the juvenile stage in order to produce enough juveniles for the on-growing stage.

The total extra costs for juveniles during the extra year are hard to calculate.

Assumption:

We assumed:

- 7% more pond area
- 100% more juvenile purchase (during the extra year 50% predation)
- 15% more feed needed
- 10% more labour (extra year, more intensive health care)
- 7% more other costs

The extra costs linked to the juveniles are estimated on 30 to 40 eurocent per kg production.

This extra costs are placed in the relevant cost categories.

App 6.7 Costs of health care, mortality

The costs are very low. Instead of medication salt and lime stone are used. The extra predation during the extra juvenile year is calculated in the juvenile purchases.

Assumptions:

- *Health care --> equal*

- *Mortality during on growing --> equal*

App 6.8 Labour

In the on growing stage no differences are expected.

In the juvenile stage more labour is needed. Over all 15% extra labour is calculated

Assumptions:

- *Labour --> 15% more*

App 6.9 Certification

Compared to the other costs they are not very high. Mr. Moessmer pays about 500-1000 euro’s yearly.

Assumptions:

- *Certification --> 600 euro on farm level (yearly)*
- *Production plan --> 2000 euro (non recurrent)*

APPENDIX 7 VAT rates per country for food

Country name	Abbreviation	VAT rate
The Netherlands	NL	6%
Denmark	DK	25%
Germany	DE	7%
Belgium	BE	6%
France	FR	5.5%
Spain	ES	21%
Italy	IT	4%
Great Britain	GB	0%
Poland	PL	8%
Greece	GR	13%
Czech Republic	CZ	15%

APPENDIX 8 Farm level prices as found in the STEFC database and used for the chain breakdown

	STEFC 2008-2012	Used as Conventional B2B price	Used as Organic B2B price	Comment
Salmon				
Norway	3.13			
Ireland	5.46			
UK	4.19			
Unweighted average	4.25			
Fish pool	3.80	3.10	4.00	Norway is far most important producer
Trout				
Denmark	2.70			
France	3.81			
Italy	2.34			
Unweighted average	2.95	3.20	4.10	
Sea bass and sea bream				
France	6.78			
Italy	7.87			
Spain	5.28			
Unweighted average	6.40	6.40	8.60	
Carp				
Romania	1.87			
Poland	2.16			
Germany	2.41			
Unweighted average	2.15	1.90	2.50	Lower price, more in balance with consumer prices

APPENDIX 9 Processing yields

	Fillet	Other edible	By-product
Salmon	50%	12%	38%
Trout	50%	12%	38%
Sea bass/bream	40%	14%	46%
Carp	36%	18%	46%

Based on FAO, http://www.fao.org/docrep/003/t0219e/t0219e01.htm#ref1