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Transitioning from blue growth to the sustainable blue economy: A review of Ireland's new marine governance in the aquaculture sector

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This paper reviews the evolution of marine governance in Ireland in response to EU policy requirements in relation to the development of a sustainable blue economy in coherence with the United Nations Ocean Decade (2021–2030). In response to these EU requirements, Ireland has introduced the National Marine Planning Framework (NMPF) and Maritime Area Planning Act, 2021 (MAPA) in 2021 to deliver this sustainable blue economy. This new marine and coastal governance framework in Ireland reforms the consenting regime for key blue economy sectors such as Offshore Renewable Energy (ORE) and sets new policy requirements for the integration of aquaculture within the MSP framework. However, the exclusion of aquaculture from the new consenting regime may hinder the full integration of the sector into MSP and impede compliance with environmental goals established by EU Directives (e.g., WFD, MSFD, MSPD). This review identifies policy and legal gaps which may impede the integration of aquaculture into the new Irish marine governance and national MSP process. Furthermore, this paper analyses aquaculture licensing cases to assess the integration of environmental criteria into planning decisions to gather insight into the readiness of the sector's transition towards a sustainable model. The analysis from this paper indicates that the legal framework underpinning MSP in Ireland may have a limited impact on the integration of aquaculture and hinder the delivery of sustainability across all marine sectors.

KEYWORDS

marine spatial planning (MSP), UN ocean decade, new blue deal, aquaculture governance, Ireland marine management

Introduction

The 1982 *United Nations Convention on the Law of the Sea* (UNCLOS) established the first international legal framework underpinning contemporary marine policy and has guided the development of national and international ocean governance regimes. Such regimes were initially developed on sector-by-sector basis, (e.g., fisheries management, aquaculture development, conservation, marine pollution, transport) limiting sustainable and equitable use of marine space. The United Nations and the European Union have recognised the need for implementing new policies and instruments such as *Integrated Marine Management* (IMP) and *Maritime Spatial Planning* (MSP), to support sustainable development of the ocean economy. To advance these efforts, the UN declared 2021 to 2030 as the *UN Decade of Ocean Science for Sustainable Development* to encourage States to advance the sustainable blue economy.

The European Union (EU) has been at the forefront of the development of marine policy and legislation to advance sustainability in the marine environment (Boyes and Elliott, 2014; Garland et al., 2019). For example, the *Marine Strategy Framework Directive* (MSFD) (2008) and *Maritime Spatial Planning Directive* (MSPD) (2014) mandate the implementation of an Ecosystem-based Approach to support the sustainable use of marine resources (European Commission, 2008; European Commission, 2014). Governance tools such as MSP have been advocated to enable the coordinated use of marine space to reduce spatial conflict between sectors and facilitate the integration of socio-economic and ecological criteria into management decisions (Ehler, 2021; UNESCO-IOC, 2021). Most recently having recognised the need for a governance model which prioritises sustainability, the EU issued a policy statement “on a new approach for a sustainable blue economy in the EU” (COM/2021/240). However, delivering a sustainable blue economy in the EU through MSP at an operational level across various sectors is proving to be challenging (Frazão Santos et al., 2021; Haapasari and van Tatenhove, 2022).

For example, Ireland has developed an MSP (e.g., NMPF) framework in which aquaculture is integrated into the process from a strategic policy standpoint, but the operationalisation of these provisions will be limited by the omission of the sector in the legal framework established by the *Maritime Area Planning Act* (Government of Ireland, 2021). In the case of ORE, the policy strategies established in the NMPF will be made operational through the MAPA. This differentiated treatment in the legal framework underpinning MSP could be arguably considered sectoral. Through the development of the *National Marine Planning Framework* (NMPF) and *Maritime Area Planning Act* (MAPA) in 2021 Ireland has met the EU requirements of the MSPD. The NMPF and the new legal framework for marine development established through the MAPA aim to promote the development of a sustainable blue economy with the support of MSP. This new marine and coastal governance framework in Ireland reforms the consenting regime for key blue economy sectors such as Offshore Renewable Energy (ORE) and sets new policy requirements for the integration of aquaculture within the MSP framework. However,

the exclusion of aquaculture from the new consenting regime of MAPA may hinder the full integration of the sector into MSP and impede compliance with environmental goals required by various EU Directives (e.g., WFD, MSFD, MSPD) (Government of Ireland, 2021).

Aquaculture has been recognised as a key sector for the blue economy through various EU regulatory and policy frameworks (e.g., *Common Fisheries Policy*, *Blue Growth Agenda*, *MSP Directive*, *MSFD Directive*). With the aim of advancing the understanding of how the EU’s sustainable blue economy can be implemented with the support of MSP, this paper focuses on Ireland’s aquaculture licensing system and the level of integration of EU environmental and marine governance policy and legislation in the sector. Through an analysis of the policy and legislation underpinning aquaculture licensing in Ireland, this paper demonstrates how the sector operates in a fragmented and complex regulatory environment that has not been integrated into the statutory basis of MSP in Ireland.

The paper starts by discussing (1) how EU marine governance has evolved; (2) how it has been integrated into Ireland’s national governance landscape; (3) how Irish aquaculture licensing operates; (4) and analyses the consistency through which environmental compliance is manifested in licensing decisions. The analysis and policy recommendations presented offers perspectives into how EU member states can strengthen the delivery of sustainable blue economy aspirations into aquaculture management through MSP and supporting regulation.

EU marine governance

The foundations of the EU’s sustainable blue economy policy were first established in the 2007 Blue Book which introduced *Integrated Maritime Policy* (IMP) to implement a cross-sectoral approach to marine and maritime affairs in the EU (European Commission, 2007). The Blue Book defined a new governance framework which identified MSP as a key instrument for adopting an integrated policy approach to maximise the economic growth of the coastal and maritime sectors in the EU, whilst complying with sustainability requirements (European Commission, 2007; European Commission, 2012a).

This new governance model was later endorsed as the Blue Growth strategy by the EU in its communication: ‘Opportunities for marine and maritime sustainable growth’ (COM/2012/494) (European Commission, 2012a). The Blue Growth Communication policy actions were centred around five focus areas: blue energy; aquaculture; maritime, coastal and cruise tourism; marine mineral resources and blue biotechnology. Sectors such as fisheries, environment and maritime transport were not included with the justification that they are covered under specific ongoing EU initiatives already in place such as the *Common Fisheries Policy* (CFP) and the *Marine Strategy Framework Directive* (MSFD). This created a policy framework in which marine environmental protection and fisheries were excluded from broader marine governance frameworks such as MSP. Arguably, this has led to the continued development of a

fragmented sectoral approach to marine governance. Research has therefore critiqued the blue growth ambitions by the European Commission as mainly focused on sectoral development and failure to integrate the environmental goals (Jones et al., 2016; Ertör and Hadjimichael, 2020; Leposa, 2020).

In the context of MSP, it was noted that the blue growth agenda was a dominant priority and often aligned with strategic sectoral planning priorities (Schultz-Zehden et al., 2019; Trouillet, 2020). In contrast, the target for good environmental status (GES)¹ through the MSFD, social and cultural priorities were relatively undermined and unachieved (Jones et al., 2016; Flannery et al., 2019). This exacerbates concerns about tensions and fragmentation between the MSPD and the MSFD, with some viewing them as having contrasting goals of advancing development and conserving biodiversity. Due to the dominance of the Blue Growth discourse in the EU, the problems to be addressed by MSP no longer related to good environmental governance, but rather, are concerned with creating the appropriate conditions for the rapid expansion of target industries including offshore renewable energy and aquaculture (Guerreiro, 2021; Ansong et al., 2022).

This is evidenced in the aquaculture sector by the use of financial mechanisms to support growth, rather than prioritising and developing policy that would advance a sustainable aquaculture model and progress environmental compliance in the sector (European Commission, 2013). More specifically, the 2013 Strategic Guidelines for the sustainable development of EU aquaculture directly linked the sector with the EU's blue growth strategy. These guidelines fail to define sustainable aquaculture and rather focus policy interventions on the promotion of the growth of EU aquaculture (European Commission, 2013). An overview of relevant EU marine policy and its alignment with aquaculture development are provided in Table 1 below based on objectives and implementation mechanisms defined for the sector.

Following policy developments requiring the implementation of environmental sustainability across marine industries, the EU aligned its policy with the United Nations Ocean Decade sustainable blue economy model. The definition of a sustainable blue economy, as stated in the *Declaration of the Sustainable Blue Economy Finance Principles*, is 'projects and activities that contribute directly to the achievement of UN Sustainable Development Goal (SDG) 14, to conserve and sustainably use the Ocean's resources, and other SDGs, especially those that contribute to the good governance of the Ocean' (UNEP, 2018). The fulfilment of the UN Ocean Decade has listed several desired outcomes for the sustainable use of the ocean of which the most relevant ones for aquaculture development are cited below (Ryabinin et al., 2019). These are:

These policy goals have been introduced through the European Green Deal, guiding the shift towards a sustainable blue economy (European Commission, 2019a). The Green Deal calls for a transformation of the EU economy to a modern, resource-

efficient and competitive economy where net emissions of greenhouse gases are phased out and the EU's natural capital is protected. Critically, the Green Deal highlights that the sustainable blue economy is essential to achieving its objectives. This is evidenced by the 2020 Farm to Fork Strategy and Blue Farming in the European Green Deal developed in support of the Green Deal, further strengthening the role of sustainable aquaculture as a key enabler for sustainable food systems (European Commission, 2012b).

In contrast to the Blue Growth Strategy, the new approach for a sustainable blue economy in the EU communication: Transforming the EU's Blue Economy for a Sustainable Future (COM/2021/240) seeks to merge environmental protection with economic goals (European Commission, 2021a). It further covers a wide range of sectors including fisheries, aquaculture, maritime transport, offshore renewable energy and decommissioning offshore platforms. Hence, it proposes a paradigm shift from blue growth to a sustainable blue economy. For this shift to happen, the Blue Deal advocated in this Communication has the following initiatives: economic activities at sea and in coastal areas need to reduce their cumulative impacts on the marine environment and value chains need to transform themselves to contribute to climate neutrality and zero pollution, circular economy and waste prevention, preserve biodiversity and invest in nature, climate adaptation and coastal resilience, sustainable food production system and improvement in the management of space at sea. MSP is identified as a priority to achieve these goals.

Maritime Spatial Planning is advocated as a key enabler for the sustainable blue economy, as identified in the EU's Blue Economy Communication. The MSP process is a key process to implementing sustainable blue economy vision and objectives through iterative stages of pre-planning, assessment, planning, stakeholder engagement implementation, monitoring, evaluation and review/adaptation. In the case of aquaculture, MSP is identified as an essential governance mechanism to enable the growth of a sustainable aquaculture sector by ensuring access to ocean space and compliance with environmental conservation requirements (Puzkarski and Śniadach, 2022).

The shift towards a sustainable blue economy in the EU (as stated in COM (2021) 240) requires the systemic integration of ocean policy into the economic policy of the European Green Deal through the New Blue Deal (European Commission, 2019b). The EU's New Blue Deal establishes a series of actions through the agenda presented in this Communication. This includes developing and expanding sustainable aquaculture and ORE, underpinned by sustainable governance models such as MSP. These actions, therefore, need to be fully and comprehensively embedded into Ireland's current and future marine policy, legislation, and blue economy sectoral strategies.

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¹ The Good Environmental Status (GES) means that the different use of marine resources is conducted at a sustainable level, ensuring their continuity for future generations (MSFD 2008/56/EC)

TABLE 1 Key EU policy and law relevant to aquaculture.

Policy	Objectives	Implementation
1983 Common Fisheries Policy	Ensure aquaculture is managed in an environmentally sustainable way	Promote development of sustainable aquaculture activities through Financial Mechanisms
IMP Blue Book 2007	Promote the development of an environmentally safe aquaculture industry in Europe	Regulatory framework
Blue Growth Agenda 2012	Promote aquaculture through an ‘open method of coordination’ based on non-binding strategic guidelines, multiannual national strategic plans and the exchange of best practices.	Strategic EU funding
Sustainable Blue Economy Communication 2021	Support best practice to ensure good environmental performance	EMAF Funding

objectives. This is evidenced by the 2020 Farm to Fork Strategy and Blue Farming in the European Green Deal developed, further strengthening the role of sustainable aquaculture as a key enabler for sustainable food systems.

The new EU strategic guidelines for a more sustainable and competitive aquaculture sector are introduced in the “Blue Farming in the European Green Deal” document (European Commission, 2021b). The Blue Farming guidelines establish policy objectives and actions to boost organic aquaculture production in the EU. This sustainable aquaculture model proposed by the EU presents an important economic opportunity for Ireland. Ireland is the leading producer of organic aquaculture products in the EU, having an output of 18.5m tonnes out of the EU’s annual output of 74m tonnes in 2020 (European Market Observatory for Fisheries and Aquaculture Products, 2022). Additionally, Ireland is the only producer of organic salmon in the EU, giving it a strong competitive advantage and opportunity for expansion (Irish Farmer’s Association, 2023). Ireland aims to implement these EU policy aspirations through its National Strategic Plan for Sustainable Aquaculture Development 2030. In order to implement these policy aspirations, it is necessary to have a licensing system that provides legal certainty and adaptability. In the following section, the definition of EU sustainable aquaculture policy is identified. This is followed by an overview of the Irish aquaculture licensing process is presented and its weaknesses highlighting where there are challenges to achieving the implementation of a more sustainable aquaculture sector.

Marine governance in Ireland

Ireland’s marine governance trajectory has followed the broad objectives contained in the wider EU policy and legislation. The Government of Ireland has shifted its marine policy and legislation to address recognised weaknesses in previous governance regimes and deliver on wider policy objectives, such as the implementation of Maritime Spatial Planning (MSP), in line with EU requirements.

In recognition of the EU’s Integrated Maritime Policy, the Government published its Integrated Marine Plan (IMP) in 2012, “Harnessing Our Ocean Wealth (HOOW).” HOOW set out three high level goals and a roadmap to realise the government’s vision of

doubling the contribution to GDP of the maritime sector to 2.4% per year, by 2020. These three goals based on sustainable development were; 1. A thriving maritime economy, 2. Achieving healthy ecosystems, 3. Increasing engagement.

Previously, HOOW (GoI, 212) set the policy context for the enabling conditions necessary to deliver on blue economy goals, whilst ensuring both environmental protection and sectoral growth. Those original goals have informed the high-level objectives contained in Ireland’s Marine Planning Policy Statement and are implemented through the National Marine Planning Framework (NMPF) adopted in 2021 and the Maritime Area Planning Act, 2021 (MAPA).

HOOW set out eight enablers essential to creating the conditions for growth and investment, and these were further broken down into 39 actions linked to one or more of the overarching goals (1-3, above) with specified timelines and allocated responsibility. One of these eight enablers was ‘Governance’ explicitly recognising the need to deliver greater efficiency in public services; removing barriers where possible, providing robust planning and licensing frameworks to support sustainable development and create more certainty for industry (Table 2). The last review of progress of HOOW, covers the year 2018 and recognises progress made under the two key Governance actions: these include the Review of Aquaculture Licensing under action 2 and the Certified Aquaculture Programme.

As is evident from Table 2 the items to be progressed under the second Governance action, relate primarily to planning and consenting systems. Noting that HOOW preceded the adoption of the EU MSP Directive, work had already commenced on reforming the extant foreshore consenting regime by the responsible government department, however, this work had to adapt in line with the requirements of the new Directive and other policy matters.

Aquaculture was positioned as a key sector for development and expansion in HOOW. Under this plan, €2.59 million in public aid supported the development of aquaculture through a sustainable aquaculture scheme, delivering 38 aquaculture capital development projects. These projects focused on improving environmental outcomes in the industry, for example addressing veterinary health issues in salmon, multi-trophic aquaculture, environmental management monitoring in connection to the Water Framework Directive, and improvements in mussel and oyster production, amongst other intervention areas (Government of Ireland, 2018).

TABLE 2 Government actions contained in HOOW.

No.	Key Action	Supports Goal
1	Develop and implement clear and forward-looking policies and strategies that support an increased contribution from our ocean economy to national GDP.	1
	-Implement existing (e.g. Food Harvest 2020) and planned (e.g. Ports Policy, OREDP) sectoral strategies/plans through effective coordination of actions across a range of government departments and agencies.	1
	-Develop an integrated enterprise strategy to generate momentum in specific emerging market opportunities prepared across development agencies (e.g. offshore renewables, offshore services, ICT and sensors, biotechnology).	1
	-Continue to develop new policies/strategies that address gap areas through an integrated approach.	1
2	Develop an integrated approach to marine and coastal planning and licensing to maximise the potential for Ireland's ocean economy; assist with managing our resources effectively and sustainably; manage potential conflicts; and ensure harmonisation with coastal/terrestrial planning	1
	-Address the deficiencies in the current planning and licensing system by continuing make business process improvements; e.g. administrative efficiencies and licensing decisions to address the current caseload.	1
	-Update/improve legislation to streamline planning and consent processes	1
	-Develop an appropriate Maritime Spatial Planning Framework for Ireland within which the scope and objectives of an overarching national Marine Spatial Plan will be defined	1,2,3

HOOW emphasised the need to update and improve legislation to streamline planning and consenting processes in marine and coastal planning and presented policy conditions to do so. Following on this policy work, the Irish government developed the Maritime Area Planning Act, 2021 (MAPA) and the National Marine Planning Framework (NMPF). The MAPA reforms the licencing and consenting system for the majority of marine activities and developments. Aquaculture was excluded from the new licencing and consenting regime despite various recommendations emphasizing the need to update the legislation for aquaculture, and multiple high-level aquaculture policy reviews ([Independent Aquaculture Licensing Review Group, 2017](#)). The differentiated governance regime between ORE and aquaculture fails to address issues of institutional and intersectoral fragmentation, posing a barrier to the development of MSP and the delivery of a sustainable blue economy.

Ireland transposed the MSP Directive in 2016 through Regulations, but this was strengthened in 2018 through primary legislation to give full effect to the Directive's requirements. A National Stakeholder Advisory Group on MSP was established in 2017 with representatives from social, economic and environmental pillars and continues to meet regularly. A Baseline Report on MSP was subject to a period of publication in late 2018 with associated public consultation events nationwide, and finalised in 2019 ([DHPLG, 2018](#)). Following that, a Marine Planning Policy Statement was launched for public consultation in June 2019 and approved by Government in November 2019, coinciding with the publication of the first draft of the National Marine Planning Framework, Ireland's first maritime spatial plan. The latter was approved by Government and formally established in May 2021 ([DHPLG, 2021](#)).

The NMPF contains Overarching Marine Planning Policies (OMPPs) that reflect social, economic and environmental aspects that need to be taken into account by all marine users and activities. The NMPF also comprises Activity specific or Sectoral Marine Planning Policies (SMPPs) policies that contain a more detailed

basis for decision-making within 16 specific marine sectors/activities ([DHPLG, 2021](#)). These policies cover the types of activity to be supported, how these interact with other users, and approaches to mitigating or avoiding impacts. Public bodies are legally obliged to "secure the objectives" of NMPF policies. Despite this, the key mechanism for implementing NMPF objectives is the consenting or licensing processes that apply to each activity, which may change with the commencement of specific parts of the Maritime Area Planning Act, 2021 (MAPA) depending on the activity concerned. This could represent a policy and regulatory risk with different sectors subject to different regimes that may not totally align in terms of sustainability outcomes. The regulatory risk presented by the exclusion of aquaculture in the new marine licensing system is highlighted in the Pre-Legislative Scrutiny report for the MAPA ([Joint Committee on Housing, Local Government and Heritage, 2021](#))

The purpose of MAPA is to regulate the maritime area, from the mean low water mark to the outer limits of the continental shelf (usually 200 nautical miles). This is to be achieved through the National Marine Planning Framework and the Act provides a strengthened legal basis for MSP in Ireland. MAPA also contains provisions on Maritime Area Consents (MACs), necessary for the occupation of the maritime area for the purposes of carrying out certain maritime uses (long term) and licenses for a shorter term or more minor uses. To administer these specific responsibilities, the Act provides for the establishment of a dedicated body, the Maritime Area Regulatory Authority (MARA), which will be responsible for granting, revoking and suspending consents, administrative responsibility for foreshore consents and general enforcement of the Act. MARA is expected to become operational in 2023.

Some of the 16 sectors included in the NMPF operate under very different regulatory frameworks and policies, which represents a challenge for integrated planning and management. Specifically, this refers to fisheries and aquaculture or developments, which will remain subject to their existing regulatory regime (e.g., Fisheries

1997, Foreshore Acts 1933-2014). Despite a different consenting regime, they are still subject to the high-level objectives of the NMPF. In addition, under s.31 of MAPA, the Minister has the power to compel public bodies to comply with the NMPF and EU MSP Directive.

Under the new Act the remaining, and majority, of other marine activities will require a single State consent, known as a Maritime Area Consent (MAC), which effectively relates to due diligence checks and regulates the terms for the occupation of sea space. If granted, it is also necessary to allow a project proponent to advance to the next stage of the planning process: an application for Development Consent, which involves a project-level assessment, including environmental impacts and public consultation. The MAC effectively streamlines the marine consent process by aligning the foreshore planning system with the planning system, facilitating integration between marine and terrestrial planning systems (Ritchie et al., 2022). Arguably, the new marine planning regime applicable to the relevant sectors (e.g., ORE) will progress integrated marine planning and harmonise land-sea interactions. In addition to the NMPF, Designated Marine Area Plans (DMAP) are provided for in the Act, enabling local authorities to propose spatial management plans for specific marine areas (Government of Ireland, 2021). Given the exclusion of aquaculture in the Act, it remains unclear how aquaculture will be provided for in this marine zoning system, potentially posing a barrier to achieving integrated marine planning and development of a sustainable blue economy.

The shift towards a sustainable blue economy in the EU (as stated in COM (2021) 240) requires the systemic integration of ocean policy into the economic policy of the European Green Deal through the New Blue Deal. The EU's New Blue Deal establishes a series of actions through the agenda presented in this Communication (European Commission, 2019b). This includes the development and expansion of sustainable aquaculture and ORE, underpinned by sustainable governance models such as MSP. These actions will need to be reflected in Ireland's current and future marine policy, legislation, and blue economy sectoral strategies.

The European Commission establishes an agenda for the adoption of sustainable value chains, including aquaculture. This agenda promotes the development of responsible food systems from marine resources and positions sustainable aquaculture as a valuable and low-impact source of food. The EU green deal through the "Blue Farming in the European Green Deal" document establishes policy objectives and actions to increase organic aquaculture production in the EU.

In the following section, EU policy relating to sustainable aquaculture is identified and is followed by an overview of the Irish aquaculture licensing process to identify how sustainability operates in the sector through environmental compliance with EU environmental protection legislation (e.g., Birds and Habitats Directives).

Sustainable aquaculture

The definition of sustainable aquaculture by EU policy has developed on a sectoral basis, having developed most of its

strategies and policies from the Common Fisheries Policy, focusing on economic growth (Long, 2016). One of the first attempts by the EU to integrate sustainability into the aquaculture sector was through the Blue Growth Strategy. The Strategic Guidelines for the sustainable development of EU aquaculture COM/2013/229 established the importance of aquaculture development in blue growth policy strategies (European Commission, 2013; European Parliament, Council of the European Union, 2013).

The aim of these guidelines was to increase aquaculture production across Member States by improving administrative procedures and coordinated spatial planning. This Communication did not provide a clear definition of sustainable aquaculture. Instead, it defines sustainable development of aquaculture as compliance with EU environmental legislation (e.g., CFP, MSFD, WFD, Habitats and Birds Directives), coordinated spatial planning and integration of aquaculture into Natura2000 sites (ibid, 6-7). Biodiversity and nature conservation was relegated to favour economic growth as evidenced by the 2012 Guidance document on aquaculture activities in the Natura 2000 Network. This guidance offered guidelines to support Member States in the development of aquaculture in Natura 2000 sites.

Following wider EU policy development such as the MSP Directive and the New Blue Deal, aquaculture policy has progressed efforts in implementing sustainability in the aquaculture sector. The Strategic guidelines for a more sustainable and competitive EU aquaculture for 2021 to 2030 integrated the sector into the EU sustainable economy ambitions under the auspice of the Green Deal, maintaining a sectoral approach (European Commission, 2021). These guidelines advance the importance of environmental quality in aquaculture production by citing the need to ensure "the mitigation of the impact that aquaculture activities may have on the environment (be it in terms of carbon footprint, effluents, waste or other impacts on marine and freshwater ecosystems), and that aquaculture activities do not significantly harm ecosystems or biodiversity" (ibid, 9-10). Environmental performance should be measured by states as; "(i) ensuring that environmental legislation is applied and its objectives are met; (ii) further mitigating the impact of aquaculture; and (iii) promoting aquaculture with lower environmental impact and aquaculture that provides ecosystem services" (ibid). The policy cited indicates that the EU has made some progress in defining sustainable aquaculture, however it continues to favour a sectoral approach in the wider marine governance landscape. The following section gives an overview of the Irish aquaculture licensing system and demonstrates the complexity of the regulatory framework.

Aquaculture licensing system in Ireland

Ireland's aquaculture licensing system operates in a complex and fragmented regulatory environment, subject to various national legislative instruments and EU regulations, and consequently under the remit of various Government institutions. The licensing system is subject to numerous regulations from

different sectors such as; agri-food, animal welfare, environmental conservation, and marine management, further contributing to its fragmentary nature. Figure 1 provides an overview of this complex governance landscape.

At a national level, aquaculture is regulated under various legislative codes which account for the different spatial scales in which the industry operates (e.g., land-based facilities, inter-tidal and marine). This has resulted in a complex system in which the sector must operate under different planning systems, accounting for use of the foreshore, in-land facilities, coastal zones, and marine zone. Figure 2 provides an overview of this complex system of legislation under which licences and permits for aquaculture operations are processed.

The general framework for processing aquaculture licensing and licence appeals are set out in Section 61 of the *Fisheries (Amendment) Act, 1997* and *Aquaculture (Licence Application) Regulations 2018*. The Minister for Agriculture, Food, and the Marine, (MAFM) is the licensing authority and the Aquaculture and Foreshore Management Division (AFMD) of the Department manages aquaculture licence processing on behalf of the Minister, and in the case of land-based development, responsibility is shared with the relevant local authority.

The general considerations for the processing of licence applications are detailed in *Section 61 of the Fisheries (Amendment) Act 1997* (Irish Government, 1997). Figure 3 provides an overview of the steps of the licensing process and indicative processing time based on the *Independent Aquaculture Licensing Review Group, 2017* report. The licensing process can be further extended in the case an appeal is presented.

Section 22 of the Fisheries Act, 1997 - *Appeals against licensing decisions* establishes an appeals mechanism for licensing decisions (Irish Government, 1997). One month after the publication of a

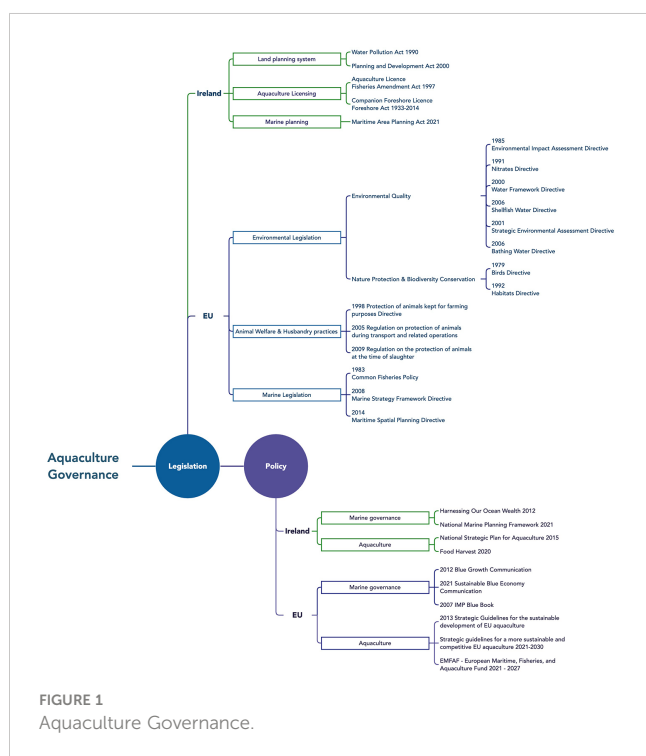
licensing decision, aggrieved parties (e.g., licensee, public consultation participants, statutory consultees) may present objections towards the licensing conditions. The Fisheries Act does not provide detailed guidance on grounds for appeals which has led to criticism of the transparency of the licensing system (*Independent Aquaculture Licensing Review Group, 2017*). The general considerations of focus during the appeals process can be based on licensing considerations (see Table 3). Through a review of selected appeals licensing decisions detailed in the following section, it has been identified that appeals focus on findings from Appropriate Assessment reports submitted with applications. These findings can determine an aquaculture site to be deemed unsuitable or have a potentially significant adverse impact, or a potential negative impact and be expected to have an adverse impact.

Furthermore, appeals focusing on the licensing considerations issued in the Act (see Table 3), and the Aquaculture Licence Appeals Board (ALAB) will request more information from the licence applicant to make a determination. This can take the form of a supplementary Environmental Impact Statement (EIA), Appropriate Assessment (AA) screening matrix, water modelling reports, sea lice dispersal models etc. More information can be requested outside of the cited scope but this is not specified in legislation or policy which can impede consistency in the appeals process.

These conditions establish the baseline ecological considerations that must be met in aquaculture production. The ecological considerations are implemented through environmental indicators and management plans in the conditions set out in licences. For example, in the case of marine-based finfish aquaculture, one of the key environmental indicators is sea-lice occurrence and is implemented through the requirement of integrated pest management plans in licences and the establishment of the *National Sea Lice Monitoring Programme* (Department of Agriculture, Fisheries and Food, 2000). In the case of shellfish aquaculture, water quality monitoring and proximity to designated Shellfish Waters must be accounted for in licensing conditions. The numerous requirements derived from this dispersed regulatory framework have contributed to the number of appeals carried forward (e.g., 14 in 2014, 11 in 2017, 37 in 2018, 69 in 2019), which can be attributed to an inconsistency in licensing decisions which will be explained in the following sections (ALAB, 2020a). For context, in 2017 there were 324 licence determinations made in 2019 (DAFM, 2020).

EU requirements

In addition to the criteria and conditions referenced above, further complexity is added by EU regulations applicable to the sector. At the EU level, there is no specific harmonised legislation for regulating aquaculture activities. The regulatory framework for the sector is fragmented and is set out by the *Common Fisheries Policy 1380/2013* and EU environmental legislation such as the *Habitats Directive (92/43/EEC)*, *EU Birds Directive (2009/147/EC)*, *Environmental Impact Assessment Directive (2014/92/EU)* and



Aquaculture Licensing in Ireland				
Legislation	Consent/authorization type			Relevant institution
Fisheries Act 1959 - 2003 S.I. No. 240/2018 Licence Application Regulations (Under Fisheries Act 1997)	i. Aquaculture Licence ii. Trial Licence iii. Renewal of Aquaculture Licence iv. Review of Aquaculture Licence	Marine based: <ul style="list-style-type: none"> • Finfish • Shellfish • Intertidal • Subtidal • Seaweed, aquatic plants • Aquatic fish food 	Land-based: <ul style="list-style-type: none"> • Finfish • Shellfish • Intertidal • Subtidal • Seaweed, aquatic plants • Aquatic fish food 	Aquaculture and Foreshore Management Division of the Department for Agriculture, Food, and the Marine
Foreshore Acts 1933 - 2011	Companion Foreshore Licence			Department of Housing, Planning and Local Government
Planning and Development Act 2000 (as amended)	Planning Permission			Local Planning Authority or An Bord Pleanála
Local Government (Water Pollution) (Amendment) Act, 1990	Licence to Discharge Trade Effluent			Environmental Protection Agency

FIGURE 2
Aquaculture Licensing in Ireland.

public consultation requirements of the *Public Participation Directive (2003/35/EC)*.

As the transposition of these Directives follows the principle of subsidiarity, national implementation has been complicated (Long, 2016). Implementation of environmental compliance requirements derived from the Nature conservation Directives has been inadequate in Ireland as evidenced by ECJ judgements. (i.e., the Birds Directive and Habitats Directive). This is evidenced by the 2007 European Court of Justice (ECJ) ruling against Ireland in *Commission of the European Communities v Ireland [C-418/04]* for not complying with Article 6 (3) and (4) of the Habitats Directive requirements for Appropriate Assessments (AA) for aquaculture activities in or adjacent to Natura 2000 areas (European Commission, 2004). As a result of this ruling, Ireland was required to conduct several Appropriate Assessments for aquaculture activities in 20 Natura 2000 sites (e.g., SPA and SAC sites).

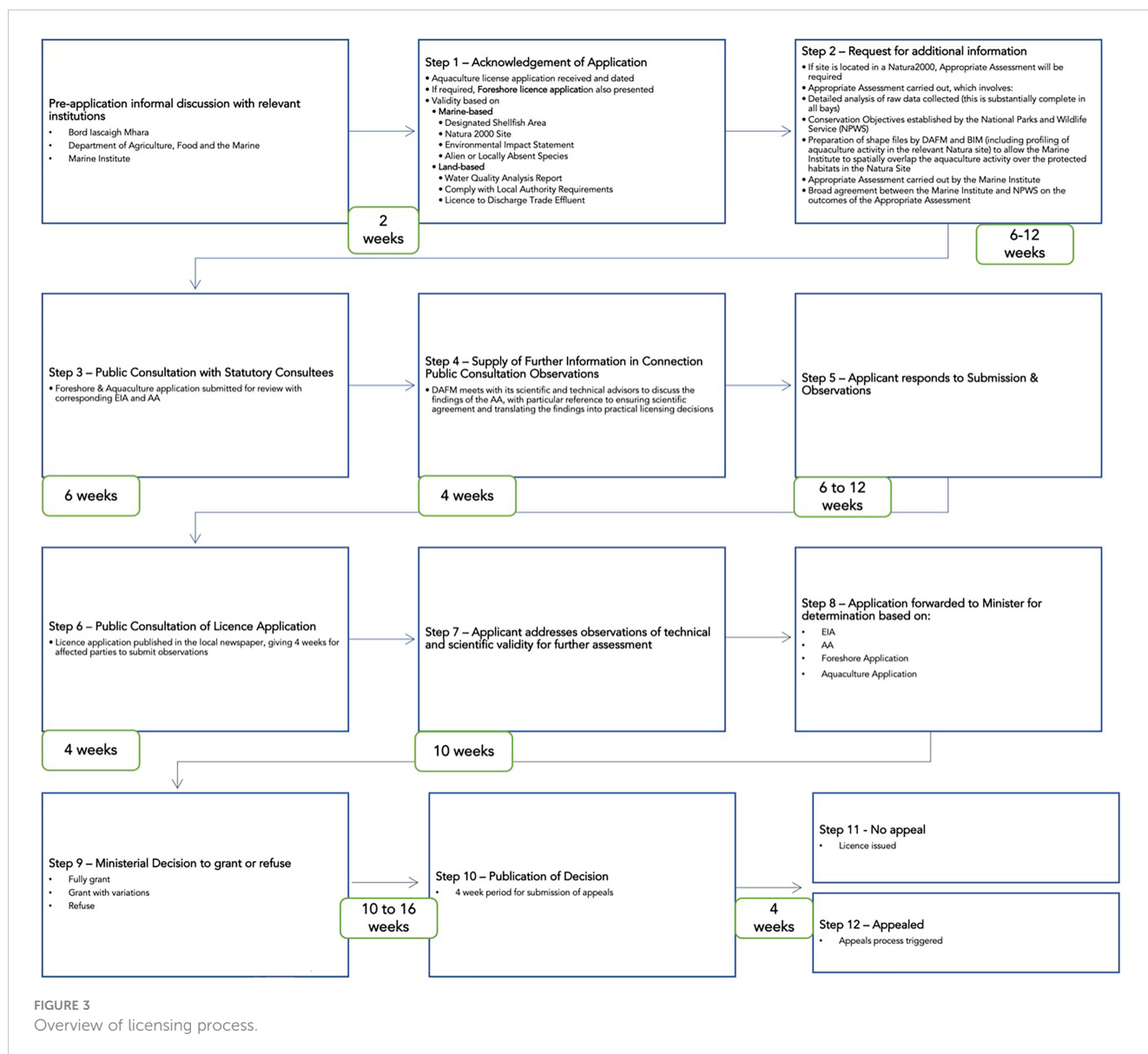
This ruling had strong implications for the aquaculture industry, as most aquaculture sites had been licensed in the 1980s and 1990s, and were in or near Natura2000 sites, making the licences of these sites in breach of AA requirements (Independent Aquaculture Licensing Review Group, 2017). Aquaculture farms were unable to renew their licences until the government developed the AA for Natura 2000 sites. This also resulted in exclusion from EU grant funding eligibility, hindering access to financial support

mechanisms aimed at supporting the sustainable development of the sector. The following section demonstrates through selected case studies the complexity of the licensing system through licence applications that went through the appeals process.

Case studies

Salmon aquaculture in Bantry Bay, Co. Cork

Salmon farming in Ireland developed in the 1980s and has been the subject of environmental and social criticism (Phyne, 2009). Poor environmental performance in salmon aquaculture operations has been assessed by the occurrence of sea-lice infestation on wild salmon and harmful algal blooms episodes (HABs). For example, such is the importance of negative environmental outcomes at a statutory level in salmon aquaculture, that Norway has embedded salmon lice incidence into its management system (Bailey and Eggereide, 2020). In this case, the government deems salmon aquaculture operations as sustainable when sea lice levels are kept at a minimum level. In the case of HAB episodes, the loss of US\$ 800M for Chilean salmon aquaculture companies in 2016 demonstrated how inadequate contingency plans can adversely affect the industry (Mardones et al., 2021). These two



environmental impact indicators are associated with poor governance and inadequate aquaculture licensing and monitoring systems (McMahon, 2000; Davidson et al., 2020; Osmundsen et al., 2022). They also affect social acceptance of salmon aquaculture in Ireland, leading to the opposition of the development of the industry as demonstrated by the numerous appeals against salmon farm applications.

Given the importance of salmon aquaculture in Ireland and its promotion by policy and sectoral strategies, the licensing application for a salmon farm at Shot Head in Bantry Bay is analysed. In 2015, the Minister for Agriculture, Food and the Marine granted aquaculture and foreshore licenses for the licence application presented in 2011 for this site. This decision was appealed under the provisions of Section 47 of the Fisheries Act 1997. Thirteen appeals were presented against the licence approval, and one appeal from the Licensee was submitted, requesting the amendment of licence conditions (ALAB, 2017).

This resulted in the licensing process for the site spanning a 7-year determination period (2015 to 2022) (ALAB, 2020; ALAB, 2022). This case study focuses on the appeals process in which a number of environmental considerations were presented by the appellants to oppose the development of salmon aquaculture in Bantry Bay. This case study provides an example of how environmental criteria are integrated into the licensing process through the grounds for appeals.

Here we focus on the issues of significant environmental concern brought forward by appellants and how these were integrated into the appeals process and subsequent licensing decision. Appellants argued that the original EIA presented with the application did not adequately address the impact of in-shore fishing activity and the “footprint of the proposed farm” on benthic conditions (ALAB, 2017). The environmental concerns cited based on this EIA which was characterised as flawed by the appellants were the following (ALAB, 2017; ALAB, 2022):

TABLE 3 Licence processing and monitoring under the Fisheries Act 1997.

Licensing considerations	the suitability of the place or waters at or in which the aquaculture is or is proposed to be carried on for the activity in question
	other beneficial uses, existing or potential, of the place or waters concerned
	the particular statutory status, if any, (including the provisions of any development plan, within the meaning of the Local Government (Planning and Development) Act, 1963 as amended) of the place or waters
	the likely effects of the proposed aquaculture, revocation or amendment on the economy of the area in which the aquaculture is or is proposed to be carried on
	the likely ecological effects of the aquaculture or proposed aquaculture on wild fisheries, natural habitats and flora and fauna
	the effect or likely effect on the environment generally in the vicinity of the place or water on or in which that aquaculture is or is proposed to be carried on; (i) on the foreshore, or (ii) at any other place, if there is or would be no discharge of trade or sewage effluent within the meaning of, and requiring a licence under section 4 of the Local Government (Water Pollution) Act, 1977
	the effect or likely effect on the man-made environment of heritage value in the vicinity of the place or waters
Licence operation conditions	a specification, by means of a map or otherwise, of the boundaries or limits of the place or waters in relation to which the licence is granted
	the amount of feed inputs
	annual or seasonal limits on stock inputs, outputs and standing stock on site
	operational practices, including the fallowing of sites
	the reporting of incidences of disease and the presence of parasites
	the disposal of dead fish
	measures for preventing escapes of fish, and arrangements for the reporting of escapes
	monitoring and inspection of the aquaculture carried on pursuant to the licence
	the keeping of records by the licensee
	the protection of the environment (including the man-made environment of heritage value) and the control of discharges
	appropriate environmental, water quality and biological monitoring
Environmental Monitoring requirements (only applicable to marine finfish)	Benthic monitoring
	Water Column Monitoring
	Strategy for improved pest control
	Sea lice monitoring and control
	Audit of operations
	Fallowing
	Structural design protocol
	Proposed site layout

1. Increased threat to wild salmon and sea trout from sea lice
Atlantic salmon is a protected species under the Habitats Directive and under the EU Freshwater Fish Directive (78/659/EEC)
2. Threat to wild salmon from escaped farm fish/disease control
3. Insufficient carrying capacity to support additional aquaculture – that the Bay has reached the limit of its ability to support multiple aquaculture activities
4. Site suitability: weather vulnerability
5. Toxic chemical discharges/pollution
6. Nutrient and settleable solid discharges
7. Impacts on farmed shellfish
8. Impacts on benthic/pelagic and local freshwater habitats, including marine mammals, birds and benthic impacts (European Commission, 2000)
9. Impact on tourism, including salmon angling
10. Impact on commercial in-shore fishing
11. Impact on on-shore angling
12. License conditions (e.g., cage dimensions and type, cage number and configuration and production and farm management strategies, including fallowing)
13. Cumulative impacts
14. Noise impacts
15. Absence of local aquaculture management scheme

16. Dissatisfaction with the licence approval process
17. Matters relating to the environmental impacts of fish farming, including: sustainability of the salmon farming industry in relation to the preparation of farm feed; contribution of fish farming to climate change; impact of license on global protection of wild salmonoid stocks
18. Applicant's supposed record of inadequate compliance, enforcement and monitoring

In consideration of the afore-mentioned environmental concerns presented, the Appeals Board determined that the Licensee's Environmental Impact Assessment (EIA) and Environmental Impact Statement (EIS) (ALAB, 2017) did not adequately address the environmental requirements, and requested the submission of a Supplementary EIS. Furthermore, no AA screening was presented with the initial application. This demonstrates that the initial licensing decision did not adequately account for sustainability criteria, therefore requiring further data and science to guide the decision-making process.

The Supplementary EIS required that the following be addressed; risk of sea-lice infestation on wild salmonoids migrating from the surrounding rivers (Dromagowlane and Trafrask) and impact on freshwater pearl mussel populations. The second issue was the impact of waste discharge from the farm on the maintenance of good water status as required by the Water Framework Directive (European Commission, 2000). This request by the Appeals Board is consistent with best practices and research which argue that the effectiveness of the integration of environmental criteria into aquaculture licensing can be measured through the environmental quality management measures and monitoring conditions of a license.

The Supplementary EIS addressed these two issues through detailed scientific assessments. For the first issue concerning sea-lice infestation risks, the farm developer, Marine Harvest Ireland, commissioned the preparation of a hydrodynamic (HD) model to investigate the dispersal of sea lice from all sites in Bantry Bay and assess the risk posed to wild salmonoid populations (Marine Harvest Ireland, 2018). The results of the model determined that there was zero probability of sea lice entering the Dromagowlane and Trafrask Rivers. The Appeals Board accepted the results from the HD model assessment and determined that the proposed aquaculture activity in the site will not have significant effects on the receiving environment, ensuring compliance with Article 6(3) of the Habitats Directive (ALAB, 2022).

The specific management actions resulting from this decision required the Licensee to comply with Sea Lice Monitoring and Control Protocol No.3 for Offshore Finfish Farms and Pest Management Plan (Department of the Marine and Natural Resources, 2000). In regards to concerns about impact on 'Good Water Status' of the receiving environment, the Board determined that no general environmental effects will result from the operations of Marine Harvest Ireland; "the modelling results in the Water Modelling Report indicate that the impacts of the finfish farm operation at the Site will not have an adverse environmental impact

on Outer Bantry Bay's and Berehaven's current classification under the WFD Directive (ALAB, 2022).

The potential for cumulative impacts of existing salmon aquaculture operations in Bantry Bay in combination with the proposed site, addressed in the Water Modelling Report, resulted in the Board determining that the proposed farm at Shot Head would not contribute significant cumulative environmental impact (RPS, 2015; ALAB, 2022). This was further supported by the AA screening exercise conducted by the Marine Institute in 2020 which screened out the surrounding SPA and SAC sites (ALAB, 2022; Marine Institute, 2022). In conclusion, the Board found that the carrying capacity of Bantry Bay is not expected to be exceeded by the operation of the Licensee's proposed aquaculture activities. The before mentioned conclusions demonstrate the level of environmental regulatory scrutiny through which licensing applications undergo in Ireland is inconsistent. For example, the initial EIA, EIS and AA presented with the application were inadequate and confirms the need for better science and data in support of the development of a sustainable blue economy. The use of cumulative impact assessments and carrying capacity assessments for aquaculture sites could be used to better inform licensing decisions.

Oyster cultivation in Spike Island, Cork Harbour, Co. Cork

A 2009 licence application for oyster cultivation in Cork Harbour was refused in April 2022, after an 11.5-year processing period. The applicant then appealed the decision unsuccessfully (ALAB, 2021a). In the first instance, the Minister refused the application based on the Visual Impact Assessment carried out for the site and its proximity to tourism amenities in Spike Island (ALAB, 2022). The basis of the determination was the potential adverse effects on other users and economic activities (e.g., tourism) and there were no environmental concerns presented in the determination (Department of Agriculture, Food and the Marine, F. and the M, 2019c). This licensing decision reflects the failure to integrate environmental criteria into the determination process.

On the presentation of the appeal, the main reason for confirming the refusal of the application was on environmental grounds. In an AA carried out during the appeals process, the ALAB identified environmentally significant (see Table 4) effects that could arise from the proposed aquaculture site which had not been identified when the licence was first presented (ALAB, 2022).

This reflects inconsistencies in the use of environmental information during the licensing process, as the initial recommendation and conclusion statements by the Marine Institute determined that the licence would not have adverse significant impacts on the marine environment and that the qualifying features of the area would not be adversely impacted (ALAB, 2021b). But in the appeals process, it was determined that the potential impacts on the SAC and SPA sites could not be ruled out, therefore refusal of the licence was recommended. The

TABLE 4 Licence and appeal for an oyster cultivation site in spike island.

Observation	Licensing Determination	Appeals Determination
Inconsistent	Suitability of the place or waters – scientific advice determined the waters are suitable for oyster cultivation	Site deemed unsuitable because of potential disturbance or displacement impact on SCI species in Cork Harbour SPA
Consistent	Other beneficial uses of the waters covered – may have negative effects on public access to recreational and other activities	Site would have a potential significant adverse impact on other uses or users Expected to have an adverse effect on the economy of the area due to effect on tourism
Inconsistent	Statutory status of waters – site is located near Great Island SAC and Cork Harbour SPA. According to both AA for aquaculture of these two sites, the sites are not located within shellfish designated waters	Potential negative impact on the statutory status of the area
Inconsistent	No significant ecological effects on wild fisheries, natural habitats flora and fauna	Expected to have a negative ecological impact
Inconsistent	No significant impacts on the marine environment and that the quality status of the area will not be adversely impacted.	Expected to have a negative ecological impact

extended processing time and changes to the final determination suggest that a robust framework for aquaculture policy through MSP could result in more time-efficient licensing.

Oyster cultivation in Trawbreaga, Co. Donegal

In 2021, the ALAB recommended the refusal for an organic Pacific oyster cultivation licence at a site in Trawbreaga Bay, Co. Donegal be upheld (ALAB, 2020). The licence determination was based on the potential impact on pre-existing aquaculture activities and aquaculture development policy in the Bay (see Table 5 for specificities).

This decision was based on the AA carried out for the SPA of Trawbreaga Bay in 2019, in compliance with Article 6 provisions of the Habitats Directive (Marine Institute, 2021). In its final report, the ALAB cited cumulative impacts and spatial conflicts with pre-existing aquaculture activities in Trawbreaga Bay as grounds for refusal (ALAB, 2021a). For example, it cited that the proposed Site would impact on “the orderly aquaculture development in the bay” and have “negative impacts on the operations of existing oyster farms and have a hydrodynamic impact with a potential for sedimentation pattern change and rerouting of currents in the area” (ALAB, 2021a; ALAB, 2021b). This case demonstrates how spatial planning policy has been developed for aquaculture activities in specific Bays in Ireland and how this policy can inform licensing decisions.

These three case studies demonstrate how the Irish aquaculture licensing process integrates environmental criteria, primarily through the Appropriate Assessment process required by Article 6 of the Habitats Directive. The appeals cases analysed above demonstrate that there are inconsistencies in the interpretation and rigour of environmental data provided to licensing authorities. In the first instance, determinations are based on best available data and limited staff time. The appeals process provides more time and data needed for a final determination.

The rigour of environmental data was inconsistent as demonstrated by outlining the inconsistencies between the original AA presented and the AA presented during the appeal. It is essential that applicants and licensing authorities refer to existing AA for aquaculture zones when preparing and determining applications to ensure consistency with past determinations in the adjacent area. Overall, the opaque determination process could be improved to ensure more efficient and robust determinations. In the following section, the limitations of the licensing system are discussed and how this may pose a barrier to the integration of the sector into the MSP process.

Discussion

The complex institutional and regulatory framework of the aquaculture licensing process has been widely critiqued and identified as a barrier to the sustainability of the sector (Independent Aquaculture Licensing Review Group, 2017;

TABLE 5 Licence and appeal determination for oyster cultivation in trawbreaga bay.

Observation	Licence Determination	Appeals Determination
Consistent	Potential negative impact on existing oyster farms through reduced growth and hydrodynamic impact with a potential for sedimentation pattern change, and rerouting of currents in the area	Satellite imagery and visit to the proposed site confirmed the potential negative impacts on adjacent licensed sites
Consistent	Negative impact on passage of migratory fish passages and boats	Migratory fish would not use the channel in the site area
Consistent	Excessive in size in respect to past licensing policy and would not be in accordance to orderly development policy in the bay	Site is over 1.3 hectares in size, licensing policy for the Bay dictates 0.9 hectares maximum

Renwick, 2018). This is in line with barriers identified for the development of EU aquaculture more generally, which include strict environmental regulation, high bureaucratic burden, and overreliance on command-and-control instruments to manage negative environmental externalities, which hinders economic development (Abate et al., 2016; Bostock et al., 2016). As far back as 2012, numerous submissions on the Consultation for HOOW emphasised the need for a “better planning system to provide for sustainable aquaculture development” and identified foreshore and aquaculture licensing systems as barriers (Department of Agriculture, Food, and the Marine, 2012).

Furthermore, the Independent Aquaculture Licensing Review Group (2017) recommended that “a root-and-branch reform of the aquaculture license application processes is necessary”, and aquaculture operators have emphasized the need to address the dysfunctional nature of the licensing system (Rendwick, 2018). However, these concerns remain largely unaddressed as evidenced by the continuing operation of the existing licensing system (with no obvious changes/improvements) and the exclusion of the sector from the scope of the Maritime Area Planning Act, 2021. There has been great concern over the need to reform the aquaculture licensing system and ensure the sector’s integration within the enabling legislation (e.g., MAPA) of the national MSP framework. During the Pre-legislative Scrutiny of the MAPA, concern about the omission of aquaculture was presented in various instances, and the Committee recommended that regulation and management of aquaculture should be provided for in the forthcoming act (Joint Committee on Housing, Local Government and Heritage, 2021). Furthermore, the Committee was informed by the Department of Housing, Local Government and Heritage which is the relevant MSP authority in Ireland that “aquaculture would feature in the regime at a later date, noting this was a matter for the Minister for Agriculture, Food and the Marine.” In spite of this aquaculture licensing was not included in the final version, it is envisioned that through the NMPF (MSP statement), spatial planning for aquaculture should be provided to

ensure compatibility and compliance within the broader marine licensing system.

The integration of aquaculture within the new marine governance framework of Ireland underpinned by the MAPA and the NMPF is limited to a policy level as shown detailed in Table 6. The lack of an updated statutory basis underpinning the implementation of MSP in the aquaculture licensing process will limit the fulfilment of these policy objectives.

NMPF and aquaculture

These policy aspirations require a modern licensing system with fast processing times which can accommodate newer sustainable aquaculture practices such as multi-trophic approaches and the introduction of new species (Independent Aquaculture Licensing Review Group, 2017). Effectively, the current aquaculture licensing system can be considered extant within the context of the new marine planning system introduced by the MAPA. This in turn limits the effectiveness of the implementation of MSP across all sectors for the delivery of a sustainable blue economy.

Various policy documents, public consultations and government reports indicated the need to update the legislation regulating aquaculture and the need to reform the licensing system. For example, the National Strategic Plan for Sustainable Aquaculture Development 2015-2020 established four actions aimed at improving the licensing process, with one of these actions focusing on the “review and revision of the aquaculture licensing process, including the applicable legal framework” (Department of Agriculture Food and the Marine, 2015).

However little progress has been made and the government has favoured sectoral strategies and policies to support the development of the sector. Sustainable aquaculture tools have been developed by the government, based on an ecosystem approach to aquaculture with limited integration of ICZM and MSP principles. Table 7 provides an overview of one of the management tools – Co-

TABLE 6 Aquaculture policy in the NMPF.

No.	Policy
1	Proposals for sustainable development of aquaculture that:
	-demonstrate use of innovative approaches, and/or
	-contribute to diversification of species being grown in a given locality, particularly proposals applying a multi-trophic approach, and/or
	-enhances resilience to the effects of climate change should be supported
2	Non-aquaculture proposals in aquaculture production areas must demonstrate consideration of, and compatibility with, aquaculture production. Where compatibility is not possible, proposals must demonstrate that they will, in order of preference:
	a) avoid
	b) minimise
	c) mitigate significant adverse impacts on aquaculture
	d) If it is not possible to mitigate significant adverse impacts upon aquaculture, proposals should set out the reasons for proceeding.
3	Land-based coastal infrastructure that is critical to and supports development of aquaculture should be supported, in accordance with any legal requirements and provided environmental safeguards contained within authorisation processes are fully met.

TABLE 7 Sustainable aquaculture tools.

FAO EEA Principles	CLAMS
The scoping and definition of ecosystem boundaries and stakeholder identification.	<p>Plans developed for each water body through Single Bay Management practices</p> <p>Bannow Bay, Co. Waterford; Carlingford Lough, Co. Louth and Co. Down (NI); Roaringwater Bay, Co. Cork; Castlemaine Harbour, Co. Kerry; Lough Swilly, Co. Donegal; Clew Bay, Co. Mayo; Killary Harbour, Co. Galway; the North Shannon Estuary, Co. Clare; Dungarvan Harbour, Co. Waterford; Kilkerrin Bay, Co. Galway; and Mulroy Bay, Co. Donegal</p> <p>Stakeholder identification</p> <p>CLAMS Group for each management area with members from fish and shellfish aquaculture operators, regulators, consultation group representing interest groups such as tourism bodies, local recreation groups.</p>
Identification of main issues	Responsible Government departments consulted to determine relevant policy and licensing issues and CLAMS representatives are then asked to review these issues and provide feedback.
Prioritization of the issues	Identification and prioritization of issues that may impact the sustainable growth of aquaculture within each region and engage proactively.
Definition of operational objectives	<ul style="list-style-type: none"> •Supporting a thriving maritime economy •Maintaining good environmental status •Sustaining local jobs and supporting communities •Producing high quality products sought by international markets
	<p>Outcomes of the implementation of these objectives</p> <ul style="list-style-type: none"> •Development of navigation plans (Special Unified Marking Schemes (SUMS)) •Deployment and maintenance of IALA navigation markers •Preparation of bay scale aquaculture profiles to inform Appropriate assessments •Water quality projects •Beach and pier clean-ups •Re-alignment and rationalisation of mussel lines •Oyster farm realignment and trestle recycling programs •Oyster farming shore litter surveys and programs
Elaboration of an implementation plan	CLAMS National Framework sets out the structure for each Regional CLAMS Group
Corresponding implementation process, reinforcing, monitoring and evaluation	Periodic monitoring of actions implemented by CLAM Groups representatives
Long-term policy review	CLAMS National Review in 2020 and update of 5 CLAMS regional plans

ordinated Local Aquaculture Management Systems (CLAMS) that have been developed within this context, in coherence with the FAO ecosystem approach to aquaculture (FAO, 2010).

Co-ordinated Local Aquaculture Management Systems (CLAMS) have been in operation since 1998 to facilitate the organised growth and sustainable development of aquaculture inshore and in bays, and implementation has been carried out by fish and shellfish farmers. This participatory policy framework established a governance mechanism for the identification of spatial conflicts, environmental impacts of aquaculture and overall operationalisation of an ecosystem approach to aquaculture (Carr, 2019; Pendleton and Carr, 2022). Even though CLAMS attempt to coordinate and integrate the different users of Bays in which aquaculture develops, it maintains a sectoral focus. For example, data-gathering and analysis activities have been limited to evaluating the environmental quality impact of aquaculture (Bottom Grown Mussel Review Group, 2008).

In 2003, BIM, Ireland's Seafood Development Agency introduced Ecopact, an environmental quality certification (ECQ) for fish farms to support the implementation of CLAMS. Ecopact was designed to support aquaculture operators to adhere to the EU's Eco-Management and Audit Schemes (BIM, 2003). Ecopact certification requires operators to implement measures such as monitoring environmental impacts, compliance with nature conservation, management of noise, odours, waste management

and stock health management. This is in line with the EEA principles and supports the delivery of a sustainable aquaculture model in Ireland in line with the EU's new sustainable blue economy model.

The environmental quality support tools provide a foundation for the implementation of a sustainable aquaculture model, in line with the EEA. But these tools are seldom cited in licensing decisions and in support of aquaculture policy. Additionally, these tools favour a sectoral approach to aquaculture management and have a limited impact in progressing efforts towards the integration of aquaculture into a wider marine planning framework.

Marine zoning and MSP can mitigate the environmental impact of aquaculture as demonstrated by the experience of the salmon aquaculture sector in Chile, Norway and the United Kingdom (Craig, 2019). In the case of Ireland, this could be achieved through the development of Designated Maritime Area Plans (DMAP) for aquaculture and the integration of existing Single Bay Management Plans. In a similar vein, Spain has identified zones for high aquaculture potential within its national MSP and provided policy guidelines on how spatial conflicts with other marine activities can be resolved. The integration of aquaculture into the MSP process in Spain is strong as reflected by the "Marine Spatial Planning of Aquaculture in Spain" plan which was integrated into the National MSP plan (Gobierno de España, 2020). This work is further supported by an ecosystem approach to the spatial planning

of aquaculture which reflects the integration of ecological boundaries as evidenced by the strategic plans created for the three eco-regions of Spain (e.g., North-Atlantic, Mediterranean and Canary Islands) (Stelzenmüller, 2016).

In Scotland, aquaculture has been integrated into the marine licensing process through the Marine Scotland Act 2010 through the requirement of a marine licence for the installation of marine farming equipment (Scottish Government, 2010). This effectively streamlines the marine planning system with the aquaculture licensing process and provides a statutory basis for the policy objectives defined for the aquaculture sector by Scotland's MSP. Overall, the Spanish and Scottish experiences demonstrate how aquaculture can be integrated within MSP national processes to ensure the sustainable development of the sector and the attainment of broader sustainable blue economy ambitions.

In order to further align the aquaculture sector with MSP, a carrying capacity approach can be applied through licensing. This could be achieved through the integration of carrying capacity assessments into DMPAs developed for aquaculture. This approach has seen particular success in the salmon aquaculture licensing system in Norway (Bailey and Eggereide, 2020). In Norway, salmon aquaculture licensing shares several elements with steps in the MSP process, providing for wider coherence in marine planning and the attainment of sustainable development;

- Establish institutional framework;
- Assess baseline and identify issues;
- Establish vision and objectives;
- Produce plan;
- Establish public consultation;
- Implementation;
- Monitoring and review.

(Stelzenmüller, 2016). Given the importance of the salmon aquaculture sector in Ireland, it will be essential for the NMPF to identify approaches to better accommodate the sector.

Conclusion

This paper outlines the fragmented regulatory framework in which aquaculture operates in Ireland and how the failure to integrate it into the legislation underpinning MSP presents a missed opportunity to develop a truly inter-sectoral marine governance approach. The development of marine and environmental governance in Ireland has developed in a fragmented manner which has led to the limited integration of the sector into the evolving marine governance landscape. This is in part a broader governance issue as Ireland has been slow at adopting statutory environmental requirements derived from EU environmental conservation law (OECD, 2021). MSP can help resolve these issues and enable the development of sustainable aquaculture. Below, recommendations based on best practices from other European jurisdictions are presented to demonstrate how aquaculture can be better integrated into MSP.

In conclusion, the differentiated management regime of aquaculture and its exclusion from the new marine planning regime demonstrates that Ireland faces barriers in the full implementation of MSP by omitting a key sector from legal reform. Furthermore, the legal uncertainty of the sector limits the development of innovative aquaculture models outlined in the NMPF such as integrated multi-trophic aquaculture and the introduction of new species with lower trophic impact (Alexander et al., 2015; Craig, 2019). The current framework poses a challenge to meeting over-arching law and policy objectives established by NMPF as aquaculture continues to operate in an extant system. To summarise it is essential that the Irish licensing system is updated to facilitate the development of sustainable aquaculture, and integrate it into the sustainable blue economy being promoted through MSP.

Author contributions

MT was the main author of the manuscript. JA wrote the following section: EU Marine Governance. AO'H assisted in the writing of the section on Marine Governance in Ireland. All authors contributed to the article and approved the submitted version.

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Conflict of interest

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

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