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1 Executive summary

The overall objective of iFishIENCi is to provide the European aquaculture sector with a competitive advantage and growth stimulation through breakthrough innovations supporting sustainable aquaculture based on enabling technologies and circular principles. In that context, it is important to identify and assess the regulatory framework and requirements linked with the Fish farming industry and the Nutrition and breeding in the European aquaculture.

iFishIENCi will contribute to implementation of ongoing Regulations such as:

- Multiannual National Strategic Plan for the development of aquaculture activities by
 - (1) Boosting current competitive advantages of European aquaculture (WP5),
 - (2) High quality and high environmental standard products (WP1),
 - (3) Provide regulatory/policy scientific/technical solutions to reduce red tape in industry (WP4)
 - (4) Bring to the world market (WP5+WP6)
- Water Framework Directive by reducing freshwater use and discharge (nutrient and suspended solid discharge) of EU aquaculture through:
 - (1) Reduce feed waste through smart feeding and valorisation in open systems (WP1+WP3)
 - (2) Accompany the development of low-through systems (WP2)
 - (3) Promoting the recirculating aquaculture systems (WP6)
- Marine Strategy Framework Directive by
 - (1) Early results and prompt dissemination to local authorities to support decision making regarding national plans for Marine Spatial Planning (WP6)
 - (2) Reduce conflict of interest between coastal activities by reducing the environmental footprint of the industry (WP4+WP6)
 - (3) Marine Strategy Plans are due to be submitted by 2021 (WP6)
- Blue Growth Strategy through
 - (1) More productive and environment-friendly coastal aquaculture production systems (WP1+WP3)
 - (2) More sustainable feed ingredients from algae to resolve a major bottleneck to aquaculture expansion and create new markets for marine biotechnology (WP1)

iFishIENCi does not only need to ascertain compliance with organic feed criteria set in various existing standards, but also to qualify new sustainable feeds and feed ingredients and organic sources through biological assessments on the fish and environment.

2 Introduction

The overall objective of iFishIENCi is to provide the European aquaculture sector with a competitive advantage and growth stimulation through breakthrough innovations supporting sustainable aquaculture based on enabling technologies and circular principles. In that context, it is important to identify and assess the regulatory framework and requirements linked with the Fish farming industry and the Nutrition and breeding in the European aquaculture.

As the European aquaculture companies operate in complex markets with multifaceted interface at local and global level, the current report D4.12 focuses on the **EU regulation**, both sector specific and cross-sector regulation, **for nutrition and breeding in the European aquaculture**, followed by national regulations seen from a Maltese, Norwegian, Danish, Spanish, Greek, Hungarian, German and French (the countries of the consortium members) perspective. Although the European national regulations for a large part are implementation of EU regulation, there are differences, which influence the competitiveness of the national industry. iFishIENCi will also look out at responsible legislation of other countries such as Ireland, Scotland and Turkey (to start with) in order to identify lessons to learn from those countries.

The objective of iFishIENCi project is also to develop and demonstrate a disruptive IoT/AI based innovations, considering the feeding value chain of aquaculture as a whole, and addressing four commercially-important species, with fish quality as focus. Therefore various data sets will be generated and processed as described in the iFishIENCi Data Management Plan (Deliverable D7.2). In that sense specifically **General Data Protection Regulation** needs to be followed.

Limitations, constraints and opportunities in terms of **Standardisation and Certification** as well as the evaluation of informal institutions will be implemented along the lifetime of the iFishIENCi project. The existing framework is described in the current report D4.12, whereas the detailed methodology to be used and the results will be described in follow-up deliverables D4.13 and D4.14 (Report on regulatory framework and requirements 2nd and 3rd version).

3 Relevant legislation, policies and regulations

3.1 COMMON FISHERIES Policy

Article 34 of the Common Fisheries Policy Regulation requires Member States to prepare multi-annual national strategic plans for aquaculture. The national plans are intended to inform investment priorities for aquaculture under Member States' operational programmes under the European Maritime and Fisheries Fund. They are also intended to identify measures to reduce the administrative burden on operators, to secure sustainable development and growth of aquaculture through coordinated spatial planning, to enhance the competitiveness of the aquaculture sector and to promote a level playing field for EU operators by exploiting their competitive advantages.

In 2013, the new Common Fisheries Policy introduced the Open Method of Coordination for the sustainable development of aquaculture. This method aims at spreading best practice and at giving practical answers to common challenges identified by Member States and stakeholders. In 2014-2015, Member States developed **Multiannual National Strategic Plans for the promotion of sustainable aquaculture**. In these plans, Member States address the four priorities identified in the Strategic

Guidelines for the sustainable development of EU aquaculture and propose concrete actions to address them.

3.1.1 Multiannual National Strategic Plan for the development of aquaculture activities

In order to implement Article 34 of the Common Fisheries Policy Regulation, the Multiannual National Strategic Plan for the development of aquaculture activities follow 3 main aims as described in the *Summary of the 27 Multiannual National Aquaculture Plans* published by DG-Mare in 2016:

- Detailed processing and presentation of current situation of national aquaculture (Baseline)
- Formulation of general strategic middle and long term targets for the growth of the national aquaculture (strategic planing)
- Formulation of actions to reach strategic targets (action plan)

Marine finfish

Baseline: In 2012, EU Member States produced 330,000 tonnes of marine finfish species with a value of EUR 1.5 billion representing roughly 25% of EU aquaculture production. More than 90% of marine finfish production is concentrated on salmon, seabass and seabream. Other marine species grown in the EU include mostly turbot, and other miscellaneous species like meagre, sole or amberjack. The main production technique for marine finfish is farming in cages with fry produced in shore-based hatcheries.

Challenges:

- The main challenge to enhancing production is the lack of available space in inshore sheltered areas. In response, the United Kingdom aims to develop offshore aquaculture while Greece, Italy, Ireland and Spain are focusing on reorganising production sites to optimise the use of available space.
- Competitiveness of products compared to similar production in third countries is another important challenge identified by Member States. Cyprus, France, Greece, Ireland, Italy and Spain aim to address this issue through the development of more cost-effective production techniques incorporating research and development outputs, improved marketing of products and better linkages between economic operators in the industry (i.e. feed manufacturers, fry producers).
- All Member States listed also intend to simplify administrative procedures related to national and regional environmental laws which have an effect on aquaculture activities in marine inshore areas.

Objectives: The objective for EU marine finfish aquaculture is to increase production to 480,000 tonnes by 2020, a 60% increase compared to current production levels.

Shellfish

Baseline: The EU shellfish aquaculture sector produced almost 550,000 tonnes in 2012 at a value nearing EUR 900 million, accounting for roughly half of EU aquaculture output. Main species produced include mussels, oysters and other bivalve species including clams, cockle, carpet shell, abalone and scallops. Shellfish aquaculture relies on extensive techniques with species consuming food web elements naturally present in the water. Fry is also mostly collected from the wild during planktonic phases. However, some shore based nurseries also produce higher growth performance spat (i.e. triploid oysters).

Challenges:

- Increases in production are constrained by the lack of space in inshore areas. Nevertheless, Spain, France, Italy and other Member States foresee a possible expansion of mussel culture on hanging ropes in offshore areas and through restructuring of existing production sites to increase productivity.

- Improved commercialisation of shellfish through better marketing and use of techniques to extend shelf-life are identified as other potential growth factors.
 - Environmental conditions causing algal blooms, and the spread of biotoxins with links to human and shellfish health also have a strong effect on production and time of harvest. Research and development is intended to increase the production efficiency of operations and also help build up the resilience of the sector to environmental hazards (bio-toxins, virus outbreaks etc.).
- Objectives: The objectives listed by Member States aim to increase shellfish production from 550,000 tonnes to 680,000 tonnes by 2020, a 25% increase compared to the current baseline.

Other marine aquaculture

Baseline:

- Bluefin tuna capture-based aquaculture is widespread in the Mediterranean basin. Adult and juvenile bluefin tuna are caught in the wild by fishing vessels and transferred live into cages and fattened until they reach valuable commercial grades. In 2014, the production reached approximately 10,000 tonnes with Spain, Malta and Croatia being the main producing Member States.
- Data on seaweed farming, as distinct from wild harvest is lacking at present, however seaweed is a sector that is poised for growth with high-value applications in food, feed, and cosmetics. Bio-fuel from cultured macro-algae may also support further developments of seaweed aquaculture in Europe.

Challenges:

- Ongoing research and development related to closing the breeding cycle of tuna to allow for captive bred juveniles will eliminate the reliance on fisheries to provide the input for fattening. This could see significant growth in the aquaculture of tuna in the near future.

Freshwater aquaculture

Baseline: In 2012 the EU Member States produced 240,000 tonnes of freshwater fish with a total value of EUR 750 million. Freshwater production accounts for about 25% of EU aquaculture output. The most important species are trout and carp, which represent 93% and 86% of the total freshwater production volume and value respectively.

Challenges:

- Most production originates from small scale farmers, with limited access to credit and low capacity to invest. Relatively high costs of labour, land and other inputs in many cases put the sector at a competitive disadvantage against cheap imports from third countries. However, such a competitive disadvantage is not always the case, notably in France, where strong markets have been developed on the basis of high-quality and highly localised production. The fragmented structure of the sector cannot respond to concentrated demand from large retail chains.
- The lack of suitable space (due to competition with other users) imposes further restrictions on the development of the freshwater aquaculture.
- Carp farming in ponds faces some additional specific problems, of which stagnating seasonal demand and damage by protected predators, especially cormorants, are the most significant. The problem of seasonality will be addressed by promoting processing, product development and marketing campaigns. Cooperation with research institutes and within the production chain are key to future success.
- Successful introduction of new species requires long start-up periods, which are difficult to finance for small scale producers.

Objectives:

- A number of countries including Italy, Austria, Germany and Slovenia plan small increases in the total volume of trout produced.

- Increased carp production is not foreseen by any major producing Member State. Rather the carp sector will focus on achieving stable production and aim for product diversification, including agro-tourism, and strengthening of the environmental role of the ponds. Hungary, on the other hand, plans to increase its total aquaculture production by 15% through construction of new ponds and modernization of some of the existing ones.
- Diversification of production to incorporate new species and new processed and added value products is an important part of the growth strategy and competitiveness of the freshwater sector. Hungary and Poland intend to strengthen fish farming in recirculation systems of species like eel, sturgeon, tilapia and perch. This is a part of an overall strategy which pursues promotion of 'modern' fish farming.
- The Netherlands and France pursue the development of knowledge, expertise and equipment all of which are viewed as potential export products.

Strategic actions most relevant for iFishIENCI are described by DG-mare in the *Summary of the 27 Multiannual National Aquaculture Plans* published in 2016:

3.1.1.1 Strategic action: Enhancing the competitiveness of EU aquaculture

Despite the large differences in aquaculture practices in the different Member States, all Member States have the same approaches to enhancing competitiveness. They focus on the importance of research and development, cooperation of stakeholders, promotion of environmentally sustainable practices and diversification and marketing.

Research and development plans are targeted at improving production technologies, especially energy efficiency (carbon footprint), waste water treatment, the efficiency of feeds, and reducing the susceptibility of the animals to diseases and viruses. Other broader issues like environmental impact and consumer demand related to the introduction of new species are also addressed.

Some Member States highlight the need for better cooperation among the producers, e.g. within producer organisations, and integration within the value chain between producers, processors and trade. This is stressed by Austria, Finland, France, Greece, Italy, Latvia, Lithuania, Portugal, Romania and Sweden. In order to benefit from the cooperation and increase efficiency and productivity, fish farms should have a sufficient commercial scale, an issue raised by Ireland, Lithuania and Malta.

It is considered essential that aquaculture demonstrates its environmental sustainability to the broader public. The need to better communicate, through certification or promotion campaigns, on the environmental impact of aquaculture (use of water, energy and medicines and other additives), animal welfare and public safety is acknowledged by most Member States. The environmental sustainability of aquaculture is considered an important issue by Austria, Bulgaria, Cyprus, Germany, Greece, Italy, Spain, Slovenia and Sweden.

Estonia, France, Greece, Italy, Lithuania, Malta and Spain stress the need to create added value for aquaculture farms through diversification and marketing and promotional activities. The Czech Republic, Denmark and Lithuania aim to develop new products, which call for cooperation between fish farmers and fish processors. Marketing studies have to guide such development towards products for which strong demand can be expected.

Translating the required innovations into practice calls for creation of infrastructure facilitating lifelong learning of those working in the sector. Lifelong learning is considered a specific competitiveness tool by Bulgaria, Denmark, Estonia, Finland, Italy and Latvia. This should be achieved through intensified cooperation with the research institutes.

3.1.1.2 Strategic action: Promoting a level playing field for EU operators

All Member States consider innovation in aquaculture through promotion of research and development, close cooperation between research institutes and the industry as important drivers for a level playing field.

Cyprus, Greece, Italy, Romania, Sweden and the United Kingdom foresee the support of Producer Organisations to assist their members in areas such as the development of traceability schemes or codes of conduct and obtaining certifications. Producer Organisations could also facilitate exchange of knowledge and experience as well as cooperation with research institutes or implementation of pilot projects.

Promotion of certification is considered an important tool by Bulgaria, Estonia, Finland, Greece, Ireland, Italy, Romania, Spain and Sweden. Austria and the Czech Republic propose to develop new (or strengthen the use of existing) regional or national labels in the form of ‘appellation / certificate of origin’, which has been successful in other food products. The Netherlands propose the development of certification schemes in collaboration with established international certification bodies (e.g. Aquaculture Stewardship Council) for species which are not being certified at present. This could pave the way for international adoption and roll-out.

The position of aquaculture products on the market needs to be improved, compared to potential substitutes. For this reason, marketing and promotion campaigns are announced by Austria, Belgium, Cyprus, Denmark, Lithuania and Malta. Certification of aquaculture products is expected to play an important role in order to improve fish farming practices as well as increase consumer awareness. Consumption of some species, particularly carp, is highly seasonal. Development of new products and promotion campaigns are intended to address this specific market characteristic in the Czech Republic, Poland and Hungary.

iFishIENCi contribution to ongoing implementation of Multiannual National Strategic Plan for the development of aquaculture activities

- ⇒ Boost current competitive advantages of European aquaculture (WP5)
- ⇒ High quality and high environmental standard products (WP1)
- ⇒ Provide regulatory/policy scientific/technical solutions to reduce red tape in industry (WP4)
- ⇒ Bring to the world market (WP5+WP6)

3.2 WATER Framework Directive

The Water Framework Directive intends to achieve good qualitative and quantitative status of all water bodies in the EU. The directive aims for good environmental status for all ground and surface waters, covering inland waters and marine waters up to one nautical mile from shore. The overall goal, cleaner water will give better living conditions for aquatic ecosystems. But restraints on emissions of nitrate and phosphorus from aquaculture has been the barrier for growth for land- and sea-based farms in some places.

iFishIENCi contribution to ongoing implementation of Water Framework Directive

Reduce freshwater use and discharge (nutrient and suspended solid discharge) of EU aquaculture:

- ⇒ Reduce feed waste through smart feeding and valorisation in open systems (WP1 + WP3)
- ⇒ Accompany the development of low-through systems (WP2)
- ⇒ Promoting the recirculating aquaculture systems (WP6)

3.3 MARINE STRATEGY Framework Directive

The Marine Framework Strategy Directive aims to protect the marine environment in Europe by reaching “Good environmental status” within 11 descriptors. Among these descriptors, most of them relate especially to aquaculture: Biological diversity, non-indigenous species, Commercial exploitation of fish and shellfish, Foodweb integrity, Human-induced eutrophication, Seafloor integrity, Concentration of contaminants and marine litter. Notably, seafloor integrity broadens the perspective from what was traditionally fisheries policy, and has in some cases led to closures of larger marine areas (also fishing areas), not due to protection of target species or bycatch, but due to concerns of seafloor and broader ecosystem issues (European Parliament and the Council 2008).

iFishIENCi contribution to ongoing implementation of Marine Strategy Framework Directive

- ⇒ Early results and prompt dissemination to local authorities to support decision making regarding national plans for Marine Spatial Planning (WP6)
- ⇒ Reduce conflict of interest between coastal activities by reducing the environmental footprint of the industry (WP4+WP6)
- ⇒ Marine Strategy Plans are due to be submitted by 2021 (WP6)

3.4 BLUE GROWTH strategy of the EU

Blue Growth is the long term strategy to support sustainable growth in the marine and maritime sectors as a whole. Seas and oceans are drivers for the European economy and have great potential for innovation and growth. It is the maritime contribution to achieving the goals of the Europe 2020 strategy for smart, sustainable and inclusive growth (European Commission. DG Mare, 2012). The strategy consists of three components:

1. Develop sectors that have a high potential for sustainable jobs and growth, such as: (a). Aquaculture, (c). marine biotechnology
2. Essential components to provide knowledge, legal certainty and security in the blue economy: (a). marine knowledge to improve access to information about the sea; (b). maritime spatial planning to ensure an efficient and sustainable management of activities at sea; (c). integrated maritime surveillance to give authorities a better picture of what is happening at sea.
3. Sea basin strategies to ensure tailor-made measures and to foster cooperation between countries: (a). Adriatic and Ionian Seas, (c). Atlantic Ocean, (d). Baltic Sea, (e). Black Sea, (f). Mediterranean Sea, (g). North Sea

iFishIENCi contribution to ongoing implementation of Blue Growth Strategy

- ⇒ More productive and environment-friendly coastal aquaculture production systems (WP1+WP3)
- ⇒ More sustainable feed ingredients from algae to resolve a major bottleneck to aquaculture expansion and create new markets for marine biotechnology (WP1)

3.5 EU regulations related to NUTRITION and BREEDING in aquaculture

Various European regulations related to breeding and nutrition in aquaculture are relevant for the research and developments to be implemented during the iFishIENCi project and will need to be considered along developments:

- **Regulation regarding introduction of new species:** Council Regulation (EC) No 708/2007 of 11 June 2007 concerning use of alien and locally absent species in aquaculture regulates any

non-routine intentional introduction of alien or locally absent aquaculture species. The regulation states that publicly available register on all introductions and translocations of alien or locally absent aquaculture species (applications, permits, monitoring) have to be implemented. Monitoring for all alien or locally absent aquaculture species after their release (2 years or full generation cycle or longer) is necessary. Contingency plans for non-routine introductions or pilot releases of alien or locally absent aquaculture species, to be implemented in case of negative effects on the environment or on native populations are also included.

- **Regulation regarding organic aquaculture:** Council Regulation (EC) No 834/2007 of 28 June 2007 on organic production and labelling of organic products stipulates that organic farming shall be based on the maintenance of the biodiversity of natural aquatic ecosystems, the continuing health of the aquatic environment and the quality of surrounding aquatic and terrestrial ecosystems in aquaculture production. In addition, COMMISSION IMPLEMENTING REGULATION (EU) No 1358/2014 of 18 December 2014 amending Regulation (EC) No 889/2008 is laying down detailed rules for the implementation of Council Regulation (EC) No 834/2007 as regards the origin of organic aquaculture animals, aquaculture husbandry practices, feed for organic aquaculture animals and products and substances allowed for use in organic aquaculture.
- **Regulation regarding maritime spatial planning:** DIRECTIVE 2014/89/EU OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL of 23 July 2014 is establishing a framework for maritime spatial planning.
- **Regulation regarding animal nutrition and functional feed ingredients:** REGULATION (EC) No 1831/2003 rules the use of additives in animal nutrition and REGULATION (EC) No 767/2009 OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL of 13 July 2009 on the placing on the market and use of feed, amending European Parliament and Council Regulation (EC) No 1831/2003 and repealing Council Directive 79/373/EEC, Commission Directive 80/511/EEC, Council Directives 82/471/EEC, 83/228/EEC, 93/74/EEC, 93/113/EC and 96/25/EC and Commission Decision 2004/217/EC addresses the use of functional feed ingredients.

3.6 NATIONAL LEGISLATIONS complementing EU Legislation

The EU framework directives sets a framework of general goals and methods for development at the specific area. But it is within national processes that the specific objectives of the policy, the means to reach the objectives as well as implementation are to be obtained. Therefore, despite of the same framework directives, the specific configuration of means will differ between the countries, and therefore the consequences for aquaculture might also differ.

Some relevant national legislations of iFishIENCi project partner countries as well as from the 3 important aquaculture countries Ireland, Scotland and Turkey completing the EU legislation described are listed below. This non-exhaustive list will be completed in upcoming deliverables D4.13 and D4.14 Report on regulatory framework and requirements 2nd and 3rd version for countries with relevant aquaculture production in EU and internationally.

3.6.1 Norway

In Norway, the **AQUACULTURE ACT (2005)** regulates the management, control and development of aquaculture in both inland waters and marine waters (internal waters, territorial waters, the exclusive economic zone and on the continental shelf), as well as land based aquaculture. The Aquaculture Act covers aquaculture of any aquatic organism - from broodstock and hatchery production, to table fish production, as well as sea ranching.

The purpose of the Aquaculture Act is "to promote the profitability and competitiveness of the aquaculture industry within the framework of a sustainable development and contribute to the creation of value on the coast". The Aquaculture Act regulates both commercial aquaculture, as well as aquaculture carried out for scientific or educational purposes.

The Aquaculture Act establishes a licensing system, and broadly applies to issues like environmental standards, land utilisation, registration, transfer and mortgaging of licences, as well as control and enforcement.

The Ministry of Fisheries and Coastal Affairs is the institution in charge of the administration of the act, and may prescribe, by regulations, detailed provisions relating to the provisions of the Aquaculture Act. The Directorate of Fisheries, an executive administrative body within the Ministry, is assigned the responsibility for coordination, administration and execution of surveillance and control of the aquaculture sector, including granting aquaculture licences and enforcing the Aquaculture Act.

The **Act Relative to Food Production and FOOD SAFETY ACT (The Food Safety Act 2003)** is the main act regulating animal health and food safety and quality in Norway, and addresses the production, processing and distribution of foodstuffs, including aquaculture production and fish processing. The Ministry of Fisheries and Coastal Affairs is the institution in charge of the administration of the act as regards aquatic animals, with the power to make regulations regarding all matters of the act. The Norwegian Food Safety Authority, a governmental body, is given management and enforcement powers pursuant to the act.

The Regulation relative to feeding stuffs (2002), adopted under the Food Safety Act (2003), prescribes for the production, import, export and trade in feed for animals, including aquatic animals. It details out rules related to the authorization of feed production plants, the use of additives and the composition of feed, the use of genetically modified feed and additives, as well as packing and labelling of feed.

The Regulation relative to the operation of aquaculture facilities (2004), adopted under the Food Safety Act (2003), provides that there shall be sufficient amounts of feed available for the fish and that it shall be composed in a manner that enhances fish welfare. The feeding shall be adjusted according to species, age, development stage, and weight of the fish, as well as needs related to physiology and instincts. The fish shall be fed on a daily basis, unless this is not required. The feeding shall be done in a manner that provides all fish with feed and which does not cause any damage to the fish. Fish shall not be fed when this is unfavourable to their health, welfare and quality.

The **Act Relative to Prevention of Cruelty to Animals (1974, as amended in 2003)** is also of importance for the aquaculture sector, by prescribing basic principles for the keeping and treatment of animals, including fish and crustaceans. As a general principle, the Act provides that animals, including fish and crustaceans, shall be treated well, and due regard shall be given to their natural instincts and needs so that they are not in danger of suffering unnecessarily. Furthermore, the Act prescribes that animals in captivity shall receive sufficient food; proper care and attention; that restraining ties or barriers do neither injure or harm the animals, and that sick or injured animals receive suitable treatment and are

killed if need be. The killing of animals shall be done in a manner that limits their suffering. The Act furthermore restricts the altering of the genes of animals based on animal welfare considerations.

The Regulation relative to the operation of aquaculture facilities (2004) includes several provision adopted under the Act Relative to Prevention of Cruelty to Animals, and prescribes that every aquaculture facility shall be equipped with personnel qualified for taking care of fish welfare. Aquaculture facilities for the production of fish shall be designed in such a manner that:

- The fish has space enough to move around and follow their natural instincts.
- They do not have sharp edges that can cause discomfort to the fish.
- They cause minimal risk of damage to the fish, also when fish are being released and captured.
- Inspections of the fish can easily be carried out.
- Care and treatment of the fish can easily be carried out.
- They are designed in way that facilitates good hygiene.
- They are adjusted to the surroundings, with regard to weather conditions.

Methods, technical devises and equipment that are being used, including equipment used for moving the fish, shall be suitable from a fish welfare perspective. New methods and technical solutions shall be tested and found safe before use. If the facility relies on electricity for securing the fish welfare, there shall be reliable sources of electricity and access to emergency supplies of electricity (aggregate) and oxygen.

Land based aquaculture facilities shall be equipped with an alarm that is activated in case of power outage, low oxygen levels, low water supplies and other deficiencies that are of concern to fish welfare.

Tests for surveying oxygen values, pH value, temperature and salinity shall not expose the fish to substantial harm. The salinity of the water in which the fish is kept shall not exceed 35 per thousand.

Moreover, the fish shall be kept in an environment that is adapted to the needs of each specific species and that protects them from unnecessary stress, pain and suffering. The fish shall be grouped according to size to the extent this is of importance and taking into consideration fish welfare. The fish shall not be handled and taken out of the water unless this is necessary. If the fish show signs of considerable discomfort or deviant behaviour, measures to secure the welfare of the fish shall be put in place.

As regards feed, the Regulation provides that the amount and nature of the feed used shall advance fish welfare.

Furthermore, the record of operations for the production of table fish, broodstock, hatcheries and hatchery-reared animals for culture-based fisheries, shall include details regarding the welfare status of the animals.

The [Agreement on the European Economic Area \(EEA\)](#) imposes several obligations on Norwegian legislation. Of particular interest here is the implementation of EC legislation on veterinary inspection, aquatic animal health and food hygiene.

3.6.2 Spain

The general legal framework for the regulation and promotion of aquaculture activity in Spain is established by the 1978 Constitution, Law No. 20/1942 concerning Development and Conservation of River Fisheries, Law No. 23/1984 on Marine Farming and Law No. 22/1988 concerning Coasts. Below,

the most relevant legislation at national level in Spain complementary to the European in relation to nutrition and breeding in aquaculture are listed:

- **Regulation regarding sale of fishery products:** Royal Decree 418/2015, 29 May, regulates the first sale of fishery products in application of REGULATION (EU) No 1379/2013.
- **Regulation regarding food production, hygiene and marketing:** Royal Decree 640/2006, 26 May, regulates conditions of application of the Community provisions in the field of hygiene, production and marketing of food product, Law 17/2011, July 5 addresses Food Security and Nutrition and the National Plan for Official Control of the Food Chain (PNCOCA) describes the official control systems throughout the food chain in Spain, from primary production to points of sale to the end consumer in application of REGULATION (EC) No 882/2004.
- **Regulation regarding research grants and European Maritime and Fisheries Fund:** Order AAA/957/2016, June 9, approves the regulatory bases of research grants in the National Aquaculture Plan and Royal Decree 1173/2015, of 29 December regulates the development of the European Maritime and Fisheries Fund in relation to assistance for the definitive and temporary cessation of fishing activity in application of REGULATION (EU) No 508/2014.
- **Regulation regarding introduction of new species:** Royal Decree 216/2019, of 29 March, approves the list of invasive alien species for the outermost region of the Canary Islands and is amending the Royal Decree 620/2013, of 2 August, which regulates the Spanish Catalog of Invasive Alien Species and Law 7/2018, of 20 July, modifies Law 42/2007 of 13 December on Natural Heritage and Biodiversity in application of REGULATION (EU) No 1143/2014.
- **Regulation regarding organic aquaculture:** the Spanish National Strategy of Ecological Production 2018-2020 issued by the Ministry of Agriculture, Fisheries and Food and the Guidelines from ECOCERT IBERICA are applications of REGULATION (EU) No 1358/2014.
- **Regulation regarding maritime spatial planning:** Royal Decree 363/2017 of 8 April is establishing a framework for maritime spatial planning in application of DIRECTIVE 2014/89/EU.

3.6.3 Greece

Apart for the general procedures implied by the EU there is particular legislation for the management of the aquaculture sector in Greece. All the players involved (state, companies, academia) are focusing on the sustainable development of the Greek aquaculture. The aquaculture industry is regulated at national and regional level through a complex legal framework (prepared in accordance with the EU Directives) including laws and regulations on licensing, pollution, food safety, use of therapeutics, costal zone planning, including regulations for installations in archaeological coastal zones etc. In the Greek policy for aquaculture environmental protection is one of the basic concerns. The development of aquaculture has been drawn up aimed at enhancing the competitiveness and sustainability of the sector by promoting innovation, high level protection of the environment and a better levelled playing field. Several ministries are involved in the regulation including the Ministry of Agriculture, of the Environment, and of Culture. In particular, the National Policy for Aquaculture is expressed through:

- **Multiannual National Strategic Plan for aquaculture development in Greece 2014-2020** (Hellenic Ministry of Rural Development and Food, 2014).

Strategic target is the sustainable development of Greek aquaculture industry through the increase of the production, which will lead to increase of employment and GDP. The quantitative target is a production increase of 7% for the next 15 years. Ongoing implementation.

- [Greek Operational Program of Fisheries and Sea 2014-2020](#).

EMFF funding will support the competitiveness and the environmental and economic sustainability of the Greek aquaculture sector, mainly through the promotion of productive investments and new forms of aquaculture with high growth potential, investments that enhance quality and increase added value for aquaculture products, provide measures for public health and animal welfare, boost innovation and provide advisory services of a technical, scientific, legal or economic nature.

Key objective is by 2023, aquaculture is to be a leading primary sector, providing a high level of environmental protection and a significant contribution to high-quality food supply, employment and economic growth. Ongoing implementation.

- [Special Framework for Aquaculture Spatial Planning and Sustainable Development \(Decision 31722/4.11.2011 of Coordination Committee of the Government Policy in the field of Spatial Planning and Sustainable Development\)](#)

To record, clarify and serve the basic spatial needs of aquaculture units in a way that their operation does not conflict with the development of other activities and not degrade the environment irreparably. Ongoing implementation.

3.6.4 Hungary

In Hungary, following legislation are relevant to breeding and nutrition in aquaculture: (Hungarian name first, translation in brackets)

- **Regulation regarding breeding:**
 - 1993. évi CXIV. törvény az állattenyésztésről (Act CXIV of 1993 on **animal breeding**)
 - 32/1994. (VI. 28.) FM rendelet a tenyészállatok teljesítményvizsgálatáról és tenyészértékbecsléséről (FM decree 32/1994 (VI. 28.) on the **performance testing and breeding value evaluation** of breeding animals)
 - 129/2004. (VIII. 25.) FVM rendelet a tenyészállat, illetve szaporítóanyag behozatalának és kivitelének szakmai előírásairól (FVM decree 129/2004 (VIII. 25.) on the professional **requirements of importing and exporting breeding animals** or reproductive material)
 - 123/2005. (XII. 27.) FVM rendelet a tenyésztő szervezeti és fajtaelismerés rendjéről (FVM decree 123/2005 (XII. 27.) on the **rules of approval of breeding organizations** and breeds)
- **Regulation regarding Food Safety:**
 - 2008. évi XLVI. törvény az élelmiszerláncról és hatósági felügyeletéről (Act XLVI of 2008 on **food chain** and its official control)
 - 22/2012. (II. 29.) Korm. rendelet a Nemzeti Élelmiszerlánc-biztonsági Hivatalról (Governmental Decree No 22/2012. (II. 29.) on the National **Food Chain Safety** Office)
- **Regulation regarding Operation of aquaculture installation/farms:**
 - 383/2016. (XII. 2.) Korm. rendelet a földművelésügyi hatósági és igazgatási feladatokat ellátó szervek kijelöléséről (Governmental Decree 383/2016 (XII.2) on the designation of bodies in charge of **managing agricultural official and administrative tasks**)

- 119/2007. (X. 18.) FVM rendelet a tartási helyek, a tenyészetek és az ezekkel kapcsolatos egyes adatok országos nyilvántartási rendszeréről (FVM decree 119/2007 (X. 18.) on the national **registration system of animal keeping** and rearing places, and of certain data related to them.)
- 34/2011. (IV. 28.) VM rendelet a halkeltető állomások üzemeltetéséről, valamint a tenyészhalak és hal szaporítóanyag felajánlásáról, értékesítéséről (VM decree 34/2011 (IV. 28.) on the **operation of fish hatcheries** and the offering for sale and selling of fish breeders and reproductive material of fish)
- Regulation regarding Nutrition in aquaculture:
 - 2017. XLII. law modified of 2013 CII. law about **fish farming** and fish protection
 - 44/2003.(IV.26.) On the mandatory **requirements of the Hungarian feed Code**

3.6.5 Ireland

In Ireland, following legislation are relevant to breeding and nutrition in aquaculture:

- National Strategic Plan for Sustainable aquaculture Development

National Strategic Plan for Sustainable aquaculture Development was released on 23 October 2015 and submitted to the European Commission¹. It consists of 24 actions that should be implemented over the period up to 2020². These actions may be undertaken by the State, by private actors, or a combination as appropriate, and some may be financially supported through the Seafood Development Programme, co-funded by the Exchequer and European Maritime and Fisheries Fund.

- Action 1 Build capacity and scale in the industry
- Action 2 Dedicated supports to new entrants to the sector
- Action 3 Promote organic aquaculture practices and certification
- Action 4 Aid shellfish producers affected by major biotoxin episodes
- Action 5 Foster knowledge, innovation and technology transfer.
- Action 6 Enhance the skills base to foster a knowledge economy.
- Action 7 Provision of expert advice to improve environmental and business performance and enhanced strategic planning by aquaculture enterprises.
- Action 8 Support best husbandry and disease management practice.
- Action 9 Applied research and collaborations between industry, scientific and development bodies.
- Action 10 Development of commercial scale growing systems for novel species.
- Action 11 Application of Guiding Principles for the Sustainable Development of Aquaculture.
- Action 12 Application of scale limits and phasing in relation to the development of individual offshore salmon farms.
- Action 13 Development of an industry Code of Practice for Invasive Alien Species.
- Action 14 Continuation of Invasive Species Ireland Project in relation to aquaculture.
- Action 15 Quantify the environmental contribution of aquaculture.
- Action 16 Ensure that aquaculture monitoring is consistent with the requirements of the Marine Strategy Framework Directive.
- Action 17 Develop opportunities and constraints mapping for aquaculture taking specific account of environmental issues, Natura 2000 sites and inshore fisheries.

¹<https://www.agriculture.gov.ie/media/migration/seafood/marineagenciesandprogrammes/nspa/NationalStrategicPlanSusAquaDevel181215.pdf>

²<https://www.agriculture.gov.ie/seafood/>

- Action 18 Identify marine tourism opportunities from aquaculture.
- Action 19 Study on integrated multi-trophic aquaculture and possible synergies with offshore wind farms or other marine renewable energy.
- Action 20 Study on how aquaculture contributes to communities in rural areas.
- Action 21 Progressively remove the current aquaculture licensing backlog.
- Action 22 Review and revision of the aquaculture licensing process, including the applicable legal framework.
- Action 23 In the context of a reviewed process and revised legal framework, consider the phased introduction of appropriate timescales for licence determination.
- Action 24 Develop a data management and information system, with online aquaculture licence application and tracking functionality, and spatial mapping of aquaculture sites.

- **Regulation regarding Nutrition**

Main organization for food safety is the Food safety Authority (FSA)³. In 1998 the Food Safety Authority of Ireland Act was passed. The FSA has service contracts with the DCMNR and Marine Institute. The DCMNR is responsible for:

- The determination of compliance with food legislation by means of
 1. the inspection, approval, licensing and/or registration of premises and equipment, including premises or equipment used in connection with the manufacture, processing, disposal, transport and storage of food,
 2. the inspection, sampling and analysis of food, including food ingredients, and
 3. the inspection and analysis of food labelling
- The provision of food safety and food hygiene education to producers, manufacturers and distributors.

The Marine Institute is responsible for:

- - the determination of compliance with food legislation by means of food inspection, and sampling and analysis of food, including food ingredients;
- - the provision of food safety and food hygiene education to producers, manufacturers and distributors.

- **Foodwise 2025**

The National Strategic plan also provides information about the Report of the 2025 Agri Food Strategy Committee that was published in July 2015. The so-called Food Wise 2025 is a ten years plan for the agri-food sector. Food Wise 2025 identifies 3 strategic priorities for the seafood sector such as expanding the raw material base, enhancing the industries structure and skills and optimise product added-value, export markets and environmental sustainability⁴.

3.6.6 UK/Scotland

This overview is focused on Scotland since is responsible for approximately 90 percent of all United Kingdom aquaculture production and its legislation is relevant for whole UK. The Aquaculture industry is very important for Scotland, especially to guarantee an economic growth in the rural and coastal regions of the north and west. Leader of the Scottish aquaculture industry is the farming of Atlantic

³ http://www.fao.org/fishery/legalframework/nalo_ireland/en#tcNB011B

⁴ Food Wise 2025, 36 pp. <https://www.agriculture.gov.ie/media/migration/foodindustrydevelopmenttrademarkets/agri-foodandtheeconomy/foodwise2025/report/FoodWise2025.pdf>

salmon. The government of Scotland support the Aquaculture Industry Leadership Group to reach their goals by 2030⁵. The goals are:

- double the economic contribution of the sector from £1.8 billion in 2016, to £3.6 billion by 2030
- double the number of jobs to 18,000 by 2030

- Aquaculture and Fisheries Act

The Aquaculture & Fisheries (Scotland) Act 2013 commenced on 13 September 2013⁶. The purpose of the Aquaculture and Fisheries Act is to ensure that farmed and wild fisheries - and their interactions with each other - continue to be managed effectively, maximising their combined contribution to supporting sustainable economic growth with due regard to the wider marine environment.

The Act also aims to amend the Fisheries Act 1981 and modernise existing enforcement provisions to ensure that sufficient powers are in place to enable British Sea Fishery Officers to:

- enforce sea fisheries regulations
- introduce legislative provisions to safeguard shellfish waters protected areas
- make provision for charges to a number of fishery functions
- extend the scope of offences that could be subject to a Fixed Penalty Notice

- Regulation regarding Nutrition and Food safety:

The main organization for handling issues concerning the food quality, food safety and the regulation of animal feeding is the Food Standards Agency Scotland (FSAS). The Organization works within the FSA framework. The Fish Labelling (Scotland) Regulations (2003) (SSI 256/2013) ensures the correct labelling of products and provides all necessary information for the customer⁷.

3.6.7 Turkey

The main national organization for fisheries and aquaculture is the Ministry of Agriculture and Rural Affairs (MARA) and is responsible for the administration, regulation, protection, promotion and technical assistance. The Ministry is divided into four general directorates. The General Directorate of Agricultural Production and Development (GDAPD) is responsible for the production, development and management of aquaculture and inland fisheries activities. The General Directorate of Agriculture Research (GDAR) deals with research and the General Directorate of Protection and Control (GDPC) with the movements of fish, diseases and fish as food issues. Last the General Directorate of Organisation and Support (GDOS). The Ministry of Agriculture and Rural Affairs (MARA) is further divided into 81 provincial directorates responsible for implementing policies issued by the central office in Ankara.

The activities are mainly regulated by the Fisheries Law No. 1380 (1971) and amended by the Fisheries Law No. 3288 (1986). Three main regulations regarding the licensing, health and environment, are regulating the Aquaculture in Turkey⁸.

⁵ <https://www2.gov.scot/Topics/marine/Fish-Shellfish>

⁶ <https://www2.gov.scot/Topics/marine/Fish-Shellfish/bill>

⁷ https://www.legislation.gov.uk/ssi/2013/256/pdfs/ssi_20130256_en.pdf

⁸ http://www.fao.org/fishery/countrysector/naso_turkey/en#tcN70118

- Rules and procedures on aquatic animal diseases and disease control are regulated by⁹:
 - Law No. 5996 of 2010 on Veterinary Services, Plant Health, Food and Feed.
 - Regulation No. 28190 of 2012 on Aquatic Animal Health and Protection and Fight Against Aquatic Animal Diseases.
 - Circular No. 2007/32 on Listed Diseases to Be Registered According to Article 4 of Animal Health and Sanitation Law.
 - Fishery Regulations No. 22223 Chapter VIII Article 23 requires a health certificate for breeding for private and public institutions.
 - Law No. 5996 on Veterinary Services, Plant health, Food and Feed

- Regulation regarding Nutrition and Food safety¹⁰:

Use of feed is regulated by Law No. 5996 on veterinary services and enclosed matters such as, production, processing and distribution of feed and furthermore the following topics concerning feed:

- • Definitions, classifications, norm and standards.
- • Declaration, registry, license and control.
- • Laboratory inspection and analyses.
- • Methods for laboratory analysis.
- • Minimum technical and health conditions of processing plants.
- • Provisions for stores and sales points.
- • Production permits or licenses, sale prices, import and export.

The main legislation for food safety in fisheries and aquaculture is the Fishery Regulations No. 22223 Chapter IX (Articles 25-32)¹¹.

TTZ contacted the aquaculture department of the Istanbul University as well as major Turkish aquaculture company ILKNAK to ascertain the legislation background and challenges listed here are correctly approached. To date the discussion is on-going and will be replicated in other relevant countries and reported in D4.13 and D4.14.

3.7 Policy on TRADE-agreements

3.7.1 The World Trade Organisation

International trade is in general regulated by international rules set by WTO, The World Trade Organisation. WTO has 164 members, nationals but also EU as a group. WTO has the overall purpose to enable a free flow of trade, as this is seen as important for economic development and well-being. This is done by removing various legal obstacles. In order to get transparent and predictable rules worldwide, so individuals, companies and governments know the trade rules and have confidence in predictability by avoiding sudden changes of policy. At the other hand though also taking into consideration „undesirable side effects“ and therefore some trade barriers could be maintained, e.g. to protect consumers or prevent the spread of disease (WTO, n.d.).

The general principal within the WTO countries is to ensure same trading conditions, that all nations are regarded as Most-favoured nations (MFN). This key principle means that a lower customs duty offered by one member of WTO to another country must be extended to all other members of the WTO. But a country (here EU) can make a free trade agreement with more favourable treatment to the participating states than to the other WTO members (though this is under strict conditions by the

⁹ https://www.tarimorman.gov.tr/Belgeler/ENG/Legislation/law_veterinary_services.pdf

¹⁰ http://www.fao.org/fishery/legalframework/nalo_turkey/en#tcNB01A0

¹¹ Fisheries Regulations No. 22223 of 10 March 1995 <http://extwprlegs1.fao.org/docs/pdf/tur20689.pdf>

WTO). This means that the trade agreements mentioned here: EAA, CETA and TTIP are exceptions from the general agreement under WTO.

3.7.2 EEA agreement

The European Economic Area (EEA), which came into force in 1994, builds upon and furthers the EU's internal market provisions set out in the European Free Trade Area (EFTA). Notable for the iFishIENCi, Norway is member of the EEA in addition to the EU member states. As an extension of the internal market of the EFTA, "The EEA incorporates the four freedoms of the internal market (free movement of goods, persons, services and capital) and related policies (competition, transport, energy and economic and monetary cooperation)," (EFTA, n.d.). However, **in regard to fisheries, the EU's Common Fisheries Policy (CFP) supersedes and regulates fishing activities within the EU, with certain provisions for the trade of fishery products addressed in the EEA agreement.** The implications for processed seafood within the EEA is that some products processed in these EEA countries is not subject to a tariff, whereas products imported into the EEA from outside is subject to tariffs. For example, cod filets processed in Iceland are not subject to an import tariff, whereas cod filets processed in a third country such as the United States would be subject to an 18% import tariff. Consequently, these differentiating taxation schemes affect the competitiveness of firms hoping to sell product on the European market, but also those firms that may choose to outsource portions of the processing to third countries. Nevertheless, trade agreements between the EU and third countries may also differentiate products within the value chain and impact competitiveness.

3.7.3 Bilateral agreements between EU and Canada and USA

The trade conditions are under constant development in on-going negotiations between the EU and third party countries. Notable for fisheries value chains are the Comprehensive Economic and Trade Agreement (CETA) between Canada and the EU and the Transatlantic Trade and Investment Partnership (TTIP) between the United States and the EU.

Canadian European Trade Agreement (CETA)

The European Parliament voted in favour of the Canadian European Trade Agreement (CETA) on 15 February 2017 and now requires approval from the national parliaments of EU member states before it takes effect (up to June 2019, 13 member states ratified). In addition to traditional trade agreement provisions such as the relaxation and removal of tariffs and trade barriers, the agreement also targets the issue of environmental sustainability and good labour practices (European Commission. DG Trade, n.d.). A key component of the agreement is the elimination of customs duties for imports of goods originating in the EU and Canada. Both countries have agreed to fully eliminate tariffs on fisheries products. One factor that has inhibited the Canadian seafood sector's capacity to acquire market share in Europe in the past is the negative effect of tariffs. Canadian fish and seafood exports to the EU currently face tariffs of up to 25%. With the enactment of CETA, those tariff rates will change. When the agreement comes into force, almost 96% of EU fish and seafood tariff lines will be duty-free. Seven years after CETA comes into force, 100% of these tariff lines will be duty-free (European Commission. DG Trade, CETA – Summary of the final negotiating results, 2016).

Transatlantic Trade and Investment Partnership (TTIP)

The negotiation between the EU and US regarding the Transatlantic Trade and Investment Partnership (TTIP) were launched in 2013 and ended without conclusion at the end of 2016 (European Commission. DG Trade, 2019). A Council decision of 15 April 2019 states that the negotiating directives for the TTIP are obsolete and no longer relevant (European Council, 2019).

3.7.4 Common organisation of markets in aquaculture

REGULATION (EU) No 1379/2013 on the common organisation of the markets in fishery and aquaculture products, stipulates that Aquaculture producer organisations may also make use of the following measures: (a) promoting sustainable aquaculture activities, notably in terms of environmental protection, animal health and animal welfare; (b) collecting information on the marketed products, including economic information on first sales, and on production forecasts; (c) collecting environmental information; (d) planning the management of the aquaculture activities of their members; (e) supporting programmes for professionals to promote sustainable aquaculture products.

iFishIENCi contribution to Regulation (EU) No 1379/2013

- ⇒ Productive and environment-friendly coastal aquaculture production systems (WP1+WP3)
- ⇒ Sustainability and Circularity assessment of the freshwater and marine aquaculture value chains demonstrated in WP2 and WP3(WP4)
- ⇒ Prepare next generation fish farmers within the Blue Economy (WP6)

3.8 General Data Protection Regulation (GDPR)

The iFishIENCi data management policy is defined in detail in the Data Management Plan (DMP) published in deliverable D7.2. The DMP details how the data will be treated during the iFishIENCi project, detailing all the procedure for managing the iFishIENCi data collection, analysing and processing, preservation and sharing.

However, especially for the development linked with disruptive IoT/AI based innovations, considering the feeding value chain of aquaculture as a whole, and addressing four commercially-important species, with fish quality as focus it is necessary to respect the REGULATION (EU) 2016/679 OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL of 27 April 2016 on the protection of natural persons with regard to the processing of personal data and on the free movement of such data, and repealing Directive 95/46/EC (General Data Protection Regulation).

4 On-going activities related to Regulatory Framework and Requirements of the iFishIENCi project

4.1 GAP AND OPPORTUNITIES analysis for iFishIENCi

Gap and opportunities for iFishIENCi will be analysed along the project lifetime using the current inventory of regulatory framework as basis. The analysis of regulatory framework will be extended to further important aquaculture countries, already implementing responsible legislation in order to learn lessons from their experiences and include accordingly iFishIENCi 's recommendations in Policy briefs to be developed in WP6.

Possible opportunity for the project identified until now could be linked with the Knowledge on intestinal fish microbiota and host-microbial relationship, which increased remarkably in the last decade. However, understanding on how the environmental microbiome impacts on it and affects fish's health and disease is limited. Multiple parameters, including those implied in the maintenance of microbial ecology, will be studied in iFishIENCi. Together with the environmental and host microbiome data, these results will allow determining new relationship patterns, to improve fish health and welfare.

Further opportunities for iFishIENCi will be identified along the project lifetime.

4.2 STANDARDISATION and CERTIFICATION

It is widely accepted amongst the best practices cited that scientific evidence should be followed to formulate and monitor management and production practices in relation to environmental impact, sanitary and veterinary conditions and food safety. Determination of the carrying capacity of the environment, in particular in open marine farming, is the principal precondition to allocation of space and provision of licenses or permits. Several Member States (Austria, the Netherlands, Spain,) refer to specific certification schemes, which must ensure sustainability, quality and social responsibility (European Union, 2016). At present at least 30 certification schemes and key international agreements relevant to aquaculture certification, as well as initiatives were also identified as addressing sustainability issues and creating a framework for differentiating sources of aquatic products in this respect (FAO, n.d.).

4.2.1 Existing SUSTAINABILITY Certificates and Standards

Societal expectations for sustainable development, transparency and accountability have evolved with increasingly stringent legislation, growing pressures on the environment from pollution, inefficient use of resources, improper waste management, climate change, degradation of ecosystems and loss of biodiversity. This has led organizations to adopt a systematic approach to environmental management by implementing environmental management systems with the aim of contributing to the environmental pillar of sustainability (ISO, 2015).

4.2.1.1 *ISO Standards*

ISO 14001:2015 Environmental Management Systems (ERM)

The purpose of the ISO14001:2015 International Standard is to provide a framework to protect the environment and respond to changing environmental conditions in balance with socio-economic needs. It specifies requirements that enable an organization to achieve the intended outcomes it sets for its environmental management system. The ISO 14001:2015 Standard helps achieve the intended outcomes of its environmental management system, which provide value for the environment, the

organization itself and interested parties. Consistent with the organization's environmental policy, the intended outcomes of an environmental management system include: (1) enhancement of environmental performance; (2) fulfilment of compliance obligations; (3) achievement of environmental objectives (ISO, 2015).

The basis for the approach underlying an environmental management system is founded on the concept of Plan-Do-Check-Act (PDCA). The PDCA model provides an iterative process used by organizations to achieve continual improvement. It can be applied to an environmental management system and to each of its individual elements. It can be briefly described as follows.

- Plan: establish environmental objectives and processes necessary to deliver results in accordance with the organization's environmental policy.
- Do: implement the processes as planned.
- Check: monitor and measure processes against the environmental policy, including its commitments, environmental objectives and operating criteria, and report the results.
- Act: take actions to continually improve.

ISO 14040:2006 and 14044:2006 Life Cycle Assessment (LCA)

ISO 14040:2006 describes the principles and framework for life cycle assessment (LCA) including: definition of the goal and scope of the LCA, the life cycle inventory analysis (LCI) phase, the life cycle impact assessment (LCIA) phase, the life cycle interpretation phase, reporting and critical review of the LCA, limitations of the LCA, the relationship between the LCA phases, and conditions for use of value choices and optional elements. ISO 14040:2006 covers life cycle assessment (LCA) studies and life cycle inventory (LCI) studies. It does not describe the LCA technique in detail, nor does it specify methodologies for the individual phases of the LCA. The intended application of LCA or LCI results is considered during definition of the goal and scope, but the application itself is outside the scope of this International Standard. (ISO, 2006)

ISO 14044:2006 specifies requirements and provides guidelines for life cycle assessment (LCA) including: definition of the goal and scope of the LCA, the life cycle inventory analysis (LCI) phase, the life cycle impact assessment (LCIA) phase, the life cycle interpretation phase, reporting and critical review of the LCA, limitations of the LCA, relationship between the LCA phases, and conditions for use of value choices and optional elements. ISO 14044:2006 covers life cycle assessment (LCA) studies and life cycle inventory (LCI) studies (ISO, 2006).

ISO 14067:2018 Carbon Foot Print(CFP)

ISO 14067 specifies principles, requirements and guidelines for the quantification and reporting of the carbon footprint of a product (CFP), in a manner consistent with International Standards on life cycle assessment (LCA) (ISO 14040 and ISO 14044). Requirements and guidelines for the quantification of a partial CFP are also specified. This document addresses only a single impact category: climate change. Carbon offsetting and communication of CFP or partial CFP information are outside the scope of this document. This document does not assess any social or economic aspects or impacts, or any other environmental aspects and related impacts potentially arising from the life cycle of a product. (ISO, 2018)

4.2.1.2 Eco-Management and Audit Scheme (EMAS)

The EU Eco-Management and Audit Scheme (EMAS) is a voluntary environmental management instrument developed by the European Commission for companies and other organisations to evaluate, report, and improve their environmental performance. EMAS is open to every type of organisation eager to improve its environmental performance. It spans all economic and service sectors and is applicable worldwide (European Commission. DG Environment, n.d.).

Although EMAS is an official EU Regulation, it is binding only for organisations which voluntarily decide to implement the scheme. The EMAS Regulation includes the environmental management system requirements of the international standard for environmental management, ISO 14001, and additional requirements such as:

- stricter requirements for the measurement and evaluation of environmental performance against objectives and targets, and the continuous improvement of that environmental performance;
- compliance with environmental legislation ensured by government supervision;
- strong employee involvement;
- environmental core indicators creating multiannual comparability within and organisations' validated environmental statements which provide information to the general public; and
- registration by a public authority after verification by an accredited/licensed environmental verifier.



4.2.1.3 Aquaculture Stewardship Council (ASC)

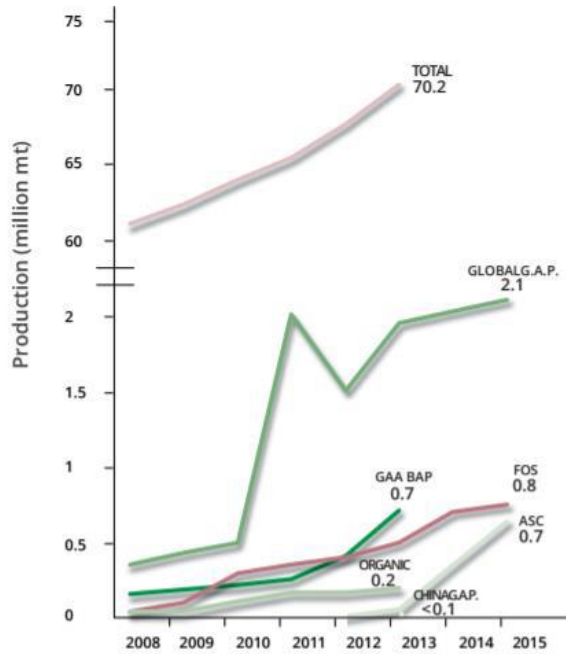
The Aquaculture Stewardship Council is an independent, international non-profit organisation founded in 2010 as an outcome of the Aquaculture Dialogues led by the WWF and Sustainable Trade Initiative (IDH). ASC standards set strict requirements for responsible farming, which encourage seafood producers to minimise the key environmental and social impacts of aquaculture. The current nine ASC farm-level standards cover 15 species groups: abalone, bivalves (clams, mussels, oyster, scallop), freshwater trout, pangasius, salmon, shrimp, tilapia, seriola and cobia, seabass, seabream and meagre. There is also a joint ASC-MSC standard for seaweed (Aquaculture Stewardship Council, 2019).

Since its inception, ASC adoption has been quick, primarily driven by large scale producers targeting the multiple-retail chains in developed countries, particularly Europe, partly due to the robustness of the scheme and the wide scope of issues addressed. While it is not clear whether a price premium is achieved, the volumes certified are expected to grow quickly in the near future, due to increasing retailers' demand of the certification as a part of their CSR strategies, on the one hand, and producer initiatives such as the Global Salmon Initiative (GSI) make commitments for full certification of its members, on the other. The majority of the ASC certified production comes from developing countries in Asia and South America. However, the producers are mostly large-scale enterprises, sometimes foreign owned (e.g. Marine Harvest Chile) targeting the export sector to developed countries. Europe is the largest market for ASC certified products.

4.2.1.4 GlobalG.A.P.



GlobalG.A.P. was established in 1997 under EUREPGAP led by major European retailers' organisation (EUREP), as a form of insurance that the products they were supplying complied with increasingly stringent food safety requirements (GLOBALG.A.P., n.d.). It was one of the leading certification in sustainable aquaculture certification in terms of volume in 2015, **Figure 1**.



Compound annual growth rates (2008–2015): ASC: 98 per cent; BAP: 35 per cent; FOS: 47 per cent; GLOBALG.A.P.: 29 per cent; Organic: 35 per cent; Total: 6 per cent. Sources: FAO Fishstat, 2015; ASC, BAP, ChinaG.A.P., FIBL, FOS, GLOBALG.A.P., MSC, Naturland, personal communication, 2015.

Figure 1 Certified aquaculture production growth, 2008-2015 (Potts, 2016)

The specific increase of some certifications schemes might be originated by promotional actions developed by these organizations or a variation of the certification price. This will be considered in the evaluation to be performed during the iFishIENCI project.

The certification is predominantly business-to-business, and until recently there was no consumer facing logo. Its rapid growth can be attributed to its stringency and wide scope covering sustainability as well as health and safety along the entire production chain, thus ticking multiple boxes in the retailers’ own strategies. Also, its close relationship with retailers, a relatively mature status, and expansion in the species groups certified have contributed to its growth. By 2015, 80% of the volumes certified were salmon, with the rest distributed between pangasius, shrimp/prawns, trout, sea bream and others. Norway, Chile and the UK covered more than 75% of the certified production.



In 2016 has been the launch of a consumer label (GGN) and an online portal containing information about the individual producers, in an effort to differentiate from other certificates by adding a layer of “personality” to the product, which seems increasingly important in globalised food supply: “We want an end consumer to be able to reconstruct how a trout grows up in Turkey and how it grows up in Norway. Or what traditional aquaculture in Thailand has in common with modern fish farming in England” (GLOBALG.A.P., n.d.).

4.2.1.5 Best Aquaculture Practices (BAP)



The BAP standards originate from the effort of the industry members of the Global Aquaculture Alliance (GAA), a trade organisation, primarily focusing on the US market. BAP has three species-specific standards farm-level (finfish and crustaceans, salmon, mussels) as well as other standards covering other links in the value chain (hatcheries, feed and processing). The certification encourages vertical integration,

and hazard analysis and critical control points along the value chain, which is reflected on the logo by a number of stars assigned.

At the farm-level there are only four species groups (salmon, tilapia, shrimp/prawns, pangaisus and catfish) over which the certification is concentrated, reflecting the corporate base behind the standard (Potts, 2016). Similarly, there is a concentrating the countries supplying BAP products, with nearly 70% of the volumes being produced in three countries (Chile, Canada and China) in 2015. BAP is the only major global certification supplying seafood from China and Canada, which points to potential first mover advantage in those countries (Potts, 2016).

However, its focus on the North American market can also be seen as a limitation to further growth, especially in the long term and in the context of the need for a global supply base and an increasingly intense competition with GlobalG.A.P., with whom significant overlap in countries like China and Chile exists.

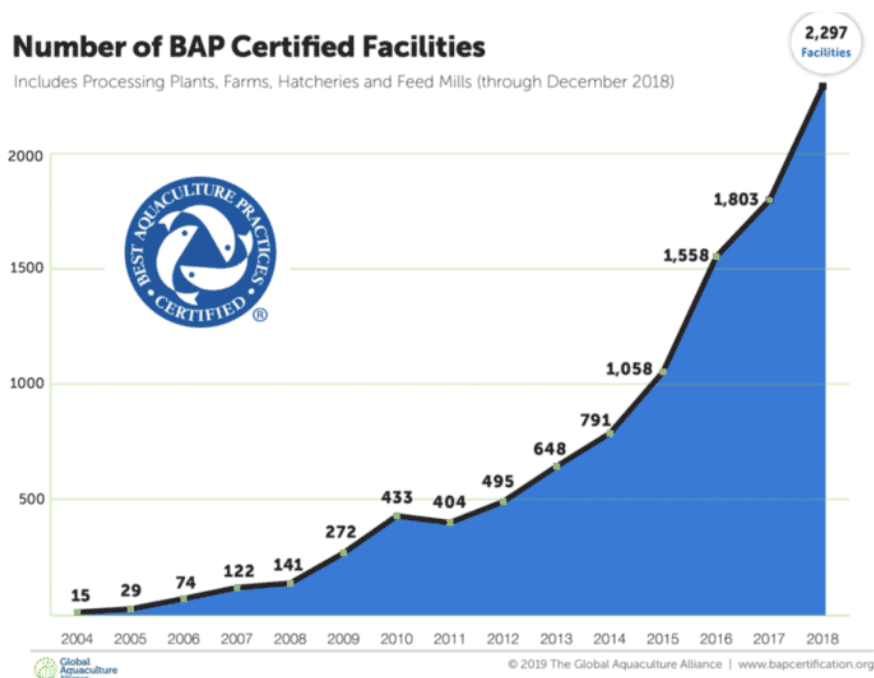


Figure 2 Number of BAP certified facilities, 2004-2018 (Global Aquaculture Alliance GAA, 2017)

4.2.1.6 Friends of the Sea (FOS)



While the origins of the certification can be traced to a single issue of dolphin protection in tuna fisheries, FOS is currently one of the most diversified seafood labelling schemes covering both capture fisheries and aquaculture. Since it was founded in 2008 FOS certified wild capture fisheries production has been growing at an average annual rate of 91% reaching 9.3 million tonnes in 2015, or 10.1% of the global landings (Potts, 2016).

Spanning both fisheries and aquaculture certification, FOS is in the unique position of controlling the distribution of inputs from fisheries to aquaculture feeds and has the potential for developing own internal market for certified marine ingredients. However, the volume of FOS certified aquaculture products in 2015 was disproportionately small, representing only 10% of the total FOS certified seafood, pointing to the need for significant expansion in the aquaculture sector in order to exploit effectively such synergies (Potts, 2016). The vast majority of aquaculture production certified by FOS is mussels and salmonids and unlike capture fisheries, is concentrated in developed countries,

particularly South Europe, where the main markets for its label are also located. Clearly a strategy for future growth and exploitation of synergies needs to incorporate a global demand for consumer-facing FOS certified products.

4.2.2 Existing QUALITY certificates

4.2.2.1 ISO Standards

ISO 9001:2015 (quality management)

ISO 9001:2008 specifies requirements for a quality management system where an organization needs to demonstrate its ability to consistently provide product that meets customer and applicable statutory and regulatory requirements, and aims to enhance customer satisfaction through the effective application of the system, including processes for continual improvement of the system and the assurance of conformity to customer and applicable statutory and regulatory requirements. All requirements of ISO 9001:2008 are generic and are intended to be applicable to all organizations, regardless of type, size and product provided.

ISO 22000:2018 (food safety)

ISO 22000:2005 specifies requirements for a food safety management system where an organization in the food chain needs to demonstrate its ability to control food safety hazards in order to ensure that food is safe at the time of human consumption. It is applicable to all organizations, regardless of size, which are involved in any aspect of the food chain and want to implement systems that consistently provide safe products. The means of meeting any requirements of ISO 22000:2005 can be accomplished through the use of internal and/or external resources.

ISO 22000:2005 specifies requirements to enable an organization

- to plan, implement, operate, maintain and update a food safety management system aimed at providing products that, according to their intended use, are safe for the consumer,
- to demonstrate compliance with applicable statutory and regulatory food safety requirements,
- to evaluate and assess customer requirements and demonstrate conformity with those mutually agreed customer requirements that relate to food safety, in order to enhance customer satisfaction,
- to effectively communicate food safety issues to their suppliers, customers and relevant interested parties in the food chain,
- to ensure that the organization conforms to its stated food safety policy,
- to demonstrate such conformity to relevant interested parties, and
- to seek certification or registration of its food safety management system by an external organization, or make a self-assessment or self-declaration of conformity to ISO 22000:2005.

4.2.2.2 BRC Global Standard for Food Safety

The Global Standard for Food Safety was developed by food industry experts from retailers, manufacturers and food service organisations to ensure it is rigorous and detailed, yet easy to understand. First published in 1998, the Food Safety Standard is now in its eighth issue and is well-established globally. It has evolved with input from many leading global specifiers. It provides a framework to manage product safety, integrity, legality and quality, and the operational controls for these criteria in the food and food ingredient manufacturing, processing and packing industry.

The Standard focuses on:

- encouraging development of product safety culture;

- expanding the requirements for environmental monitoring to reflect the increasing importance of this technique;
- encouraging sites to further develop systems for security and food defence;
- adding clarity to the requirements for high-risk, high-care and ambient high-care production risk zones;
- providing greater clarity for sites manufacturing pet food; and
- ensuring global applicability and bench-marking to the Global Food Safety Initiative (GFSI).

4.2.2.3 *International Featured Standards (IFS)*

IFS Standards are uniform food, product and service standards. They ensure that IFS-certified companies produce a product or provide a service that complies with customer specifications, while continually working on process improvements. IFS was founded in 2003 under the name International Food Standard. Since then the company, has expanded its range by six further standards and operates globally. All IFS-related information is published in five primary languages: German, English, Spanish, French and Italian. IFS aims to ensure comparability and transparency for the consumer throughout the entire supply chain, and to reduce costs for suppliers and retailers.

The IFS Standards currently comprise eight standards, which have been developed for and by the stakeholders involved in all parts of the supply chain. All standards are process standards which help users when implementing legal provisions regarding food and/or product safety, and provide uniform guidelines on food, -- product safety and quality issues. An IFS certification shows that the certified company has established processes which are suitable for ensuring food and/or product safety, and that it has considered and implemented customer specifications. Certification is open to food manufacturers, brokers, logistics providers, manufacturers of household and hygiene products as well as wholesalers and retailers.

4.2.3 Existing PRODUCTIVITY certificates

4.2.3.1 *Denomination of origin (Member States specific)*



Product names registered as PDO are those that have the strongest links to the place in which they are made (Food, agricultural products and wines). Every part of the production, processing and preparation process must take place in the specific region.

4.2.3.2 *Aquaculture Stewardship Council (ASC)*

See 4.2.1.3

4.2.3.3 *Best Aquaculture Practices (BAP)*

See 4.2.1.5

4.2.3.4 *Friends of the Sea (FOS)*

See 4.2.1.6.

4.2.4 Existing SOCIAL RESPONSIBILITY certificates

4.2.4.1 *ISO 26000:2010 (Social Responsibility)*

ISO 26000:2010 provides guidance rather than requirements, so it cannot be certified to unlike some other well-known ISO standards. Instead, it helps clarify what social responsibility is, helps businesses

and organizations translate principles into effective actions and shares best practices relating to social responsibility, globally. It is aimed at all types of organizations regardless of their activity, size or location. The standard was launched in 2010 following five years of negotiations between many different stakeholders across the world. Representatives from government, NGOs, industry, consumer groups and labour organizations around the world were involved in its development, which means it represents an international consensus.

4.2.4.2 Fairtrade



FAIRTRADE
INTERNATIONAL

Fair trade is an alternative approach to conventional trade based on a partnership between producers and traders, businesses and consumers. The international Fairtrade system - made up of Fairtrade International and its member organizations - represents the world's largest and most recognized fair trade system (Fairtrade Labelling Organizations International, 2019).

4.2.4.3 Fair for Life

Fair For Life programme, a Certification standard for Fair Trade and responsible supply-chains, was developed in 2006 by the Swiss Bio-Foundation in cooperation with the IMO Group. Since then, the Fair For Life programme has undergone regular revisions (2010, 2013) and has changed ownership and now belongs to the ECOCERT Group. So far only around 1.000 products are certified with the Fair



For Life label worldwide (ECOCERT SA, n.d.).

4.2.4.4 SA 8000

SA8000 is an auditable certification standard that encourages organizations to develop, maintain, and apply socially acceptable practices in the workplace. It was developed in 1989 by Social Accountability International, formerly the Council on Economic Priorities, by an advisory board consisting of trade unions, NGOs, civil society organizations and companies. The SA8000's criteria were developed from various industry and corporate codes to create a common standard for social welfare compliance.

4.2.5 Existing ORGANIC Standards

Regarding different standards, it is important to consider specific organic standards, or at least the most important ones that impact on seafood trading, production and import to major markets. These standards impact on how aquaculture is certified as organic and thus impact on the marketability of organic fish.

4.2.5.1 Soil Association Certification (UK)



The Soil Association Certification is UK's leading organic certifier offering a huge range of organic and sustainable certification schemes across food, farming, catering, health and beauty, textiles and forestry. The Soil Association standards put the principles of organic production into practice. These organic standards encompass EU Regulations 834/2007, 889/2008 and 1235/2008 (referenced throughout as the EU Organic Regulation). The Soil Association has higher organic standards than required by the EU Organic Regulation in key areas: delivering the highest levels of animal welfare, protecting human and animal health, safeguarding the environment and protecting the interests of organic consumers.

Businesses across the world can become certified to the Soil Association standards. A 'competent authority' is authorised by EU Member States to make rulings on organic legislation. In the UK the competent authority is usually Defra or one of its devolved agencies who have delegated some

controls to accredited organic certification bodies. The certification body that is appointed by the Soil Association to inspect and certify to Soil Association organic standards in the UK is Soil Association Certification (Soil Association, 2019).

4.2.5.2 *Naturland Standards (Germany)*



Naturland is one of the major international associations for organic agriculture worldwide. Naturland was created by farmers and processors in the 1980s to convert tea gardens in Sri Lanka and India to organic agriculture. Currently 65,000 farmers, beekeepers, fish farmers and fishers in 58 countries throughout the world manage an area of some 440,000 hectares according to the Naturland standards. To Naturland, organic agriculture means combining tradition with modern practices and experience with the courage to adopt new approaches. Naturland transferred the organic principle to the production of fish and seafood in aquaculture. The Naturland standards for organic aquaculture cover the farming of fish and crustaceans, mussel cultivation, the cultivation and collection of marine macroalgae and the cultivation of microalgae (Naturland, 2018).

4.2.5.3 *Debio Certification (Norway)*



The private organisation, Debio has been appointed as the only organic inspection and certification body in Norway by the competent authority, the Norwegian National Food Authority. Debio certifies for the use of Debio's seal for organic products, "Ø-merket", and for the use of the combination of "Ø-merket / Demeter" for bio-dynamic products. The organisation, active since 1986, has as members producers, distributors, traders and consumers (Debio, n.d.).

4.2.6 Existing Initiatives: Global Salmon Initiative (GSI)

Launched in August 2013, the GSI is a pre-competitive industry commitment toward greater transparency and cooperation for continuous improvement in the environmental and social performance of salmonid aquaculture around the world. Following a meeting of 6 Norwegian, Scottish and Chilean farmed salmon CEOs in 2012 the GSI was framed around a perceived need, and opportunity for greater dialogue, cooperation in an increasingly consolidated sector; 'to reach the global potential of the salmon [farming] industry'. More specifically, the GSI aims to secure greater social license and market acceptability by demonstrating industry sustainability leadership. This is achieved through regular disclosure of performance metrics against a suite of environmental and social indicators ('increased transparency'), along with positive messaging around the health-benefits of eating salmon and the [superior] performance of salmon farming on a range of selected indicators (e.g. yield, feed, protein and energy conversion ratios) compared to animal protein substitutes.

Now with 14 members, with operations covering 8 countries – Australia, Canada, Chile, Faroe Islands, Ireland, New Zealand, Norway, and the United Kingdom the group represents approximately 50% of the global farmed salmon sector.

4.2.7 Methodology for Assessment of Limitations, constraints and opportunities in terms of current use and potential of voluntary market-based labelling & certification schemes and their interaction with mandatory certification schemes

The assessment of current use and potential of voluntary market-based labelling & certification schemes as well as their interaction with mandatory certification schemes will be performed in the frame of Task 4.1 and presented in deliverables D4.13 and D4.14.

Stakeholder from industry and environmental organisation, among others, will be invited to participate to dedicated focus groups. Question related to labelling & certification schemes (voluntary and mandatory) will be included in the questionnaires to be discussed qualitatively. A subsequent quantitative evaluation might complete the assessment.

4.3 Role of informal institutions

4.3.1 Mapping: who are the relevant informal institutions?

A mapping of existing informal institutions such as Lobby group for algae or single cell proteins, national monitoring of animal well-being, etc... will be implemented in the coming months along work in WP6, identifying aquaculture operators, farmers and suppliers.

4.3.2 Methodology for definition of the role of informal institutions

Along the identification of the informal institutions, their role will be defined. The methodology therefore still needs to be designed.

5 Conclusion

In order to create new feed materials fulfilling organic standards, as described in the description of action of the iFishIENCi project, it is necessary to respect the principles on which organic standards are based. Organic is a 'whole system' approach to farming and food production. It recognises the close interrelationships between all parts of the production system from the aquatic environment to the consumer (Soil Association, 2019).

Organic production is based on following principles (Council of the European Union, 2007):

1. Appropriate design and management of biological processes based on ecological systems.
2. Using living organisms and mechanical production methods.
3. Using natural resources internal to the system.
4. Sustainable exploitation of fisheries.
5. Using preventative and precautionary measures and risk assessment when appropriate.
6. The design and management of organic systems which makes the best use of natural resources and ecology to prevent the need for external inputs.
7. Where this fails or where external inputs are required, the use of external inputs is limited to organic or natural or naturally-derived substances.
8. To limit the use of chemically synthesised inputs to situations where appropriate alternative management practices do not exist, or natural or organic inputs are not available, or where alternative inputs would contribute to unacceptable environmental impacts.
9. The exclusion of genetically modified organisms (GMOs) and products produced from or by GMOs with the exception of veterinary medicinal products.
10. The respect of regional, environmental, climatic and geographic differences and appropriate practices that have evolved in response to them.

Organic aquaculture systems are based on (Council of the European Union, 2007):

1. The continuing health of the aquatic environment and the quality of surrounding aquatic and terrestrial ecosystems
2. Feeding of aquatic organisms with feed from sustainable exploitation of fisheries as defined by Art 3 Regulation 2371/2002 Conservation and sustainable exploitation of fisheries resources under Common Fisheries Policy, or
3. With organic feed made of agricultural ingredients from organic farming and natural non-agricultural substances.

And the Feeding priorities for all species are defined as (Council of the European Union, 2007) (Commission of the European Communities, 2008):

- To feed aquaculture animals with feed that meets the animals' nutritional requirements at the various stages of their development
- To design feeding regimes to prioritise:
 - 1) animal health
 - 2) the production of high quality aquaculture products including nutritional composition
 - 3) low environmental impact.

How can iFishENCI fulfill the organic standard?

iFishENCI does not only need to ascertain compliance with organic feed criteria set in various existing standards, but also also to qualify new sustainable feeds and feed ingredients and organic sources through biological assessments on the fish and environment.

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