# Recommendation on Aquaculture Values

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## Context

In 2018, the EU-28 ranked 6th in the top 15 fisheries-producing countries in the world, with a total production of 6.6 million tonnes[1]. This position is mainly based on the catches of the commercial fishing sector, where the EU-28 has the same ranking, with a total of 5.3 million tonnes, which represented 5.48% of the global capture. Regarding aquaculture production, the EU-28 reported a total of 1.3 million tonnes, which represented 1.15% of the global aquaculture production[2]. The EU-28 imported 9.4 tonnes of fisheries and aquaculture products from third countries in 2018 and exported 2.2 million tonnes, reaching an apparent consumption of 12.5 million tonnes/year, out of which 3.2 million tonnes came from aquaculture. The data for 2018 show that the EU-28 imported 2.1 million tonnes of aquaculture products and exported 0.21 million tonnes. These figures reveal that only 1.1 million tonnes of EU-28 aquaculture production are consumed by EU consumers, which represents 34.25% of the apparent consumption of aquaculture products.

In the last 25 years, the volume of aquaculture production (live weight) increased globally at an average growth rate of 5.9% per year, while in the EU-28, the growth rate was a discrete 0.61% per year[3]. The causes of this modest growth were addressed several times in EU official documents, such as *Strategic Guidelines for the sustainable development of EU aquaculture (2013)*[4], which was revised recently with a structured and consistent set of recommendations in *Strategic guidelines for a more sustainable and competitive EU aquaculture for the period 2021 to 2030 (2021)*[5].

Sustainable aquaculture has also been identified as an important contributor to facilitating the transition to a sustainable food system with a low environmental footprint and short supply chains. The recently published Communication from the Commission to the European Parliament, the Council, the European Economic and Social Committee and the Committee of the Regions on a new approach for a sustainable blue economy in the EU, ***Transforming the EU's Blue Economy for a Sustainable Future*** (2021)[6] acknowledges that: "*EU aquaculture meets high standards in terms of product quality and animal health, but there is still margin for improvement in terms of diversification, competitiveness and environmental performance. Low-impact aquaculture (such as low-trophic, multi-trophic and organic aquaculture), and environmental services from aquaculture can, if further developed, greatly contribute to the European Green Deal, to the farm-to-fork strategy and to a sustainable blue economy*."

It is worth mentioning that aquaculture is extremely diverse in terms of species, environment requirements, technologies, specific infrastructure and location. In contrast to other animal husbandry branches, which are focused on only one species each, global aquaculture relies on 466 individual species and other 156 species groups at the genus, family or higher taxonomic level, including interspecific finfish hybrids.

This complexity must be addressed more often when debates and statements linked to aquaculture are involved, either positively or negatively. It is also noteworthy that some of the values of

[1] The EU fish market – 2020 Edition, European Market Observatory for Fisheries and Aquaculture Products (EUMOFA). Luxembourg: Publications Office of the European Union, 2020. pp 107

[2] FAO. 2020. The State of World Fisheries and Aquaculture 2020. Sustainability in action. Rome. https://doi.org/10.4060/ca9229en. pp. 224

[3] FAO. 2020. The State of World Fisheries and Aquaculture 2020. Sustainability in action. Rome. https://doi.org/10.4060/ca9229en pp. 224

[4] https://eur-lex.europa.eu/legal-content/EN/TXT/HTML/?uri=CELEX:52013DC0229&from=EN

[5] https://eur-lex.europa.eu/legal-content/EN/TXT/HTML/?uri=CELEX:52021DC0236&from=EN

[6] https://eur-lex.europa.eu/legal-content/EN/TXT/HTML/?uri=CELEX:52021DC0240&from=EN

aquaculture changed during the long history of the sector, others resisted or were confirmed by scientific research and new values are explored and debated.

This recommendation does not intend to offer an exhaustive list of values associated with EU aquaculture, but rather reflects the engagement of aquaculture farmers and other groups from society concerning several issues related to aquaculture activity.

## Values common to all EU aquaculture

Among the values identified for aquaculture, some surpassed the centuries and are intrinsic to almost all aquaculture activities. Aquaculture was developed as a social necessity to provide a constant supply of fresh aquatic food in seasons and regions where capture fisheries failed to deliver it, thus fulfilling one of the most important roles for society: the provision of healthy fresh food mainly for the local or regional market. The expansion of aquaculture in Europe is strongly linked to traditional cultural practices, which were more or less specific to one or another part of the continent.

Having an aquaculture pond was and still is an important achievement not only for local self-esteem but also for the economy and the social infrastructure at the local and regional levels by creating jobs in rural areas and all along the value chain. The EU's register of the names of agricultural products and foodstuffs, wine, aromatised wine products and spirit drinks that are registered and protected across the EU includes 51 registered geographical indications for fresh fish, molluscs, crustaceans and products derived therefrom but does not specify whether the product comes from aquaculture or from capture fisheries. According to the most recent economic report on EU aquaculture[7], in 2018, there were 12389 enterprises dealing with aquaculture, with a total of 74634 employees or 39931 FTE, which indicates that there were 6 employees per enterprise or 3.22FTE/enterprise. In total, 48% of the aquaculture enterprises belong to the freshwater sector, 47% to the shellfish sector, and only 4% operate in the marine sector. The shellfish sector employs over half of the employees in the sector, covering 53% of the employment. Moreover, freshwater finfish production employs 35% and marine finfish production 13% of the persons employed in EU aquaculture. These data reflect that aquaculture is overwhelmingly performed by small and medium enterprises (SMEs) of local and regional importance.

Technological practices were developed through empirical research and by building up knowledge throughout generations, which later, in modern times, evolved into institutional research and development practices. Aquaculture is definitely a part of nature and is in a strong correlation with all natural cycles, with famers being the first to see changes in water quality, in fish ethology, in climatic evolutions, in biodiversity status and other aspects. The ecosystem services provided by aquaculture were described in a previously released AAC recommendation.

Some of these values were gradually enforced by the EU and national legislation tackling biodiversity protection, water quality aspects, animal health and welfare issues, fight against pathogens, the control of alien and locally absent species used in aquaculture, control of veterinary medicines and on medicated feed and other regulations that make EU aquaculture safer and more acceptable for consumers.

[7] Scientific, Technical and Economic Committee for Fisheries (STECF) – The EU Aquaculture Sector – Economic report 2020 (STECF-20-12). EUR 28359 EN, Publications Office of the European Union, Luxembourg, 2021, ISBN 978-92-76-36192-3, doi:10.2760/441510, JRC124931

In its latest report on Blue Economy, the European Commission acknowledges the high-quality standards of aquatic food produced in the EU: "Aquaculture can be a source of sustainable food and has the potential to further become a large source of low-impact food. The sector already complies with the highest quality, safety and health standards. By improving its environmental performance, European aquaculture can solidly contribute to the EGD and the F2F."[8]

From this perspective, even if the assertion that EU aqua farmed products have a high quality standard is accurate, we should remember that the EU consumer gets two thirds of the aquaculture products from developing nations and that 75% of all aquatic food consumed by the EU is imported.

## Aquaculture values and sustainability

As a consequence of its complexity, aquaculture displays a wide range of values, and there is no species, system, type or region that delivers all of the values at their best, as there is always room for improvement for each specific case. As aquaculture targets sustainable development and sustainability is based upon at least three main pillars: ecosystemic viability, economic robustness and socio-cultural consonance, some aquacultures show different degrees of meeting one or more of these criteria.

Ecosystemic viability shows the capacity of a system to integrate its techniques and technological framework, such that it does not affect the natural functions of the environment, taking advantage of them and improving imbalances generated by other activities or even by aquaculture itself. We should mention here the major role some forms of aquaculture, such as the extractive or integrated aquacultures—shellfish, algae, pond aquaculture or integrated multitrophic aquaculture—have in recycling excess external or internal nutrients. Several scientific papers have substantiated this observation. For example, 50–60 tonnes of mussels per hectare in a eutrophic Danish fjord per year could extract 0.6–0.9 tonnes of N and 0.03–0.05 tonnes of P per hectare[9]; for ponds that yield up to 2000 kg ha-1 of carp, every hectare of pond retains on average 5.71 kg P and 78.5 kg $N_{mineral}$ per year the P-retention, increasing with the production intensity[10]; and bouchot mussel production has low eutrophication and other climate impacts in comparison with other food productions[11]. Algae production also plays an important role in mitigating nutrient accumulation transforming nutrients in food, feed and biofuel, and its contribution has also been identified in the sustainable blue economy: "The production of algae in the sea can aid in removing excess carbon nitrogen and phosphorus from wastewater, thus combatting eutrophication."[12]

The ecosystemic viability of aquaculture is also linked to the important role that some forms of aquaculture play in biodiversity conservation by providing semi-natural habitats for nesting, nutritive

[8] European Commission (2021). The EU Blue Economy Report. 2021. Publications Office of the European Union. Luxembourg

[9] Petersen, J.K., Hasler, B., Timmermann, K., Nielsen, P., Tørring, D.B., Larsen, M.M. & Holmer, M. (2014) Mussels as a tool for mitigation of nutrients in the marine environment. Marine Pollution Bulletin 82 (1-2): 137–143.

[10] Knosche R., Schreckenbach K., Pfeifer M., Weissenbach H. (2000). Balances of phosphorus and nitrogen in carp. Fisheries Management and Ecology 7(1-2): 15-22

[11] Aubin, J.; Fontaine, C.; Callier, M.; Roque d'Orbcastel, E. Blue mussel (Mytilus edulis) bouchot culture in Mont-St Michel Bay: Potential mitigation effects on climate change and eutrophication. Int. J. Life Cycle Assess.2018,23, 1030–104

[12] Communication from the commission to the European Parliament, the Council, the European Economic and Social Committee and the Committee of the Regions on a new approach for a sustainable blue economy in the EU Transforming the EU's Blue Economy for a Sustainable Future COM/2021/240 final

requirements or resting during migrations, as well as in terms of in-situ or ex-situ conservative practices.

Animal welfare is also an important value because, during the whole life cycle of the aquatic farmed product, it considers securing the physical and physiological needs of animals in terms of nutrients, pathogens impact prevention, effective and adequate treatment, stress mitigation induced by the environmental pressures (pollutants, oxygen depletion, predators, etc.) or by human management practices (harvesting, transportation, slaughtering). Welfare also requires meeting the ethological needs of animals/fish, enabling them to perform naturally motivated behaviours. Good physical and natural welfare, in turn, can lead to good mental welfare.

From the environmental perspective, although aquaculture has one of the lowest environmental footprints in the food production system, we should take a closer look at the impact of aquaculture on the environment, performing life cycle assessment to identify spots where improvement is needed and evaluate the impact of environmental conditions, such as the presence of predators and water quality status, on aquaculture.

Economic robustness is a prerequisite for every business, especially for nature-based activities, such as aquaculture. From this perspective, extensive and semi-intensive aquaculture represents one of the most resource-effective ways of producing animal and vegetal protein. Intensive aquaculture is also effective in delivering good financial returns and makes efficient use of natural resources. Moreover, to mitigate its impact on the environment, intensive aquaculture has developed integrative approaches, such as combined intensive-extensive systems[13] or integrated multi-trophic aquaculture, alongside effective emissions abatement techniques.

There is a wide variability in the degrees of economic performance within aquaculture practices, species, systems and regions, even if all of them have an equal role in providing high quality protein. However, this high-quality protein comes with increasing costs for abiding to the regulatory requirements, which very often, in a consumer-oriented market based mainly on the price, generates competitiveness issues[14]. Moreover, aquacultures that show higher degrees of ecosystemic viability have lower economical robustness and financial performance, which should be addressed accordingly to maintain their operation. As aquaculture development has been, in the last decades, encompassed by ecosystem-based management and because aquaculture is a resource-based activity, which competes for economic, social, physical and ecological resources with other industries, its development, in the absence of a fair allocation and designation of the sustainable aquaculture development areas (SADA), could be obscured. Hence, to ensure the economic robustness of aquaculture, physical, production, ecological and social carrying capacities should be assessed.

Socio-cultural consonance identifies the role of aquaculture in the societal matrix, especially in freshwater, estuarine and marine rural/coastal areas, in terms of securing jobs and achieving social well-being in those regions. However, unlike other economic activities, similar to like other agricultural activities, aquaculture depends on land and water and on the weather and natural conditions. Due to indivisibility, lack of mobility and limited productivity, aquaculture sites, as well as agricultural land, remain uncompetitive with respect to labour and capital. The average wage per FTE for the EU aquaculture sector in 2018 was about €25 700 per year, with a wide variability among MS much lower than the non-agricultural activities, which puts additional pressure on the workforce's

[13] Varadi, L., (2017). Rearing of carp in Combined Intensive Extensive CIE systems: Practical results and experiences, In: Proceeding of the 4th International Carp Conference. 21-22 September 2017. Zagreb. Croatia

[14] AAC Recommendation: Achieve greater sustainability standards of imported aquaculture products and a level playing field (to be updated)

tendency to migrate to better paid activities. Abandoning this kind of activity, as observed several times throughout history, would have a detrimental effect not only on the economic status of the local communities but also on the whole society, as the main types of aquaculture have positive contributions to natural mechanisms.

## Addressing societal concerns about aquaculture

The public perception of aquaculture is, of course, influenced by insufficient knowledge about aquaculture and about the continuous efforts made by farmers to raise their consciousness and knowledge about the needs of aquatic farmed animals. The complexity of aquaculture and the low level of aquaculture literacy of the general public sometimes induce confusion in the public perception regarding the performances of the sector and its values. Examples are present quite often in the media and in public speaking. These concerns include, but are not limited to, information that none or all aquaculture types have a huge impact on the environment, use high amounts of medicine and chemicals, have serious welfare issues or are climate friendly, reduce pressure on wild fish stocks, or are more or less safe and nutritious than the capture fisheries. As always, and moreover, in aquaculture, the reality has lots of nuances and there is no perfect producing system, but among the farmers there is a constant concern in continuously improving the technologies based on constant cooperation and support of the research and development structures.

This modest literacy in aquaculture should be addressed both by farmers through professional or producers' organisations and by public European, national or regional authorities responsible for aquaculture development by promoting higher transparency of activities, better consumers' information, education in aquaculture practices, tailor-made regulations and so on.

Different views on aquaculture and its practices might occur between stakeholders, but it remains important to inform public opinion and consumers based on sound scientific facts and in a balanced way.

## Conclusions

All food systems have environmental costs, which differ based on protein type, system, environment and species, and should be performed at an optimal level of exploitation and acceptable to all users. The level of acceptability is constantly changing and should be based on scientific, economic, social and cultural insights of the aquaculture types.

Evidence of the positive impact of farmed aquatic foods on human health and on ecosystem services provided is prevalent in the scientific literature, mainly regarding the marine environment, but it is not reaching enough decision makers, marginalising the role that aquatic food should play in national food security and nutrition policies. Good aquaculture practice guides are an important tool in emphasising the effort made by farmers to comply with legal restrictions and strengthen the importance of their activity for society and the values they share.

As the competition for water areas and volumes is increasing, sustainable aquaculture should be of higher importance in the allocation of water resources (freshwater, transitional or marine waters). Water bodies used by aquaculture should be of fair quality and protected against pollution and nutrient overloading, as some farming types and species, mainly those that also use environmental

nutrients, have the ability to transform nutrients into high-quality proteins, but this ability is not limitless.

Raising production standards must continue, but too ambitious and fast changes in a price-driven market could make the sector less competitive for the average consumer. For example, organic production will reduce the quantity of fish produced and increase prices, which is exactly the opposite of the sector's aim of increasing production and maintaining prices. The NGOs dedicated to animal welfare argue that there are still far too many aspects of aquaculture production that are not aligned with their standards, especially concerning animal welfare, and consider that the necessary improvements are not a luxury. The aquaculture sector and NGOs should, together with other parties, such as researchers, develop standards for farmed aquatic animals and marketing plans to offer fish farmers who raise their production standards an economic perspective.

Research and development projects should also explore freshwater aquaculture, which is underrepresented in fisheries and aquaculture priority lists.[15]

One essential objective in making the consumers, the stakeholders, and the regulators understand the aquaculture sector is to increase the level of aquaculture literacy and transparency and improve the communication strategy about our activity.

## Recommendations

a. The AAC requests more consistent support for aquaculture research activities based on farmers' needs to answer both the market demand and societal concerns.

b. The AAC proposes including the values of the different types of aquaculture in the promotional campaigns carried out by public authorities.

c. The AAC stresses the need to encourage continuous improvement of farming procedures to increase its social acceptability.

d. The AAC encourages the raising of consumers' awareness for a greater understanding of aquaculture and about the efforts carried out by aquaculture farmers to pursue its sustainable development.

[15] SCAR-Fish (2020) Evaluation of the freshwater aquaculture research needs in Europe. Edited by P. Lengyel.


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