

Strengthening policy action to tackle social acceptability issues in European aquaculture

José Antonio Pérez Agúndez^{1,*}, Ramón Filgueira^{2,3}, Nesar Ahmed⁴, Furqan Asif⁵,
Suzannah-Lynn Billing⁶, Lucia Fanning², Amber Himes-Cornell⁷, Teresa R. Johnson⁸,
Gesche Krause⁹, Cornelia Kreiss¹⁰, Eirik Mikkelsen¹¹, Selina Marguerite Stead^{12,13},
Sander van den Burg¹⁴, Yari Vecchio¹⁵, Sebastian Villasante¹⁶

¹Ifremer, Univ Brest, CNRS, IRD, UMR 6308, AMURE, Unité d'Economie Maritime, IUEM, F-29280 Plouzané, France

²Marine Affairs Program, Dalhousie University, Halifax B3H 4R2 Nova Scotia, Canada

³Institute of Marine Research, Bergen, Nordnes 5005, Norway

⁴Policy and Economics, Fisheries and Oceans Canada, Ontario and Prairie Region, 501 University Crescent, Winnipeg, Manitoba R3T 2N6, Canada

⁵Centre for Blue Governance, Aalborg University, Rendsburggade 14, 9000 Aalborg, Denmark

⁶Scottish Association for Marine Science, Oban, PA37 1QA, UK

⁷Food and Agriculture Organization of the United Nations, viale delle Terme di Caracalla, 00153 Rome, Italy

⁸School of Marine Sciences, University of Maine, 360 Aubert Hall University of Maine Orono, ME 04469-5706, USA

⁹Science and Society, Alfred Wegener Institute Helmholtz Center for Polar and Marine Research, Am Handelshafen 12, 27570 Bremerhaven, Germany

¹⁰Thuenen Institute of Fisheries Ecology, Herwigstr. 31, 27572 Bremerhaven, Germany

¹¹Nofima, Muninbakken 9-13, Stakkevollan Postboks 6122, 9291 Tromsø, Norway

¹²Australian Institute of Marine Science, PMB 3, Townsville MC, Townsville, QLD 4810, Australia

¹³AIMS@JCU, Division of Research and Innovation, James Cook University, Townsville, QLD 4811, Australia

¹⁴Wageningen Economic Research, Wageningen University & Research, Droevendaalsesteeg 5, 6708 PB Wageningen, The Netherlands

¹⁵Department of Veterinary Medical Science, Alma Mater Studiorum University of Bologna, Via Zamboni, 33 - 40126 Bologna, Italy

¹⁶Oportunus Research Professor, CRETUS-EqualSEa Lab, University of Santiago de Compostela, Rua Constantino s/n, 15782 Santiago de Compostela, Spain

*Corresponding author. Biological Resources and Environment Department of Ifremer, 1625 Rte de Sainte-Anne, 29280 Plouzané, France. E-mail: jose.perez@ifremer.fr

Abstract

Despite the rapid development of aquaculture worldwide, production has stagnated in Europe and North America, notwithstanding the public policies that support the sector. This stagnation may stem from the insufficient integration of social dimensions into aquaculture governance, often characterized by top-down policies and technology-driven approaches. While environmental, economic and social factors significantly influence the social acceptability of aquaculture, environmental impacts, such as habitat degradation and the spread of disease, have historically dominated regulatory frameworks. Today, low social acceptability appears to be the major obstacle to the sector's growth, highlighting shortcomings in terms of stakeholder engagement, transparency and fairness in the distribution of the benefits generated by the sector. This paper reflects the collective insights from the ICES Working Group on Social and Economic Dimensions of Aquaculture, emphasizing that challenges to social acceptability of aquaculture are widespread but context-dependent and remain insufficiently addressed in public policies related to aquaculture development. This paper recommends broadening governance beyond environmental concerns to include social and economic dimensions from the outset, strengthening public participation in decision-making processes and adopting holistic, socially informed marine spatial planning. In addition, it highlights the importance of recognizing the role of informal governance mechanisms and the production of meaningful social data as essential aspects to foster community acceptance and the sustainable development of aquaculture. Adapting aquaculture policies to local contexts through inclusive and adaptive governance is therefore essential to the sustainable growth of the sector.

Keywords: social acceptability; aquaculture governance; stakeholder participation; sustainable development

Setting the scene

The aquaculture sector represents a rapidly growing food production system in countries like China, Indonesia, India, and Vietnam, among other countries. At the same time, a stagnation in production volume, partially accompanied by a decrease in the number of farms and employees, is occurring in regions such as the European Union (EU) and North America (EUROSTAT, FAO 2024, Guillen et al. 2025). This stagnation

has remained despite the political will to develop the sector and the allocation of funds to boost production to ensure food security, produce nutritious seafood (Golden et al. 2021), and drive economic development (Guillen et al. 2019, European Court of Auditors 2023). In most cases, initiatives to support the sector in these regions mostly follow a top-down approach or are focused on innovation from a technology-driven perspective (Joffre et al. 2017, Vecchio et al. 2023). However,

for the sustainable aquaculture sector to realize its full potential, participatory governance should integrate both top-down (i.e. political will leading to aquaculture development) and bottom-up (i.e. improving social license to operate that supports development) processes (Krause *et al.* 2015, Stead 2019, Masi *et al.* 2025).

The principal barriers to aquaculture development globally have spanned environmental, economic, social, cultural and regulatory concerns. Historically, environmental considerations have been the major bottleneck for expansion and the main driver of aquaculture regulations in the Global North (Bostock *et al.* 2010, Troell *et al.* 2014). While access to capital and technology can be a bottleneck in the Global South and in the Mediterranean area (Mitra *et al.* 2019), this is less of a barrier in developed countries due to private capital and public mechanisms (Young *et al.* 2019). Recently, industry, academia, and public administrations in the EU and North America have recognized that low social acceptability acts a central stumbling block that hinders aquaculture development (COFASP 2017). Behind this lie other shortcomings, including the lack of consideration of social issues in governance by regulators and companies (Krause *et al.* 2015), and poor inclusion of stakeholders in management processes (Young *et al.* 2019, Cavallo *et al.* 2023, Haugen and Olaussen 2025).

Key concepts such as social license to operate (Mather and Fanning 2019) and social corporate responsibility (Wartick and Cochran 1985, Armstrong and Green 2013) have emerged in the private sector and have been considered critical components for the industry to thrive. These concepts can be grouped under the overarching umbrella of social acceptability. Within the literature, there are many different definitions of social acceptability (Batellier 2015). As proposed by Caron-Malenfant and Conraud (2009), social acceptability is a social process that leads to the acceptance or the rejection of a public or private decision. This definition incorporates dynamic social interactions and the question of governance of collective goods and resources. From a societal lens, sustaining and promoting aquaculture requires a social contract that couples social responsibility with economic incentives framed within an environmental context in policy-making. This approach would enhance the understanding of the co-benefits that can arise from a growing sustainable aquaculture sector. While the identification of major drivers of social acceptability is important, it is also crucial to include social aspects in strategic planning documents and policies guiding aquaculture development and management. However, the degree to which social aspects have been considered in planning and policies varies across jurisdictions and contextual societal settings (Naylor *et al.* 2023, Jolly *et al.* 2023, Lam and Pauly 2010).

The aim of this paper is to capture the breadth of debates yet to be resolved if sustainable aquaculture is to realize its full potential in some European countries. We summarize the perspectives of countries striving to understand the barriers to developing sustainable aquaculture at a rate that meets the goals and ambitions of countries recognizing the co-benefits of a blue economy that includes mariculture. Drawing from these perspectives and expert knowledge, we propose a series of recommendations to raise awareness of the significant role of social acceptability in advancing sustainable mariculture development.

Although this paper focuses on Europe, similar concerns about the social licence to operate (SLO) in aquaculture are ev-

ident worldwide. In New Zealand, public opposition to finfish aquaculture highlights the importance of strong, trust-based relationships between companies and stakeholders (Sinner *et al.* 2020). In Australia, perceptions of benefit distribution, historical legacies, and stakeholder credibility drive opposition to salmon farming (Alexander 2022), and calls for long-term confidence-building strategies (Condie *et al.* 2022, 2023). In Canada, socio-demographic traits, personal values, and perceptions of risk management shape attitudes, with ecosystem and cultural values playing a key role (Weitzman *et al.* 2022). In Japan, the social acceptability of aquaculture is studied in light of reduced consumer acceptance of aquaculture products vis-a-vis fishery products (Onozaka *et al.* 2010, Uchida *et al.* 2014). In the USA, public trust in policymakers and the aquaculture industry and the incorporation of public input into decision-making has been found to influence social license (Guthrie *et al.* 2024). In all cases, consideration of the deeply contextual nature of social acceptability is key.

Contrasting perspectives

The narrative put forward in this paper is based on collective insights from an international group of experts working on the social and economic dimensions of aquaculture (WGSEDA) of the International Council for the Exploration of the Seas (ICES). The knowledge and experience of each country represented in this group regarding the bottlenecks to aquaculture development were shared. This has made it possible to highlight the diversity of situations, as well as common points that reflect patterns in literature addressing issues of social acceptability in aquaculture.

These collective insights are based on situations observed at the national level (Ireland, France, Spain, Italy, Greece, Portugal, Norway, Germany, the Netherlands, Denmark, and Malta), but also include some regional contexts (Andalusia and Galicia in Spain, Scotland and England in the UK, as well as regions and counties in Norway). These insights cover varied aspects that need to be emphasized, such as scales (regional/national), species involved, production systems, and multiple issues related to social acceptability. All of these involve the production of commonly farmed fish species, such as salmon, sea bass, and sea bream, or bivalves, such as mussels, clams, and cockles. The respective production systems range from cages and rafts to land-based juvenile production and sea ranching. While local contexts play a key role in understanding social acceptability within each jurisdiction, this global analysis focuses on general trends rather than exceptions.

The acceptance or rejection of private and public decisions regarding aquaculture development is influenced by a complex plethora of environmental, economic, and social factors. Consequently, the key issues surrounding social acceptability are synthesized and analyzed through the lens of these factors (Fig. 1). Observed realities are compared with the political responses to these issues, aiming to identify potential gaps in public interventions and their effectiveness in addressing them. The social dimension and governance are considered together in this document, as the social dimension is a cross-cutting factor encompassing human, social, political, cultural, and decision-making aspects. It is important to highlight that the members of this ICES Working Group reside and work in a variety of countries including many not listed above. Thus, this international, collective knowledge, gathered and applied

Stakes and Issues	Policy Responses and Actions	Gaps in policy strategies and areas for improvement
Significant governance challenges with spatial conflicts and stakeholder opposition impacting policy implementation	Regional aquaculture benefit distribution, promote the involvement of local stakeholders, engaging NGOs	Enhancement of (meaningful) stakeholder engagement, expanding social acceptability measures, clarity in benefit distribution
Unfair share of benefits between area-based stakeholders	Promoting the development of integrated management practices (including certification)	Insufficient integrated policy action (main focus on technical marine spatial planning) and quantitative objectives
Social exclusion, justice around access to marine space	Enhancing transparency across production chain, consistent product labelling	Implementation of social-ecological monitoring for aquaculture's environmental and community impacts
Local governance conflicts and weak political will have isolated aquaculture, hindering its integration into broader blue economy initiatives	Building trust and improving aquaculture's image through communication, education, and awareness	Enhancement of coordination between environmental, economic, and social factors
Competition for workforce from other activities, profitability of businesses, low salaries, unstable market demand, decline in demand	Providing risk-sharing instruments for producer organisations such as mutual funds	Improvement of public image by providing transparent information and strengthening animal welfare measures
High pollution risk and ecosystem loss concerns, alongside social opposition due to environmental impacts	Improvement of marine spatial planning that accounts for the different sub-sectors of aquaculture	Enhance consumer information and use third-party certification to ensure best practices and strengthen the social acceptability of aquaculture
Low to moderate environmental issues, but pressures exist from resource competition	Environmental impact mitigation, integrated monitoring of key statistics	Design aquaculture policies suited to national contexts, considering value chain needs and trade dynamics for both imports and exports
Bivalve aquaculture sometimes seen as a beneficial solution but it also faces issues of spatial access	Emphasis on bivalve aquaculture as environmentally beneficial	Lack of ex-ante evaluation studies on financial instruments for aquaculture
		Strong focus on consumers and communication, with limited attention to social issues like space conflicts, local concerns, and benefit sharing

Figure 1. Summary of factors important for social acceptability—divided into stakes and issues, responses and actions, gaps in policy strategies and areas for improvement. Responses and actions that (could) provide improvements to stakes and issues are indicated. Note: Due to the heterogeneity of the information available, the distribution of the figures' contents is intended to be practical and illustrative, as some of the results relate to cross-cutting issues.

here, enriches the context for understanding the key trends highlighted.

Stakes and issues

The diversity of negative impacts on ecosystems that can be induced by aquaculture activities are often put forward as factors of social opposition to the sector. These impacts vary depending on the farmed species (Weitzman et al. 2019), but in general, the most prominent ones are related to the modification of landscapes, the degradation of water quality (Murray and D'Anna 2015), the alteration of habitat (Holmer 2010), the introduction of non-native species (Honkanen and Olsen 2009), and the spread of diseases and pathogens (Krkošek 2017).

Economic factors affecting social acceptability can derive from insufficient real or perceived economic returns for locals (Eriksen and Mikkelsen 2024) or from competition for access to marine space (Sanchez-Jerez et al. 2016). At a national scale, strategic aquaculture plans address the necessity to ensure the profitability of the sector; however, moderate social opposition to aquaculture, especially from activities related to traditional (local/community) practices, can be observed where economic benefits may not fully meet local expectations. In general, it is important to balance the sector's efficiency and performance objectives with the guarantee of maintaining (and potentially improving) economic returns for locals (Åm 2021). Competition for labour or public funds with other sectors, such as fisheries and new/expansion license applications in aquaculture, can be drivers of negative social

acceptability among stakeholders with interests in different marine-related activities (Knapp and Rubino 2016).

Social factors affecting aquaculture acceptability vary across different contexts, with common challenges including negative perceptions about visual impacts and the distribution of benefits and costs, including area-conflicts with other coastal activities and stakeholders (citizens, tourism sector, fisheries recreational activities, locals, environmental NGOs) (Krause *et al.* 2015). Furthermore, being a novel line of production in developed countries' marine systems, the need for improved governance is apparent. Aquaculture in Norway, for example, has experienced criticism and demands for a fairer regional distribution of benefits, which has resulted in recent governance reforms and for which the impact on social acceptability is not yet clear (Olsen *et al.* 2023). Spatial conflicts of use or visual impacts on local residents can also generate problems, especially when considering the expansion of aquaculture in the context of specific projects that may be discussed in a given area. Here, identified gaps in managing such social impacts emphasize the need for targeted and integrative integrated policy and governance improvements.

Policy responses and actions

We have found that these ecological, economic, and social issues are addressed with a diverse array of strategies across European countries, with a distinction between proactive and reactive responses. Proactive responses focus on enhancing social acceptability, ensuring environmental and economic sustainability, and improving the industry's public image. In contrast, reactive responses address specific issues, such as improving regulations to mitigate environmental impacts or providing trustworthy information when the issue arises from misinformation, disinformation, or unrealistic expectations. Reactive responses also concern the management of conflicts between users, especially when applying for a new license or an extension of the sector. Once the conflict is established, it is difficult to resolve.

Proactive approaches center on promoting resilience and healthy communities while strengthening the sector through initiatives such as Blue Economy strategies. This reflects a broader trend in Northern Europe through the integration of factors affecting social acceptability into national policies with unsatisfactory results to date. This can be attributed to its primary focus on addressing environmental concerns and conflicts between wild and farmed species rather than proactively engaging with social concerns. Communication actions are often promoted, as well as certification and campaigns to educate consumers to increase the acceptance of aquaculture production and products. Combating the negative image of the sector by proactively addressing perceived misconceptions through communication actions is often prioritized.

Specific objectives in National Strategic Plans also aim to improve public perception of aquaculture production systems and their products. Private initiatives from industry can also play a key role in enhancing its image and engaging with local communities. Social acceptability and sustainability in aquaculture require a multifaceted approach. This includes adapted strategic planning, legal frameworks, public or private initiatives, and communication actions to promote social acceptability of aquaculture development. In sum, there is a plethora of proactive and reactive ap-

proaches to governance and management of the sector, initiatives and incentives that exist across Europe with a varying degree of "success" in endorsing the social dimensions of aquaculture.

Gaps in policy strategies and areas for improvement

There are still issues that need to be better addressed in order to fill policy gaps. Particular emphasis is placed on the need to improve governance on the basis of better stakeholder inclusion enabling spatial conflicts and stakeholder opposition to be managed. It is also necessary to take better account of the equitable distribution of benefits between stakeholders and the challenges of social exclusion and justice in access to marine resources. Governance shortcomings also include conflicts with local populations and the weak capacity to set up coherently integrated policy frameworks, moving away from a sectoral (sector by sector) logic. In addition, communication strategies are generally aimed at "forcing" social acceptability of the sector, rather than creating the conditions for this acceptability through more inclusive political action.

Sharing experiences on addressing the social dimensions of aquaculture by local or national institutions reveals several significant gaps and illustrates, for instance, the need to improve policy frameworks and the way of assessing social considerations (Krause *et al.* 2020). However, each country and region has its own contextual particularities that make a streamlined approach to tackling the social stake within aquaculture difficult. For instance, these issues are illustrated through the examples in Norway and Scotland where the main issue is the lack of specific actions to achieve well-intended strategic sustainability goals, highlighting the difficulty of moving from planning to meaningful implementation (Table 1).

These examples show certain shortcomings in the public policies governing aquaculture, resulting in social acceptability issues. The lack of transparency and confidence in governance is linked to their ineffectiveness in taking full account of social expectations, such as the redistributive effects of the income generated by aquaculture or the reduction of the environmental impact generated by intensive fish farming. The vision of sustainability set out in the sector's development plans is often limited in practice by mainly economic drivers, focusing on the sector's ability to generate income. Responses often aimed at communication operations are proving insufficient to reverse the general public's negative perception of the aquaculture sector.

Conclusions and recommendations

This paper highlighted key challenges associated with aquaculture development in different European countries, focusing on how they matter for social acceptability and are addressed in public governance. Progress is needed in terms of political action that acknowledges contextual local/regional settings, such as the creation of integrated policy frameworks, adaptation strategies to cope with climate change, the strengthening of action in support of markets, and the monitoring and enforcement of management rules. This collective insight reveals several gaps in the way social acceptability could be addressed by proactive policy responses. These gaps include limited community involvement in decision-making about access and use

Table 1. Specific examples of social acceptability issues.**Norway**

Salmon aquaculture is a significant industry in Norway, especially for rural employment and income, but also for national exports, income and tax income (Nyrud et al. 2024). Environmental issues also make it significant, particularly for its impact on wild salmon stocks (Taranger et al. 2015, Grefsrud et al. 2024). A national survey in 2020 revealed that a strong majority accepted the industry, but on the issue of further growth, equally large proportions of the respondents opposed and supported this (Olsen et al. 2024a). Attitudes and perceptions are most important for shaping individuals' social acceptance for the industry. In particular, perceptions of the industry's environmental sustainability, whether it acts according to societal expectations, if it is trustworthy, and whether there is a fair distribution of the benefits from the industry, are important factors (Eriksen and Mikkelsen 2024). The survey also showed that the Norwegian public in general have relatively high trust in Norwegian authorities, but for "regulating salmon aquaculture for the good of society," the level of trust is lower (Olsen et al. 2024b). This may indicate that the Norwegian public would like the authorities to do more to improve the sustainability of the industry. Norwegian authorities have introduced several new policy measures over the last ten years to improve the environmental performance of salmon farming and the regional and social distribution of economic benefits from the industry (e.g. Hersoug et al. 2021, Larsen and Vormedal 2021, Osmundsen et al. 2022, Misund et al. 2024). While redistribution of benefits has certainly taken place, the environmental situation for the wild salmon has not improved, rather the opposite, with wild Atlantic salmon now having become red-listed as "near threatened" in Norway (Artsdatabanken 2021). In 2024, the National parliament pressured the government to come up with an "environmental flexibility mechanism" to strongly incentivize the extended use of salmon farming production technologies with little or no impact on wild salmon.

Scotland

Salmon is the UK's largest food export and provides well-paid, non-seasonal jobs in rural and island areas (Scottish Government 2023). However, the acceptability of salmon farming is contested, mainly due to environmental, animal welfare, and ethical concerns (Billing 2018, Pascual and Schwabe 2024). As a result of petitions to Members of the Scottish Parliament to investigate the environmental impact of marine fish farms in 2016 and 2017 by the environmental NGO, Salmon and Trout Conservation Scotland, the Scottish Government's Rural Economy and Connectivity Committee conducted an inquiry into the environmental impacts of salmon farming in Scotland in 2018 (The Scottish Parliament 2018a). The inquiry included commissioning an independent scientific report on the impacts of salmon farming (Tett et al. 2018), and collecting/hearing evidence across a wide variety of stakeholders from interested individuals and environmental NGOs to salmon farming companies. The Committee concluded that the environmental impacts highlighted in the last governmental inquiry (16 years prior, in 2002) were unchanged and had expanded (The Scottish Parliament 2018b). Several work streams followed the 2018 inquiry, including an independent review of the regulatory processes of Scottish aquaculture. This review criticized the policy, planning, and regulatory frameworks across all aquaculture species as "complex... with no overall authority or joined up process." Further, it found the "degree of mistrust, dislike, and vitriol at both an institutional and personal level between the industry (mainly finfish), certain regulators, parts of the Scottish Government and other stakeholders is at a level that I have never seen before which makes the current working relationships within the sector challenging" (Griggs 2022). The review provided several recommendations with robust environmental data/monitoring at their centre, but also included the recommendation of a "social contract" within the consenting procedure that "recognises the community and its needs" (Griggs 2022). Since 2022, the Scottish Government has produced a "Vision for sustainable aquaculture" that centres aquaculture activities as necessary for rural and island communities' economic sustainability, but balances this with operating within environmental limits (Scottish Government 2023). In May 2024, the Scottish Parliament Rural Affairs and Islands Committee announced a follow-up inquiry into salmon farming, following record-breaking levels of mortality at farms in 2022 and 2023 (The Scottish Parliament 2024).

of marine space, insufficient transparency and communication on decision-making processes, little consideration of cultural and social dimensions that can be impacted by aquaculture development and equity, a narrow vision of aquaculture development focused on environmental issues and technological approaches, and a lack of adaptive management strategies.

Strategic frameworks or national strategic plans aim to integrate aquaculture into broader economic and environmental objectives. These plans are designed to ensure sustainable growth while addressing issues of governance and spatial management to balance aquaculture development with other coastal uses. The most common responses adopted by these frameworks to address these issues are articulated around two main pillars. The first concerns the perceived misconceptions of aquaculture and the role of communication in addressing them. The rejection of aquaculture is often perceived as the result of a misconception of the sector and its products by consumers, and more generally the general public. As a result, a major common response relies on improving public perception and trust through targeted communication strategies to improve the image of aquaculture. Labeling and certification to build trust in aquaculture products can also be among a set of concrete responses but is mainly addressed at the private (industry) level.

The second pillar concerns issues related to environmental sustainability and how regulations address them at different institutional levels of implementation (Mikkelsen et al. 2021). The main responses rely on environmental management and regulatory reforms to ensure that aquaculture practices are environmentally sustainable. This includes tackling issues such as pollution, habitat disturbance and the interaction between farmed and wild species, among others. Although many countries are striving to resolve social conflicts and improve social acceptance by involving local stakeholders in decision-making processes to align aquaculture development with local socio-economic contexts, in most cases, the main focus remains largely on environmental issues.

Environmental resource issues are complex because there is no single way to define or solve them. Individuals and stakeholder groups perceive the value of natural resources differently and are not all affected in the same way by policies, which can lead to conflicts (Lam 2021). One of the main challenges for aquaculture management is to consider that these conflicts arise from differences in values and identities (Weitzman et al. 2022). To mitigate them, both scientific and ethical approaches are necessary. Moreover, in some countries the need to implement economic regulations that ensure a fair distribution of aquaculture benefits is emphasized. Accordingly, these regulations should also in-

volve local stakeholders in decision-making processes. However, at the local level, governance can sometimes be inefficient due to a lack of infrastructure and resources needed to support inclusive and well-coordinated decision-making processes.

While public institutions can play a key role in improving the social acceptability of aquaculture, the adoption of private or hybrid initiatives through regulatory mechanisms is also important. In this sense, aquaculture eco-certifications such as Aquaculture Stewardship Council (ASC), Best Aquaculture Practices (BAP) and GLOBALG.A.P. reflect a shift from traditional state-led regulation toward market- and consumer-driven oversight. This model engages non-state actors and emphasizes trust and cooperation within the aquaculture sector. However, certification alone does not guarantee SLO as community mistrust and failure to address local issues, including conflict among users, can limit the effectiveness of such hybrid arrangements (Vince and Haward 2019, Rector *et al.* 2023). While certification enhances market access and promotes sustainability, it also challenges the role of governments in regulation (Vandergeest and Unno 2012). Collaboration with regulators strengthens both public trust and policy alignment. Thus, a hybrid governance approach offers both opportunities and limitations, stressing the need for inclusive, trustworthy, and transparent governance structures that can align with the main ingredients to enhance social acceptability of aquaculture operations.

Since the aim of this insight is to illustrate the gaps that still exist in the way social considerations are addressed in public policies relating to aquaculture, this analysis does not claim to be exhaustive. We argue, as acceptability is a social construct that is also linked to the socio-cultural and institutional characteristics of each local, regional or national context, there is no single model or framework that can be extrapolated to all situations, even if some countries may have commonalities in the way they approach these issues. For example, improving social acceptability is often approached largely from the angle of improving communication with consumers and citizens. However, there is still room for improvement in public management, notably in terms of better inclusion of stakeholders in decision-making to acknowledge the important role and interplay between identities, values and norms. Furthermore, the development of integrated regional and national strategies that address conflicts associated with the use of the coastal and marine spaces in an equitable manner needs to be advanced. It is therefore important to take a pragmatic approach in governance of aquaculture development to implement measures of an environmental, economic and social nature to promote sustainability that could be societally endorsed.

Main recommendations

Based on a common insight and the expertise of the WGSEDA team, it has been possible to formulate key recommendations to better deal with the challenges of social acceptability of aquaculture.

- (1) Expand the vision beyond environmental and technological focus

A cross-sectional analysis of the case studies highlights some common factors in the way institutional frameworks address issues of social acceptability of aquaculture. A common response is the emphasis on implementing environmental reg-

ulations to encourage sustainable practices and mitigate the impact of aquaculture on ecosystems. To achieve these objectives, financial support mechanisms are mobilized to encourage sustainable aquaculture development and market support. While these aspects are important, taking social dimensions into account is crucial to guard against the potential rejection of projects that may be technically coherent but fail to meet the aspirations of local communities (Krause *et al.* 2015). All sustainability dimensions of aquaculture must be considered from the outset of project development. Moreover, it is more difficult to re-establish social acceptance of a project once it has been rejected (Luhmann 2000). Achieving political will to support a sustainable mariculture sector vision demands a sustainable mariculture strategy that captures the social, economic and environmental considerations in a measured way so people can understand the trade-offs when considering the vision.

- (2) Promote public participation

Recent work on social acceptability based on aquaculture (Pérez Agúndez *et al.* 2024), renewable energy (Segreto *et al.* 2020, Susskind *et al.* 2022), forestry (Shindler and Toman 2003) and mining (Moffat and Zhang 2014) all highlight the need to involve local communities in the decision-making process to address concerns of distributive and procedural justice. Lack of participation and perceived injustices can lead to opposition, particularly in rural and disadvantaged areas. On the contrary, when local communities perceive new projects as fair and transparent, and offer local economic benefits, their acceptability increases (Katránidis *et al.* 2003, Kraly *et al.* 2022). This is especially valid for countries with a tradition in democratic decision-making processes, such as most European countries and North America. Improved social acceptability can be fostered by meaningfully involving local communities in decision-making processes, so as to guarantee transparency and legitimacy in the development and implementation of public policies. All stakeholders must be involved, including NGOs, industry and local people. The creation of advisory councils or public forums can facilitate active participation and thus address contextual societal concerns. In addition, developing comprehensive communication strategies to inform the broader affected public about the benefits, risks and practices of the aquaculture industry can also facilitate trust and counter perception bias. Indeed, recognizing and integrating cultural and social values into public policy, particularly in regions with strong cultural traditions, can strengthen public support for community values (Pomeroy *et al.* 2022).

- (3) Endorse a social-ecological systems perspective in Marine Spatial Planning

Marine Spatial Planning (MSP) is a process that organizes human activities in marine contexts to achieve ecological, economic, and social objectives; however, some works highlight several critiques regarding its practical application. One significant issue is that MSP often prioritizes sectoral interests, such as economic and geopolitical goals (de Vivero and Mateos 2012), over its intended holistic, ecosystem-based management approach. This has led to concerns that MSP may reinforce existing (more often than not negative) power dynamics rather than promote equitable participation across different stakeholder groups towards fostering long-term sustainability. Further, some works argue that MSP processes

have often been made under top-down perspectives, with limited practical stakeholder involvement in decision-making, hence contradicting the participatory ideals that MSP promotes (Jones et al. 2016). To date, MSP tends to focus on technical and natural science perspectives, neglecting social and political dimensions or underestimating the social complexity of its practical implementation at the local level (Flannery et al. 2020). Disregarding the social dimension within MSP can compromise its efficiency in addressing complex societal issues due to the disconnection between policy design and actual practice (Brugère et al. 2019). The way in which MSP is implemented needs to be reviewed, with the objectives and levers of action adapted to the local level so as to include the various concerns of local communities and thus integrate the reality and social complexity of coastal territories into the decision-making process. To overcome these bottlenecks, it is necessary to incorporate core global principles of good governance, such as accountability, transparency, stakeholder participation, efficiency and equity, into institutional multi-level decision-making (Kumar et al. 2013, Davies et al. 2019, Stead 2019, Engle and van Senten 2022).

(4) Acknowledge and support informal governance

Political will can be a major determinant of success in realizing any proposed vision of sustainable aquaculture (Stead 2019). Whilst more attention has been paid to formal aquaculture governance in recent years, there remain gaps in our understanding of the impact informal governance (e.g. agreed shared co-benefits from access to marine resources) has on the social acceptability of aquaculture. In practice, informal governance (unwritten rules) and soft law (written soft rules), while non-binding, can influence human behaviour more strongly than formal governance mechanisms regarding social acceptability. Decision-making at an individual and community level commonly reflects local values, norms and place-based rules that shape attitudes and actions toward the use of aquatic resources. When these actions build social capital, group behaviour can become powerful in determining locally agreed rules, for example, petitions to stop aquaculture or prevent new projects. The concept of social capital (Putnam 2015) as a catalyst for coordination and collaboration has been widely used to assess actors' capacities to act in environmental governance (e.g. Bodin and Crona 2008). Social capital can simply be described as social relations that collectively produce benefits greater than the sum of the parts. In coastal communities, especially those that are remote or isolated from the main population—which is where many aquaculture production sites are based—or are located far from those enforcing regulations, local social norms and values will play a major role in determining the likelihood of informal governance mechanisms on a day-to-day basis (Anbleyth-Evans et al. 2020). Thus, understanding and harnessing the role of informal governance and soft law is critical to choosing management and policy measures that are more likely to be supported by local communities and consequently enhance sustainable aquaculture.

(5) Include social dimensions in policy-making

Like many organisations and governments worldwide, ICES is increasingly recognizing the value of using interdisciplinary teams and methods to consider the human dimension in aquaculture governance (Brugère et al. 2023). Therefore, more effort is being placed on integrating social and eco-

nomic sciences into aquaculture policy making, which underpinned the set-up of the ICES WGSEDA. To improve the understanding between socio-political considerations and aquaculture governance, it is important to deepen the understanding of the benefits of engaging the whole range of stakeholders and involving them in establishing and managing aquaculture operations. A lack of integration in decision-making between actors and stakeholders and between different levels at which decisions are made (local, national, and international) can lead to fragmented and weak aquaculture governance systems (Krause and Stead). The success of sustainability in general, and in particular in the aquaculture development framework, should integrate key social dimensions at multiple scales as they are often absent or insufficient in decision-making (Hicks et al. 2016).

(6) Generate meaningful social data to support decision-making

The mismatch between the political will to develop aquaculture and the limited outcomes actually achieved calls for a critical analysis of governance mechanisms that could affect the development of the sector. We hypothesize that this mismatch could be, at least partially, a consequence of the lack of meaningful inclusion of local interest- and rights-holders in decision-making processes, exemplified by the limited use of indicators to monitor the social impacts of aquaculture. Overlooking the degree of social impacts at the local level could lead to poor social acceptability, which could compromise the expected outcomes of political initiatives. A set of relevant holistic indicators, environmental, economic, and social, becomes crucial to evaluate success and inform adaptive management (Krause et al. 2020, Mikkelsen et al. 2021).

(7) Linking aquaculture development policies to the local context

The construction of aquaculture policies, particularly in Europe (but also other regions like North America), is highly structured by top-down approaches developed at high institutional levels for application at the local level. This rationale is often based on unrealistic quantitative objectives that may not integrate local specificities and social constraints. This institutional gap between planning construction and its implementation at a local scale often leads to social acceptability issues. It is therefore necessary to reverse this situation and build visions of the place of aquaculture (among all other uses of resources and space) on a local scale, involving local communities, to ensure the convergence between the aspirations, constraints and opportunities in local communities and the objectives of public policies at larger scales. Regional and local governance enhances participation and ownership, ensuring that policies are aligned with community needs and aspirations. This is also a more pertinent scale to improve policy integration across sectors, allowing for more coherent approaches to address the complexity of social processes at a local scale. Adapted policies to local contexts foster social innovation and promote conflict resolution through inclusive decision-making. Finally, regional and local governance support sustainable and inclusive development by balancing local interests with broader societal goals.

The implementation of these seven recommendations can be guided by the following practical principles and actions:

1. Strengthen strategic governance and transparency

- Define clear, measurable, and outcome-oriented objectives for aquaculture governance to enhance transparency and accountability.
 - Develop national or regional aquaculture strategies with clearly defined, social, and economic targets (e.g. carbon neutrality, rural employment, food security).
 - Ensure that decision-making processes are traceable, understandable, and publicly accessible, including transparent criteria for licenses and operating conditions.
 - Promote integrated impact assessments that go beyond environmental concerns to include social and economic dimensions of aquaculture projects.
2. Enhance local participation and institutional capacity
 - Reinforce local institutions by ensuring effective coordination between high-level policy frameworks and local implementation, while taking into account specific territorial contexts and social complexity.
 - Increase capacity building of public agencies to support participatory processes, by strengthening the technical, facilitation, and mediation skills of staff involved in aquaculture governance.
 - Engage all relevant stakeholders upstream of decision-making, avoiding top-down or merely consultative approaches, and fostering co-construction and negotiation processes.
 3. Promote integrated and inclusive territorial management
 - Enlarge decision-making to adopt an integrated territorial management approach, accounting for interactions between aquaculture and other (economic and non-economic) coastal and marine uses.
 - Encourage co-monitoring and citizen science, and support aquaculture literacy initiatives (e.g. in schools, tourism venues, local markets) to improve public understanding of sustainable aquaculture practices and their benefits.
 - Promote integration with research and adaptive governance through co-management committees enabling continuous learning, feedback, and inclusive stakeholder engagement.
 - Facilitate models of active cooperation with external actors and invest in staff training and participatory governance at local level.

Government regulation plays a key role in shaping how aquaculture stakeholders engage with social acceptability in two main ways (1) regulating as a foundation for legitimacy to influence the industry about environmental and social expectations, and (2) collaborating with stakeholders as a means for stakeholders to build trust with regulatory bodies, given the perceived impact of regulations on industry development (Higgins *et al.* 2024). An Australian survey of rural industries provides strong evidence that increasing community trust significantly enhances social acceptability, particularly when the sectors address environmental performance, animal welfare, a fair share of benefits, industry responsiveness, and confidence in regulation (Voconiq 2023).

In summary, the overarching goal of this synthesis is to raise awareness of the significant role of social acceptability, and its importance for achieving sustainable growth in the aquaculture sector and show how it can be better integrated into

aquaculture governance. This has been approached by synthesizing different European contexts, showcasing a diversity of social acceptability issues and how they have been addressed by authorities.

Conflict of interest

The authors declare no conflict of interest.

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Author contributions

Jose Antonio Pérez Agúndez (Conceptualization [equal], Investigation [equal], Writing – original draft [equal], Writing – review & editing [equal]), Ramon Filgueira (Conceptualization [equal], Investigation [equal], Writing – review & editing [equal]), Nesar Ahmed (Conceptualization [equal], Investigation [equal], Writing – review & editing [equal]), Furqan Asif (Conceptualization [equal], Investigation [equal], Writing – review & editing [equal]), Suzannah-Lynn Billing (Conceptualization [equal], Investigation [equal], Writing – review & editing [equal]), Lucia Fanning (Conceptualization [equal], Investigation [equal], Writing – review & editing [equal]), Amber Himes-Cornell (Conceptualization [equal], Investigation [equal], Writing – review & editing [equal]), Teresa R Johnson (Conceptualization [equal], Investigation [equal], Writing – review & editing [equal]), Gesche Krause (Conceptualization [equal], Investigation [equal], Writing – review & editing [equal]), Cornelia Kreiss (Conceptualization [equal], Investigation [equal], Writing – review & editing [equal]), Eirik Mikkelsen (Conceptualization [equal], Investigation [equal], Writing – review & editing [equal]), Selina Marguerite Stead (Conceptualization [equal], Investigation [equal], Writing – review & editing [equal]), Sander van den Burg (Conceptualization [equal], Investigation [equal], Writing – review & editing [equal]), Yari Vecchio (Conceptualization [equal], Investigation [equal], Writing – review & editing [equal]), Sebastian Villasante (Conceptualization [equal], Investigation [equal], Writing – review & editing [equal]).

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Data availability

The data used in this study relies on expert knowledge.

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