



AAC Recommendation on the Concerning Impact of Climate Change on EU Mussel Production

AAC 2025-16

October 2025



The Aquaculture Advisory Council (AAC) kindly thanks the EU for its financial support





Recommendation on the Concerning Impact of Climate Change on EU Mussel Production

Index

| | |
|---------------------------|----|
| Index | 2 |
| I. Background | 3 |
| II. Justification | 3 |
| III. Recommendations..... | 8 |
| IV. Bibliography | 10 |

This recommendation aims to alert the European Commission to the severity of climate change impacts on the mussel farming sector, in order to identify the technical, regulatory, administrative, and financial levers essential for its sustainability.

I. Background

Since the 1950s, global mussel production has steadily increased, reaching 2.1 million tonnes with an estimated value of USD 4.5 billion in 2020 (Food and Agriculture Organization of the United Nations [FAO], 2025). Although the European Union (EU) accounts for 20% of global mussel production, both in volume and in value, its mussel farming sector has experienced a continuous decline since the 1990s, dropping from 600,000 tonnes to around 400,000 tonnes in 2020, with an estimated value of EUR 369 million (DCF data¹) (Advelas et al., 2021; Scientific, Technical and Economic Committee for Fisheries [STECF], 2023). This decline has contributed to the stagnation of European aquaculture production, as mussel farming represents one-third of the total volumes produced (Guillen et al., 2019). The main producing countries remain Spain, Italy, France, and the Netherlands, focusing primarily on the farming of two species: the blue mussel (*Mytilus edulis*) and the Mediterranean mussel (*Mytilus galloprovincialis*) (STECF, 2023).

Between 2019 and 2020, EU mussel production declined by 8% in volume and 6% in value. This decrease was largely driven by a 10% drop in Spanish production, which led to an 11% fall in revenue (STECF, 2023). Other producing countries, including the Netherlands, France, and Italy, have also experienced significant production declines in recent years, warranting attention from European institutions.

This recommendation therefore aims to highlight recent episodes of production losses and their probable causes, with particular attention to the impacts of climate change on mussel farming. It also seeks to identify the technical, regulatory, administrative, and financial measures essential for ensuring the long-term sustainability of this strategic sector within European aquaculture.

II. Justification

The decline in mussel production in the EU results from a combination of interrelated factors. Scientific research highlights several direct causes, including the spread of diseases, harmful algal blooms, seed shortages, predation, and low profitability in a sector largely composed of small, family-owned mussel farms employing fewer than ten people (Advelas et al., 2021). These challenges are compounded by local conditions, such as structural and organizational characteristics of enterprises (Villasante et al., 2013; Theodorou and Tzovenis, 2017), and by the limited adoption of zootechnical innovations (Labarta and Fernandez Reiriz, 2019), the carrying capacity of ecosystems (Villasante, 2009), and the growing effects of climate change (Álvarez-Salgado et al., 2009; Rodrigues et al., 2015; Outeiro et al., 2018). However, most

¹ Data Collection Framework, implemented within the framework of the European Union's Common Fisheries Policy

analyses converge in emphasizing that the main drivers behind the decline of EU mussel production are primarily environmental, rather than economic, in nature (Advelas et al., 2021). Despite variations across production areas and countries, the outcome remains the same: reduced yields and increasing economic challenges for mussel farming enterprises across Europe.

A. Climate Change: A Threat to Shellfish Farming in Europe

Climate change affects all ecosystems, including coastal marine environments, and therefore directly impacts shellfish farming in all its forms. It alters key environmental parameters and triggers chain reactions that profoundly disrupt ecological balance. Among its main effects are rising ocean and sea temperatures, an increase in extreme weather events, sea level rise, ocean acidification, and changes in precipitation patterns that influence salinity, as well as the concentration and quality of nutrients necessary for phytoplankton development (Philippart et al., 2011). Climate change is now considered a major threat to aquaculture in several European countries, including Spain, Italy, France, Greece, Germany, Slovenia, and Portugal (Advelas et al., 2021).

Two recommendations published by the Aquaculture Advisory Council describe in more detail the effects of climate change on aquaculture:

- Recommendation on the Risk of Emerging Bivalve Mollusc Pathogens in Relation to Climate Change (2022)²
- Recommendation on the Adaptation of Aquaculture to Climate Change and Its Mitigation (2023)³

In addition, the recent recommendation drafted by the Aquaculture Advisory Council on blue crab emergency in Italy⁴, discusses the effects of climate change on marine biodiversity, particularly with the proliferation of invasive alien species that are having a significant impact on shellfish farming.

B. Current Status of Mussel Farming Sectors in the Main Producing Countries of the EU

Spain

Spain is the leading mussel producer in the EU, with an annual production of around 250,000 tonnes (Ministerio de agricultura, pesca y alimentación, 2024). The main producing region is Galicia (Xunta de Galicia, 2024), located in the northwest of the country. More than 95% of Spanish mussel production takes place on rafts in the Galician rías, where the sector plays a major socio-economic role and forms the basis of a significant processing and valorisation industry for this shellfish.

² [AAC Recommendation on the risks of bivalve mollusc pathogen emergence in connection with climate change – aac-europe](#)

³ [AAC Recommendations for Climate Change Adaptation and Mitigation in Aquaculture – aac-europe](#)

⁴ [AAC Recommendation on Blue Crab Emergency in Italy – aac-europe](#)

A favourable marine environment and nutrient-rich cold waters, sustained by coastal upwelling, have enabled the development of mussel farming in Galicia for over 80 years. Galician mussels are recognized as high-quality products and benefit from a Protected Designation of Origin (PDO) label.

The years 2023 and 2024 have been particularly challenging for the mussel sector in Galicia and for the companies throughout its value chain. An abnormal environmental situation, which began in 2023 with a marked reduction in coastal upwelling (and thus reduced food availability for mussels) combined with exceptionally high water temperatures, persisted into 2024. Mussels were exposed to highly unfavourable conditions that led to a lack of growth, low meat content, weakened condition resulting in detachment from farming structures, and increased mortality.⁵ These combined effects caused historically low production levels in 2023 and 2024, amounting to 178,065 and 178,813 tonnes, respectively.

Environmental changes observed at sea in recent years have been diverse and, at times, concerning. For instance, in 2013, anemone blooms were detected in certain areas of the Ría de Arousa, causing significant mussel detachment (Barbarro et al., 2018). A few years later, an invasion of juvenile starfish resulted in intense predation on mussel seed in rafts located in the southernmost rías.⁶

In the Spanish Mediterranean, where mussel production is much more limited, producers have long faced mass summer mortalities due to extremely high-water temperatures. To adapt to these conditions, professionals have advanced their harvesting schedules and sought deeper farming areas with improved water renewal and lower temperatures.

Overall, the Spanish mussel sector has expressed deep concern over rising water temperatures, changing coastal upwelling patterns, and other abnormal environmental phenomena affecting production. Studies are needed to help farmers better manage their operations by providing them with more information and forecasts on expected environmental conditions for each production season. In addition, financial support is required to cope with catastrophic situations such as those recently experienced.

Italy

In Italy, the main mussel farming areas are located in the northern and central Adriatic Sea, along the Tyrrhenian coast between Rome and Naples, and in the Ionian Sea (Taranto), where mussels are traditionally grown on longlines. Between 2014 and 2021, Italian mussel production fluctuated between 50,000 and 63,000 tonnes; these variations were largely due to increasingly frequent losses and mortalities occurring at the end of summer. Ongoing

⁵ <https://theconversation.com/pequenos-mejillones-grandes-retos-237888>
https://www.madrimasd.org/blogs/ciencia_marina/2024/12/12/138964

⁶ https://www.cuatro.com/cuatroaldia/plaga-estrellas-mar-pontevedra-ria_18_2796420219.html
https://www.lavozdeg Galicia.es/noticia/somosmar/2019/07/20/plaga-estrellas-mar-devasta-bancos-marisqueros-bateas-ria/0003_201907P20C3991.htm

scientific research attributes most of these losses to the weakening of byssal threads, which are essential for mussel attachment (De Marco, 2025). Until 2023, mortalities, although present, remained limited and were not linked to the presence of pathogens.

At the end of summer 2024, however, the sector experienced exceptionally high mortality rates, resulting in the loss of 75–100% of farmed mussels. As the 2024 marketable products had already been sold, this event mainly affected intermediate-sized mussels that would normally have reached commercial size in 2025. This episode resulted from a combination of winter 2023–2024 temperatures 2–4 °C above the seasonal average and an exceptionally hot, windless summer that lasted three weeks, pushing water temperatures above the lethal threshold of 30–31 °C. The absence of water column stratification made it impossible to submerge mussels below the thermocline, where temperatures typically remain cooler. Following this crisis, seed recruitment during winter 2024–2025 and survival during summer 2025 proceeded normally in the northern and central Adriatic regions. Unless new extreme events occur, production in 2026 is expected to return to normal levels in line with the past. In contrast, recruitment in the southern Adriatic was much lower than expected and insufficient to allow production to restart. Consequently, the farms located further south, which were hardest hit by mortalities and faced below-average recruitment, now face a serious risk of closure. As a result of these mortalities, Italian mussel production is expected to be 53,000 tonnes in 2023 (Eurostat data) and 32,000 tonnes in 2024 (estimate), compared with 60,550 tonnes in 2022.

Overall, Italian mussel farming is increasingly concerned about the growing frequency of extreme summer heat events, which dangerously approach the species' tolerance threshold and lead to a gradual shrinking of the areas suitable for farming. Even when summer heat waves do not exceed this threshold, losses are rising due to mussel detachment and fall-off caused by weakened byssal threads. This trend is exacerbated by the impoverishment of Adriatic waters, likely linked to the combined effects of decreased average precipitation, shorter but more intense rainfall events, and reduced nitrogen and phosphate inputs from freshwater inflows – also consequences of the Nitrates Directive, the Water Framework Directive, and the Marine Strategy Framework Directive.

Financial support under the European Maritime, Fisheries and Aquaculture Fund (EMAF) will be mobilized to compensate for 'income losses in 2025'.⁷ However, due to administrative delays, this aid, which is conditional on at least a 30% drop in 2025 operating results compared with the average of previous years and calculated on this basis, will only be disbursed between late 2026 and early 2027. Therefore, it is clear that this support, which is no longer accessible in the event of business closure, does not provide an immediate response to the difficulties encountered. This mechanism is effective for occasional difficulties, but it is not suited to cases of recurrent problems such as those linked to climate change. Indeed, a company can withstand one or two years of reduced or even absent income while awaiting compensation after 2.5 years but cannot endure longer. Furthermore, the calculation method

⁷ Avviso attuazione obiettivo specifico 2.1, azione 7, intervento codice 221707, "Sostegno alle imprese di acquacoltura" – Art. 27 of EU Regulation No. 2021/1139.

gradually reduces the reference average with each year of missing income, mathematically decreasing the amount of aid to be provided.

This situation highlights the lack of appropriately designed European-level financial instruments to support companies during repeated emergency events, even though climate change inherently implies recurrent crises. This regulatory gap became particularly evident during the blue crab crisis, which led to the permanent closure of approximately 750 out of 2,500 businesses within two years.

France

In France, mussel production extends along almost the entire coastline. It is mainly based on the common blue mussel, cultivated on the English Channel and Atlantic coasts, while the Mediterranean mussel occupies a more limited area along the Mediterranean coast. Farming techniques vary by region and include bouchots, longlines, and ropes. Since 2014, production has been continuously declining: it reached 70,000 tonnes in 2014, compared to only 50,000 tonnes in 2023 (FAO, 2025).

This decline began in 2014 with a severe mortality event (90–100%), primarily concentrated in Charente-Maritime and Vendée. The exact causes remain difficult to identify, but the presence of bacteria of the genus *Vibrio* has been noted. Since 2018, a new bacterial agent, *Francisella haliotcida*, has been detected during abnormal mussel mortalities in Normandy and northern Brittany. Associated with other factors, such as the physiological conditions of mussels, biotic and abiotic conditions, and the presence of pathogenic or opportunistic bacteria and various parasites, it is now considered a 'high-risk factor'.

At the same time, professionals have observed environmental changes that directly affect production. Reduced summer rainfall decreases freshwater inflow and, consequently, nutrient availability in the environment, thus limiting phytoplankton development, which is essential for mussel growth. Farmers also report weakening of the byssus, of unknown causes, which favours mussel detachment and results in direct losses for businesses. These phenomena have been reported across several production areas, including Normandy, northern and southern Brittany, Pays de la Loire, and Charente-Maritime, as well as by shellfish gatherers exploiting natural mussel beds.

The Thau Lagoon is also particularly vulnerable to the effects of climate change due to its location and climatic conditions. The shellfish local sector has been severely affected by several summer anoxia events (2006, 2018, and 2025), caused by high temperatures combined with a lack of water mixing by wind, resulting in stock losses of up to 100%.

To better analyse the risk factors associated with these mortalities and their indirect effects, the PANDA project, led by Ifremer, aims to centralize all data collected by French mussel observatories. This approach could be extended to the European level, provided there is genuine data sharing.

In addition to these challenges, natural predation – by starfish, boring snails, seabirds, gilthead seabream, and other species – also negatively affects production. Since 2016, a significant proliferation of spider crabs has caused considerable damage to bouchot farms in Normandy and Brittany, sometimes leading to the total destruction of farming concessions. Although this phenomenon is not directly linked to climate change, it is hypothesized that certain environmental changes favourable to this species have contributed to its proliferation. This issue is currently being studied under the SPIDER Programme (EMFAF, 2024-026), which investigates changes in the ecology and biology of spider crabs in the Norman and Breton gulfs.

Finally, French mussel farming faces the same structural challenges as the Italian sector, particularly the lack of financial instruments capable of providing timely and effective support in response to increasingly frequent and severe crises.

Ireland

The Irish longline mussel industry has experienced a slowdown in growth and a deterioration in mussel condition over the past two years, with mortality events reported in certain stocks located in the southwest of the country.

In 2024, IFA Aquaculture conducted a self-assessment survey on longline mussel production in the southwest (Kenmare, Bantry, Dunmanus, and Roaringwater Bays). The results revealed that the total harvest had fallen by nearly 40% over the entire harvest season (from autumn 2023 to the end of spring 2024) compared to the 2021–2023 seasons, representing an estimated loss of over EUR 5 million. Longline mussel production declined from 13,000 tonnes in 2022 to 9,500 tonnes in 2024, a 25% decrease over two years. The causes of this decline in production remain unknown.

Furthermore, difficulties in spat recruitment have been reported. To better understand the underlying factors, the Irish Seafood Development Agency (BIM) launched, in March 2025, a mussel larvae monitoring project running through December 2025. The project focuses on larval abundance, mussel condition indices, and water temperature variations in six southwest bays. The results, still ongoing, can be consulted at: [Southwest Mussel Larvae Monitoring Project](#).

III. Recommendations

The European mussel farming sector is currently facing a critical period marked by a structural decline in production and growing vulnerability to environmental pressures exacerbated by climate change. Mass mortality events, physiological weakening of shellfish, recurrent environmental disturbances, and the emergence of new pathogens pose direct threats to the sustainability of the industry, particularly for small-scale enterprises with limited economic resilience.

In light of these challenges, it is imperative that the European Commission recognizes the urgency of the situation and mobilizes appropriate technical, regulatory, administrative, and financial levers to support innovation, strengthen business resilience, and anticipate future crises. Preserving mussel farming means safeguarding a strategic sector that contributes fundamentally to the blue economy, European food security, and the social and ecological balance of coastal territories.

AAC recommendations:

To the European Commission

- 1. Adapt European financial instruments:**
 - a. Create a climate emergency fund for shellfish businesses, providing immediate support in the event of mass mortality or sudden production drops.
 - b. Revise the functioning of EMFAF to offer faster and better-adapted compensation for recurrent crises.
 - c. Simplify and harmonize administrative procedures across Member States to accelerate crisis response.
- 2. Strengthen research, monitoring, and innovation:**
 - a. Support the creation of a European mussel mortality observatory, centralizing biological, health, and environmental data.
 - b. Encourage the development of predictive models to anticipate crises (extreme temperatures, anoxia, predation, etc.).
 - c. Promote zootechnical applied research (farming in deeper waters, adaptation of farming techniques, diversification of cultures) to foster innovation and farm resilience.
 - d. Strengthen cooperation between producers, scientists, and authorities through European consultation platforms.
- 3. Co-develop with Member States a plan to safeguard and expand current aquaculture areas,** incorporating potential relocations of aquaculture activities in response to climate change impacts.

To the EU Member States

1. Simplify administrative procedures and authorization processes for adaptations, whether on-site or offshore (buildings, basins, nets, purification, or thermal protection systems), to facilitate the adaptation of businesses to climate change impacts.
2. Ensure legal stability in the event of forced climate-driven relocation.

3. Develop and support more flexible research funding mechanisms, adapted to the administrative constraints of small and micro-enterprises in the sector, by promoting rapid local experiments led by professionals and their technical centres.

IV. Bibliography

- Álvarez-Salgado XM, Fernández-Reiriz MJ, Labarta U, Filguera R, Peteiro L, Figueiras FG, et al. (2009). Influencia do cambio climático no cultivo de mexillón das rías galegas. In: VP Muñozuri, M FernándezCañamero, JL Gómez Gesteira (coord.) *Evidencias do cambio climático en Galicia*, pp. 373–390. Xunta de Galicia, Consellería de Medio e Desenvolvemento Sostible, Spain.
- Avdelas L, Avdic-Mravljje E, Borger Marques AC, Cano S, Capelle JJ, Carvalho N, et al. (2021). The decline of mussel aquaculture in the European Union: Causes, economic impacts and opportunities. *Reviews in Aquaculture* 13: 91–118.
- Barbarro JMF, José MF, Padin XA, Filgueira R, El Morabet H, Longa A (2018). The impact of the sea anemone *Actinotohoe sphyrodeta* on *Mytilus galloprovincialis* mussel cultivation (Galicia, Spain). *Biofouling* 34(10): 1138–1149.
- Food and Agriculture Organization of the United Nations (FAO) (2025). *FAO Yearbook. Fishery and Aquaculture Statistics 2019/FAO annuaire and Global Aquaculture Production Quantity (1950-2022)*.FAO, Rome.
- Guillen J, Asche F, Carvalho N, Fernandez Polanco JM, Llorente I, Nielsen R, et al. (2019). Aquaculture subsidies in the European Union: Evolution, impact and future potential for growth. *Marine Policy* 104: 19–28.
- Labarta U, Fernandez Reiriz MJ (2019). The Galician mussel industry: Innovation and changes in the last forty years. *Ocean and Coastal Management* 167: 208–218.
- Ministerio de agricultura, pesca y alimentacion (2024). Produccion talla comercial (t) acuicultura marine año 2024. [Producción de acuicultura](#)
- Outeiro L, Villasante S, Sumaila RU (2018). Estimating fishers’ net income in small-scale fisheries: Minimum wage or average wage? *Ocean and Coastal Management* 165: 307–318.
- Philippart CJ, Anadón R, Danovaro R, Dippner JW, Drinkwater KF, Hawkins SJ, et al. (2011). Impacts of climate change on European marine ecosystems: Observations, expectations and indicators. *Journal of Experimental Marine Biology and Ecology* 400: 52–69.
- Rodrigues LC, van den Bergh JCJM, Massa F, Theodorou JA, Ziveri P, Gazeau F (2015). Sensitivity of Mediterranean bivalve mollusc aquaculture to climate change and ocean acidification: results from a producers’ survey. *Journal Shellfish Research* 34: 1161–1176.



Recommendation on the Concerning Impact of Climate Change on EU Mussel Production

- Scientific, Technical and Economic Committee for Fisheries (STECF) (2023). Economic Report on the EU aquaculture (STECF-22-17). Nielsen R, Virtanen J, Guillen J (editors). Publications Office of the European Union, Luxembourg. doi: 10.2760/51391, JRC132648.
- Theodorou JA, Tzovenis I (2017). Managing the risks of the Greek crisis in aquaculture: A SWOT analysis of the Mediterranean mussel farming in Greece. *Agricultural Economics Review* 18: 18–26.
- Villasante S (2009). Magnitude implicaciones de la Política Pesquera Comunitaria: aplicación de indicadores de sostenibilidad sobre el metabolismo de los ecosistemas marinos. PhD Thesis, University of Santiago de Compostela, Spain, 645 pp.
- Villasante S, Rodríguez-González D, Antelo A, Rivero-Rodríguez S, Lebranon-Nieto J (2013). Why are prices in wild catch and aquaculture industries so different? *Ambio* 42: 937–950.
- Xunta de Galicia (2024). Acuicultura mariña 2024. [Publicacións Acuicultura mariña // Pesca de Galicia - Plataforma tecnolóxica da pesca](#)



Aquaculture Advisory Council (AAC)

Rue Montoyer 31, 1000 Bruxelles, Belgium

Tel: +32 (0) 2 720 00 73

E-mail: secretariat@aac-europe.org

LinkedIn: <https://www.linkedin.com/company/aquaculture-advisory-council/>
www.aac-europe.org