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Implementing the Strategic Guidelines on EU Aquaculture
Planning of space and access to water for marine aquaculture

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DISCLAIMER: This document reflects only the views of the Commission and is not of a legally binding nature. It has been prepared according to the methodology described in Annex 1. It rests with the EU Court of Justice to provide a definitive interpretation of relevant EU legislation.

LIST OF ACRONYMS

AMA	Aquaculture management area
AZA	Allocated zone for aquaculture
EIA	Environmental impact assessment
EU	European Union
FAO	Food and Agriculture Organization
GIS	Geographic information systems
IMTA	Integrated multi-trophic aquaculture
MPA	Marine protected area
MSFD	Marine Strategic Framework Directive
MSP	Maritime spatial planning
PSOEM	Plano de Situação do Ordenamento do Espaço Marítimo Nacional
SEA	Strategic environmental assessment
WFD	Water Framework Directive

1. INTRODUCTION

In May 2021, the European Commission adopted a *Communication on strategic guidelines for a more sustainable and competitive EU aquaculture for the period 2021 to 2030 ([1])* ('the Strategic Guidelines'). These guidelines set the vision for EU aquaculture to grow into an even more competitive and resilient sector and become a global reference for sustainability by 2030. They are the result of extensive consultation with EU Member State experts and the Aquaculture Advisory Council as well as a public consultation.

The Strategic Guidelines identify a wide range of areas where further action is needed, including access to space and water for aquaculture. These guidelines note that 'coordinated spatial planning, with the early involvement of relevant stakeholders, is essential' as it can 'ensure the allocation of space and water among different activities, while preserving ecosystems'. They provide some recommendations and call on the Commission (Annex 2.1.1.) to *'develop a more detailed guidance document on the planning for space and access to water for marine, freshwater and land-based aquaculture'.*

This document covers only access to space and water for marine aquaculture. It concerns marine waters under the jurisdiction of coastal EU Member States, i.e. offshore, coastal and estuarine areas of full seawater and transitional (brackish) water. The Commission is currently preparing a separate document on access to space and water for freshwater and land-based aquaculture.

The document seeks to offer authorities and policymakers in Member States responsible for planning in the marine environment, and in particular for the allocation of marine space to aquaculture activities, potential solutions to facilitate the development of the EU aquaculture sector. This document (i) identifies key challenges and conditions for providing access to space to marine aquaculture; (ii) describes the relevant aspects and steps for providing access to space to marine aquaculture; (iii) consolidates existing good practices and describes relevant tools; and (iv) refers to some concrete examples of the application of those good practices and tools.

Annex 1 describes the methodology for its preparation. In addition to EU Member States, work to prepare for this document has also taken into consideration practices and tools from the UK and Norway, due to their proximity to the EU and the importance of their aquaculture production, research and innovation.

Annex 2 contains a list of EU-funded projects referred to in the document.

Taking into consideration the continuous development of the sector (e.g. emerging integrated multi-trophic aquaculture (IMTA) and offshore aquaculture), this document will need to be regularly updated. Any future updates will be published on the EU Aquaculture website (https://aquaculture.ec.europa.eu/).

[1]) Communication from the Commission to the European Parliament, the Council, the European Economic and Social Committee and the Committee of the Regions on the strategic guidelines for a more sustainable and competitive EU aquaculture for the period 2021 to 2030 (COM/2021/236 final) (Aquaculture guidelines (europa.eu))

It is important to note that the hyperlinks in this document are valid at the time of its publication. Updates to these hyperlinks might be necessary in the future and will also be provided via the EU Aquaculture Assistance Mechanism website.

2. CONDITIONS AND CHALLENGES FOR ACCESS TO SPACE FOR MARINE AQUACULTURE

Not all available locations are suitable for aquaculture, and not all suitable locations are available for aquaculture. Several conditions and challenges impact the potential for marine aquaculture to access space in the present and the future. These are described below and are related to: (i) production and economic conditions; (ii) policy and regulatory and institutional framework; (iii) environmental and climate-related conditions; (iv) socio-economic considerations; and (v) knowledge and technology.

2.1. PRODUCTION AND ECONOMIC CONDITIONS

2.1.1. Production constraints and conditions for space allocation

The development of marine aquaculture is highly dependent on the surrounding environment. Environmental features of the space targeted therefore need to be taken into consideration when planning aquaculture development, in particular water quality, but also other features like bathymetry (submarine topography), wave amplitude or the renewal rate of sea masses. The impacts of anthropogenic pressures from land (e.g. pollution) are a particularly relevant factor to assess. It is therefore important to define the necessary distance of aquaculture sites from other activities and sources of pollution.

Furthermore, different species and types of aquaculture production have different demands in terms of the conditions of space and water (e.g. distance to the seashore, water quality). Water quality is particularly important to minimise food safety risks and associated producer costs (e.g. depuration) for the farming of molluscs. In terms of space, seaweed and molluscs produced in suspended/rope culture require a large surface area.

Identifying ‘secure’ sites to ensure that aquaculture facilities are resilient to extreme events is also an important consideration.

Table 1 recalls the level of dependency of different types of marine aquaculture production on key conditions that have a direct impact on the location of the production sites.

Table 1: Production constraints for different aquaculture groups

Conditions	Farmed species		
	Finfish	Molluscs/bivalves	Macroalgae
Requirement for space (surface area)	Medium	Medium (intertidal zone)/high	Very high
Distance to the shore for production	Short distance	Very short (oyster)- Short/medium (mussels)	Low relevance (except when co-located with offshore wind farms)
Frequency of access	Daily (feeding if not automated)	Weekly/monthly (oyster) Low for mussels	Low
Access to land	Medium (port close to the farm)	High for oyster (refining) Medium for mussels	Low (port)
METOC ([2]) condition sensitivity	High (wave) Temperature	Temperature Acidification (pH)/ salinity	Low
Environmental sensitivity	Mid/low – need for water circulation under the cages	High with land pollution	Low (except at very large scale)

Note: High (red), medium (orange) or low (green) level of production constraints for each aquaculture species.

Source: Assistance Mechanism for Maritime Spatial Planning (AM-MSP)

The Strategic Guidelines note that spatial planning should 'anticipate the development of offshore aquaculture, where natural conditions allow ([3])'. Offshore sites indeed allow aquaculture development further from coastal areas, where most human activity and pollution are concentrated and where water temperatures are more variable. However, offshore aquaculture still has a number of challenges, including a more hostile physical environment, logistical challenges, and knowledge gaps ([4]).

([2]) Meteorological and oceanographic.

([3]) For the purpose of the strategic guidelines and this document, 'offshore aquaculture' is aquaculture 'located > 2 km or out of sight from the coast, in water depths > 50 m, with wave heights of 5 m or more, ocean swells, variable winds and strong ocean currents, in locations that are exposed (open sea, e.g. ≥ 180° open) and where there is a requirement for remote operations, automated feeding, and where remote monitoring of operating systems may be required.'

([4]) Offshore sites' physical conditions include bigger waves, different climate and strong currents, which have implications for mooring, stock containment and operations. Logistical challenges include longer transit times to/from farms, and the need for larger work boats and support facilities e.g. for storage, access to port facilities and farm security, all of which have an impact on cost and profitability. In addition, there is a need for more knowledge and information, including for modelling of growth and other farm performance that is still lacking

2.1.2. Economic considerations for space allocation

In terms of the economic viability of aquaculture activities, it is important to take into consideration the following factors: (a) the interest of the sector (investors); (b) existing or targeted production; (c) proximity to potential markets; (d) land infrastructure, in particular port infrastructure and connectivity (port facilities to ensure access to production sites, storage space for food stock, breeding or mollusc depuration or conditioning before sale); (e) interactions and synergies with other sectors (e.g. tourism or processing); and (f) availability of skilled workers and experts. Aquaculture should ideally be part of larger blue economy clusters in order to share landside facilities and infrastructure with other maritime economic activities and benefit and contribute to services such as research and innovation.

2.2. POLICY, REGULATORY AND INSTITUTIONAL FRAMEWORK

2.2.1. Policy context

A key driver in access to space for aquaculture is the political priority given to this activity at national and regional levels in relation to other maritime economic activities. Moreover, aquaculture development should contribute to the objectives of the broader policy agenda. In the EU, aquaculture should contribute to the objectives of the European Green Deal, including the decarbonisation of the economy, the fight against climate change and the mitigation of its impact, the reduction of pollution, better preserving biodiversity, and a more circular management of resources. In particular, the following objectives have to be taken into consideration:

- increase in the EU's network of marine protected areas (MPAs) to 30% of EU waters by 2030, of which 10% should be strictly protected ([5]);
- put in place restoration measures covering at least 20% the EU's marine area by 2030, and other relevant targets of the proposed Nature Restoration Regulation([6]).
- develop offshore renewable energy ([7]);
- upscale algae production in the EU ([8]);
- significant increase in organic aquaculture ([9]);

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for a number of different systems and development options, as well as the adaptation of many husbandry practices to offshore farms.

([5]) The Commission Communication *EU Biodiversity Strategy for 2030 Bringing nature back into our lives* (COM/2020/380 final) commits to legally protect 30% of our seas, of which one third should be strictly protected. See also the related Communication *EU Action Plan: Protecting and restoring marine ecosystems for sustainable and resilient fisheries* (COM (2023) 102 final).

([6]) Pending the final adoption by the Council, see the most recent version of the Nature Restoration Regulation here (provisionally agreed text adopted by the European Parliament): https://www.europarl.europa.eu/doceo/document/TA-9-2024-0089_EN.pdf.

([7]) Commission Communication *EU Strategy to harness the potential of offshore renewable energy for a climate neutral future* COM(2020)741 final of 19.11.2020, updated by the Communication COM(2023)668 final of 24.10.2023.

([8]) Commission Communication *Towards a Strong and Sustainable EU Algae Sector*, COM (2022) 592 final (EUR-Lex - 52022DC0592 - EN - EUR-Lex (europa.eu)).

([9]) The Commission Communication *A Farm to fork strategy for a fair, healthy and environmentally-friendly food system* (COM(2023) 381 final).

- achieve 'good environmental status' in the marine environment ([10]);
- achieve 'good ecological status' and 'good chemical status' of EU waters ([11]).

In the context of the European Green Deal, special attention should be given to the development of aquaculture with a lower environmental impact (such as farming low-trophic and non-fed species, or combining the farming of different species to reduce the emissions of nutrients and organic matter into the environment in IMTA systems). Furthermore, increasing the integration of suitable aquaculture activities (in particular those offering ecosystem services) into protected areas such as Natura 2000 sites and other MPAs should also be an important objective.

2.2.2. Legislative and regulatory conditions

Aquaculture development in the EU needs to respect applicable legislation both at EU and Member State level. EU legislation relevant for access to space for marine aquaculture is mostly environmental legislation, sanitary legislation (in particular for shellfish farming) and legislation on organic production ([12]). Moreover, the Maritime Spatial Planning (MSP) Directive obliges EU Member States to adopt and implement maritime spatial plans (MSP plans)([13]). Member States' plans identify the spatial and temporal distribution of relevant existing and future activities and uses in their marine waters. Aquaculture is among the maritime economic activities that could be covered by these plans ([14]).

EU environmental legislation applicable to aquaculture includes the Birds and Habitats Directives ([15]), the Water Framework Directive (WFD), the Marine Strategy Framework Directive (MSFD), the Strategic Environmental Assessment (SEA) Directive ([16]), and the

([10]) Directive 2008/56/EC of the European Parliament and of the Council of 17 June 2008 establishing a framework for Community action in the field of marine environmental policy (Marine Strategy Framework Directive).

([11]) Directive 2000/60/EC of the European Parliament and of the Council of 23 October 2000 establishing a framework for Community action in the field of water policy (Water Framework Directive).

([12]) See Regulation (EU) 2018/848 of the European Parliament and of the Council of 30 May 2018 on organic production and labelling of organic products (Regulation - 2018/848 - EN - EUR-Lex (europa.eu)) (Organic Production Regulation). Annex II, Part III of this Regulation sets the production rules for algae and aquaculture animals. Some of these rules are relevant in terms of allocation of space for organic aquaculture, notably in terms of locating farms in areas not subject to contamination with products or substances not authorised for use in organic production, or with pollutants that would compromise the organic nature of the products, and minimum separation distances from non-organic production.

([13]) Directive 2014/89/EU of the European parliament and of the Council of 23 July 2014 establishing a framework for maritime spatial planning (MSP Directive).

([14]) According to Article 5.2 of the MSP Directive (Objectives of maritime special planning), 'Maritime spatial planning shall contribute to the sustainable development of aquaculture, among other sectors, and to the preservation, protection and improvement of the environment, including resilience to climate change impacts'. Article 8(2) (Setting-up of maritime spatial plans) provides that when setting up maritime spatial plans, Member States shall take into consideration relevant interactions of activities and uses. 'Aquaculture areas' are mentioned among possible activities and uses.

([15]) The Birds and Habitats Directives provide the legislative framework for the protection of biodiversity. See Directive 2009/147/EC of the European Parliament and of the Council of 30 November 2009 on the conservation of wild birds; and Council Directive 92/43/EEC of 21 May 1992 on the conservation of natural habitats and of wild fauna and flora.

([16]) Directive 2001/42/EC of the European Parliament and of the Council of 27 June 2001 on the assessment of the effects of certain plans and programmes on the environment.

Environmental Impact Assessment (EIA) Directive ([17]). This legislation establishes an ecosystem-based approach ([18]) with the precautionary principle and adaptive management at the core of its operation. Complying with the requirements of EU environmental legislation therefore requires a good understanding of the marine environment, taking into account its ecological carrying capacity in each selected area ([19]).

Under the Birds and Habitats Directives, requirements related to species protection and management of Natura 2000 sites are particularly relevant for aquaculture activities, including their planning and permitting. For example, MSP plans as well as other plans or individual projects should be subject to an assessment of their effects on Natura 2000 sites. This should contribute to strategic planning and ensuring compatibility of aquaculture activities with conservation of the sites.

The WFD sets out the framework for the integrated management of river basin districts, with the aim of achieving good status for all EU waters (including transitional and coastal waters). It includes provisions that enable Member States to designate protected areas for the protection of economically significant aquatic species and to set objectives, additional to those set to achieve good status, to ensure the water reaches the necessary quality for such species.

Aquaculture, the same as other sectors, needs to contribute fully to the achievement of the 'good environmental status' of the marine ecosystem. Under the MSFD, this should be reached for 11 descriptors, some of which are pertinent for marine aquaculture activities ([20]). The key issues in relation to the MSFD are the spatial scale at which the environmental impacts occur, and their cumulative impact considered together with the impacts from other anthropogenic pressures. These need to be considered in relation to the criteria for assessment under the different MSFD descriptors and at the spatial scales defined for the MSFD assessments. The establishment of threshold values from the different MSFD descriptors will apply to the aquaculture sector and help consider cumulative impacts in planning activities at sea.

The Commission published guidance documents to facilitate the knowledge and implementation of EU environmental legislation in relation to aquaculture activities ([21]). As established in the Strategic Guidelines, a future document on environmental performance will provide further guidance on implementing the legal requirements for the sector laid down in EU legislation, including relevant case-law.

([17]) Directive 2011/92/EU of the European parliament and of the Council of 13 December 2011 on the assessment of the effects of certain public and private projects on the environment.

([18]) See Article 1(3) of the MSFD: 'Marine strategies shall apply an ecosystem-based approach to the management of human activities, ensuring that the collective pressure of such activities is kept within levels compatible with the achievement of good environmental status and that the capacity of marine ecosystems to respond to human-induced changes is not compromised, while enabling the sustainable use of marine goods and services by present and future generations'.

([19]) On the assessment of ecological carrying capacity, see section 4.3.

([20]) These include: D2 (non-indigenous species), D6 (seabed integrity), D8 (contaminants), D9 (contaminants in seafood) and D10 (marine litter).

([21]) See the Commission Staff Working Document on the application of the Water Framework Directive (WFD) and the Marine Strategy Framework Directive (MSFD) in relation to aquaculture | EU Aquaculture Assistance Mechanism (europa.eu), and the Guidance on aquaculture and Natura 2000: Sustainable aquaculture activities in the context of the Natura 2000 Network | EU Aquaculture Assistance Mechanism (europa.eu).

Taking into consideration the objectives of the MSFD, the threshold values for determining 'good environmental status', and the restoration objectives defined in the proposed Nature Restoration Regulation, the development of marine aquaculture and the allocation of space to this activity will increasingly depend on the ability to reduce/compensate the environmental impact of aquaculture activities and contribute positively to environmental conservation.

On sanitary legislation, food safety legislation is particularly relevant for planning space for the farming of bivalve molluscs. This legislation sets a classification of harvesting areas depending on the levels of microbiological and chemical contaminants, including marine biotoxins. The WFD requires Member State authorities to ensure the special protection of waters for bivalve mollusc production ([22]).

2.2.3. Institutional aspects

Different authorities in Member States are involved in providing access to marine space for aquaculture (e.g. authorities responsible for spatial planning, environmental protection and aquaculture respectively). Moreover, the allocation of marine space is often delegated to the regional/local level. The coordination and sharing of information between these authorities, including the central government responsible for wider spatial planning and regional and local authorities responsible for the allocation of marine space, is therefore required.

2.3. ENVIRONMENT AND CLIMATE

2.3.1. Environmental considerations

In addition to the production conditions for aquaculture described above (ensuring a suitable environment for the development of aquaculture), there are other important environmental aspects to consider for access to space for marine aquaculture. The first is the evaluation and mitigation of any potential significant negative impact on the environment of planned aquaculture activities in line with EU environmental legislation (see section 2.2.2). The other aspect to be considered is the promotion of positive impacts of aquaculture on the environment (e.g. by promoting certain types of aquaculture offering environmental services).
In particular, the following key aspects should be considered:

(1) evaluating at an early stage potential impacts on the ecosystem where planned aquaculture activities are to be located, in particular by relying on the provisions of the SEA Directive;
(2) determining the maximum aquaculture production that does not cause unacceptable impact on the environment (ecological carrying capacity), taking into account the threshold values for 'good environmental status established in the MSFD ([23]); and

([22]) Regulation (EU) 2017/625 of the European Parliament and of the Council of 15 March 2017 on official controls and other official activities performed to ensure the application of food and feed law, rules on animal health and welfare, plant health and plant protection products (Regulation on official controls) requires Member State authorities to undertake an extensive programme of official control monitoring of live bivalve molluscs from their harvesting waters. The results of this programme are used to determine whether an area should be open or closed for harvesting depending on the levels of microbiological and chemical contaminants, including marine biotoxins. Furthermore, under the Organic Production Regulation, the criteria for the selection of the areas for organic production of bivalve molluscs refer to the highest quality criteria set under the food safety legislation for shellfish and set for water under the WFD and MSFD.

([23]) On the assessment of ecological carrying capacity, see section 4.3.

(3) evaluating potential synergies and conflicts with nature protected areas.

2.3.2. Climate change

The Strategic Guidelines highlight that planning of space for aquaculture should anticipate and integrate the impacts of climate change. These are both short-term (e.g. loss of production or infrastructure due to extreme events, increased risk of diseases, toxic algae blooms and parasites) and long-term (e.g. reduced availability of wild seed, too high water temperatures, acidification of sea water). Some available adaptation measures have space allocation implications, such as the reconsideration or relocation of existing aquaculture sites and the identification of new areas for marine aquaculture (e.g. areas with natural protection for fish farms and structures against extreme events), as well as protection and restoration of natural ecosystems to increase the resilience of those systems to deliver services like wild seed as well as natural predators for parasites ([24]).

2.4. SOCIO-ECONOMIC CONSIDERATIONS

Planning of aquaculture activities cannot disregard the need to ensure a 'social licence to operate'. Aquaculture is an economic activity that can create jobs, promote coastal and rural development and maintain the provision of services (social, medical and educational) in rural or isolated communities. However, the social acceptability of the activity among these communities relies also on the long-term sustainability of the sector in terms of environmental protection, and on its integration with other activities and the traditional 'heritage' of that particular area (e.g. fisheries, tourism). Providing small-scale operators and young generations (e.g. start-ups) with access to the activity can also contribute to social acceptance. Aquaculture development can in fact be a way to ensure that young people can remain in their coastal and rural areas after they finish their studies. It can also provide alternative or complementary sources of income to fishers in case of declining fishing stocks ([25]).

2.5. KNOWLEDGE AND INNOVATION

2.5.1. Knowledge

Providing suitable space to marine aquaculture while preserving the ecosystem requires gathering a significant amount of knowledge and data, including on the space available, aquaculture activities (e.g. planned, active and inactive), socio-economic data on economic development in the marine environment and other maritime economic activities, physical data about marine waters, and other environmental data for assessing and monitoring the potential impact of aquaculture activities in marine ecosystems.

Furthermore, data needs to be available to different public authorities and private operators. Although the EU provides platforms for sharing marine environmental data ([26]), there is still a

([24]) The Commission is currently preparing a document on climate-change adaptation in the aquaculture sector, which will contain more details on this issue.

([25]) As provided in the Annex to the Strategic Guidelines, the Commission will work on a document collecting good practices on the integration of the aquaculture sector into local communities, in particular in developing synergies with other sectors and a circular economy approach.

([26]) The European Marine Observation and Data Network (EMODnet) provides free and unrestricted access to marine data collected in the field, covering seven thematic disciplines. The network and Copernicus Marine will provide the data at the core of the European Digital Twin of the Ocean, a digital modelling platform that

lack of sharing of spatial data between sectoral managers at national level (e.g. aquaculture, shipping, etc.) and the agencies responsible for spatial planning ([27]).

2.5.2. Production development and technical innovation

The allocation of space to marine aquaculture should be forward-looking, anticipate production and technological developments, and allow sufficient flexibility to adapt to and support the changing nature of aquaculture activities and, in particular, the development of forms of aquaculture with a lower environmental impact. This includes, for example, moving aquaculture offshore or developing the farming of lower trophic species, including macroalgae molluscs and IMTA. Relevant developments and technological innovation in other sectors (e.g. offshore renewable energy, shipping, ports) should also be taken into consideration to avoid conflict and maximise synergies.

3. RELEVANT ASPECTS AND STEPS FOR PROVIDING ACCESS TO SPACE TO MARINE AQUACULTURE

The allocation of space to marine aquaculture can be divided into three main phases:

1) planning and identification of areas suitable for aquaculture (zoning);
2) site allocation to economic operators; and
3) area management and monitoring.

These phases follow each other for the creation of new zones or areas. However, where aquaculture sites have already been established for individual operators (phase 2), it is of course still possible to assess these allocations within a new or revised planning approach (phase 1) or with changes to the conditions to maintain the space (phase 3).

This document will focus on the first phase ([28]). However, good planning and the identification of areas suitable for aquaculture facilitates the two other steps. Furthermore, the design of an aquaculture management area can be part of the planning and identification of areas suitable for aquaculture ([29]). Also, regular monitoring of aquaculture areas can help provide information useful for the future allocation of space.

Providing access to marine space for aquaculture activities should be based on the ecosystem approach to aquaculture. This approach integrates aquaculture into the wider ecosystem. According to the three principles of the approach applicable to planning, marine aquaculture should: (i) be developed in the context of ecosystem functions and services (including biodiversity) with no degradation of these beyond their resilience; (ii) improve human well-being with equity for all relevant stakeholders (e.g. access rights and fair share of income); and

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will boost our ability to assess and evaluate policy alternatives for the marine environment by testing different management scenarios. To do this, the platform will incorporate environmental, social and financial information. European Marine Observation and Data Network (europa.eu).

([27]) See section 4.8 Sharing of data relevant to aquaculture activities.

([28]) Site allocation to economic operators and area management are steps covered in other documents, in particular the document on the regulatory and administrative framework of aquaculture.

([29]) See section 4.4 on aquaculture management areas.

(iii) be developed in the context of other sectors, policies and goals as appropriate ([30]). Ecosystem-based management therefore presents a transition from traditional sector-by-sector planning and decision-making to the broader approach of integrated natural resource management at different scales and for ecosystems that cross administrative boundaries.

4. GOOD PRACTICES AND TOOLS IN THE PLANNING AND IDENTIFICATION OF AREAS FOR AQUACULTURE

The Strategic Guidelines provide some general recommendations on good practices in the planning and allocation of space for aquaculture. This section describes in more detail relevant good practices and tools both at the level of MSP and the identification of suitable areas for aquaculture outside the MSP process. These good practices and tools include:

1) integration of aquaculture into MSP, integrated coastal zone management ([31]) and national environmental strategies;
2) zoning and identification of allocated zones for aquaculture;
3) decision support and geographical information systems and definition of ecological carrying capacity;
4) aquaculture management areas;
5) integrated and multi-stakeholder decision-making process for space allocation;
6) strategic environmental assessment and appropriate assessment under the Habitats Directive;
7) multi-use and co-location;
8) sharing data relevant to aquaculture activities;
9) monitoring the use of space allocated to aquaculture.

4.1. INTEGRATION OF AQUACULTURE INTO MARITIME SPATIAL PLANNING, INTEGRATED COASTAL ZONE MANAGEMENT AND NATIONAL ENVIRONMENTAL STRATEGIES

As indicated in the Strategic Guidelines, integration of aquaculture into MSP as a priority activity is essential for securing access to space for the sector. This can be done either as a sole user or ideally as a recognised user in a multi-use scenario. MSP plays a critical role in allocating space to different maritime economic activities and fully integrating ecological carrying capacities in the most efficient and synergistic way possible.

Even if the MSP Directive explicitly recognises aquaculture as one of a number of maritime economic activities for inclusion in maritime spatial planning, it is non-prescriptive about how aquaculture (or any other maritime sector) should be included in national plans. More aquaculture-specific guidance for the allocation of space was made available through projects

([30]) See FAO policy brief on Aquaculture zoning, site selection and area management under the ecosystem approach to aquaculture (fao.org).

([31]) Integrated coastal zone management is a dynamic, multidisciplinary and iterative process to promote the sustainable management of coastal zones.

like the Horizon 2020 project AQUASPACE and the cross-border MSP planning projects for the Black Sea (Bulgaria and Romania) in the MARSPLAN I & II projects ([32]).

The geographical scope of MSPs as described in the MSP Directive is 'marine waters'. This may exclude coastal waters falling under a Member State's town and country planning, provided that this is communicated in its MSP ([33]). Given much of EU aquaculture is currently coastal, this is a significant clause that should not lead to Member States excluding aquaculture from fine-scale spatial planning at local level.

EU Member States' plans have integrated aquaculture in different ways:

1) Some plans identify the areas where aquaculture activities can take place. Among those, some plans restrict aquaculture activities to designated areas (e.g. Denmark, Finland ([34]), France ([35]), Croatia). In other Member States, plans are flexible and new areas for marine aquaculture can still be identified or created afterwards (e.g. Portugal) ([36]).
2) In some plans aquaculture is excluded from certain areas (e.g. Estonia) ([37]).
3) Some plans do not define specific areas for aquaculture but provide guidelines for the development of the sector (e.g. Estonia and Latvia) ([38]).
4) In some Member States, opportunities for the sector's development are provided in multi-use areas (e.g. Belgium and Estonia) ([39]) ([40]).

It is important to note that in several Member States where aquaculture plans or zoning plans were already in place before the MSP Directive and endorsement of the national MSP plans, those plans were integrated into the MSP plans. Box 1 below describes this integration.

([32]) These projects developed specific case studies for the major challenges within the Romanian and Bulgarian maritime space, including aquaculture.

([33]) See Article 2.1 of the MSP Directive on scope.

([34]) In Finland, sites have been identified as potentially suitable for marine aquaculture, but this does not guarantee that permits will be issued due to case-by-case considerations.

([35]) In France, each MSP plan ('Document Stratégique de Façade') includes vocational areas dedicated to marine aquaculture. Any marine aquaculture plan or project at regional or local level must comply with the geographical scope of the MSP plan, which can include a wide range of administrative levels.

([36]) In Portugal, new areas can be secured by an applicant by drawing up an allocation plan and environmental impact assessment. The newly established area will then lead to an update of the PSOEM.

([37]) Estonia's MSP designates areas prohibited for marine aquaculture, mainly for conservation reasons (national parks) and also for reasons related to the navigation of vessels and military activities.

([38]) This is also the case for the Scottish National Marine Plan, which includes 14 specific marine planning policies relating to aquaculture development in Scotland.

([39]) In the Belgian MSP plan, in addition to a number of specific zones allocated to aquaculture, sustainable aquaculture can also be developed within the five more generic 'Commercial and Industrial zones'.

([40]) See section 4.7. Multi-use of space and colocation.

Box 1 – Integration of marine aquaculture plans and areas into MSP plans in Portugal, France and Spain

In **Portugal**, aquaculture production areas (APAs) created in 2008 have been absorbed into the Plano de Situação do Ordenamento do Espaço Marítimo Nacional (PSOEM ([41])). This plan now includes the existing APAs plus new identified potential areas. The APAs have defined environmental carrying capacities and can also define what type of aquaculture activity might be used in that area. The Aquaculture in Brackish Waters Plan for mainland Portugal, published in September 2022, aims to organise the activity, promote its sustainability in accordance with territorial plans and identify current and potential areas for aquaculture purposes.

In **France**, the current regional marine aquaculture development schemes will disappear and be fully included in MSP defined at sea basin level (the 'Documents Stratégiques de Façade', DSFs). This integration is part of the DSFs' Action plan. Full integration into the DSFs will give more visibility to the use of marine aquaculture areas (even if management is carried out at the local level) and facilitate the development of the sector, taking advantage of the legal compliance of all the plans related to the sea under the geographical scope of the DSF.

In **Spain**, work was carried out between 2016 and 2022 within the framework of the National Advisory Board on Aquaculture (JACUMAR) to line up different regional approaches and share concepts and criteria. The aim was to come up with a harmonised and robust spatial planning proposal. This joint work has allowed for an exhaustive sectoral characterisation (inventory of existing uses) of Spanish marine aquaculture and to draw up an inventory of potential areas for future use (inventory of future uses). This coordinated technical work has been developed by the regional authorities. It has allowed them to present a single joint proposal of aquaculture for integration into the MSP adopted in February 2023.

A good practice in integrating aquaculture activities in MSP is to include specific **policies and guidelines for aquaculture development**. These would cover (a) **aquaculture-specific policies**, such as the promotion of certain species or production systems overall (e.g. new aquaculture species, species and systems with good environmental performance and systems that contribute to climate change adaptation and mitigation), or the definition of species and production methods for different spatial areas taking into consideration environmental conditions ([42]); and (b) **cross-sectoral policies**, providing guidance on how aquaculture can avoid spatial conflict with other maritime economic activities (e.g. the use of exclusion zones) and how synergies and co-location opportunities can be maximised (e.g. development of seafood clusters that support both marine aquaculture and fisheries).

Some MSP plans identify the **type of species targeted** in areas designated for aquaculture. For example, the Portuguese plan establishes spatial segregation of the different forms of aquaculture (e.g. bivalves are within 1 nm of the coastline and finfish 1.5 nm), although the licensing process is the same. In France, the types of species targeted are designated in existing production areas. In Denmark, there is a defined level of specification for the areas where

([41]) Início – Ordenamento do Mar Português (psoem.pt)

([42]) For example, an MSP plan could determine that areas for finfish pen culture need to comply with certain requirements related to depth and distance from the shoreline.

aquaculture can be developed, as the MSP includes: (a) development zones for marine fish farming; (b) development zone for cultivation and transplantation banks for the production of mussels and oysters; and (c) development zone for the farming of mussels and oysters in the water column. Belgium's MSP plan encourages the farming of shellfish and macro algae, either in stand-alone systems or combining their production with existing or new 'offshore' infrastructure.

Moreover, as indicated above, it is important that spatial planning (including MSP plans) **is forward-looking, anticipatory and flexible** to new spatial needs. This requires a suitable sector analysis as part of the MSP process, with the involvement of aquaculture stakeholders in the MSP consultation as well as the coordination between responsible MSP and aquaculture authorities.

MSPs should therefore be dynamic and living documents that are updated to take into consideration the technical changes and the evolution of aquaculture production models and associated needs for space allocation (e.g. offshore aquaculture ([43]), expansion of low-trophic aquaculture such as seaweed and IMTA), manage possible conflicts and create synergies with other sectors as changes occur (e.g. development of low-trophic aquaculture and IMTA at suitable scales in combination with MPAs).

In order to ensure that they remain fit for purpose, MSP plans and their updates should include evolutions related to changing environmental conditions under climate change as well as spatial management for more resilient systems, including, if necessary, the relocation of aquaculture activities. Spatial implications of climate change on aquaculture should be included in Member States' climate adaptation plans ([44]).

As indicated in section 2.1.1, aquaculture needs access to land facilities and space. In addition, anthropogenic pressures from land (e.g. contaminants) need to be taken into consideration. Space allocation for the sector therefore needs to integrate maritime and land planning. This can be done through the development of **integrated coastal zone management** in connection with the MSP process, which requires coordination between relevant authorities in all the planning processes.

Furthermore, it is important to ensure the **incorporation of aquaculture development within national environmental strategies**, in particular marine strategies ([45]). This helps develop

([43]) MSP plans have an essential role in addressing challenges to the expansion of aquaculture offshore, especially since it will often bring it under national rather than local jurisdiction. This might include: (a) spatial zoning for particular types of aquaculture systems; (b) the integration of models for wave climate, storm frequency, current and wind speeds that will facilitate the development of all offshore maritime economic activities (including aquaculture); and (c) the identification of spatial synergies across maritime economic activities for either co-development or land-sea access integration (e.g. ports, maintenance trips, etc).

([44]) The future document on climate-change adaptation in the aquaculture sector will cover space allocation adaptation measures.

([45]) The MSFD requires Member States to achieve 'good environmental status' (in terms of health, biodiversity, productivity and long-term sustainability) in EU marine waters and draw up marine strategies to this end. The Directive considers the pressures on the seas and oceans, including those associated with aquaculture, in an attempt to address the cumulative impact of human activities. Other relevant environmental strategies include: river basin management plans (required by the WFD); prioritised action frameworks, which set out actions to be taken to protect Natura 2000 areas; and action plans on pathways of invasive alien species.

aquaculture while achieving environmental objectives. MSP should take such integration into account.

4.2. ZONING AND DEFINITION OF ALLOCATED ZONES FOR AQUACULTURE

According to the Strategic Guidelines, spatial planning should be based on the designation of areas suitable for aquaculture (or allocated zones for aquaculture, AZAs) ([46]). This can be done as part of the national MSP or separately (regionally or locally), but in a way consistent with the broader spatial planning set by an MSP plan and related information. Identifying AZAs already in the context of MSP has the advantage of allowing them to be integrated with environmental carrying capacity studies across defined water areas both at large scale (e.g. sea basins) and finer scale (e.g. bays/estuaries/fjords).
The designation of AZAs has numerous benefits. It facilitates site selection for aquaculture activities by (i) identifying space where aquaculture can be developed in an optimum way to respond to environmental, technical and administrative criteria; (ii) avoiding conflict with other activities and areas; and (iii) developing necessary synergies. Within AZAs, local-level aquaculture planning can benefit from the 'bigger picture', while taking into consideration specific local characteristics and conditions.

The designation of AZAs also makes the licensing process easier for individual farms as it provides useful guidance and reliable information necessary for the location of aquaculture activities (e.g. regarding environmental impact assessments, definition of ecological carrying capacity). This reduces the burden of applicants and improves the coordination and assessment of applications by relevant public authorities. AZAs also provide more legal certainty to operators and investors and support expectations for the growth of the sector.

Furthermore, AZAs, especially when combined with aquaculture management areas, can also offer more integrated and coordinated management and monitoring of aquaculture activities, including in relation to the control or management of disease and treatment or environmental monitoring.

As indicated in the Strategic Guidelines, "*the designation of areas suitable for aquaculture should be based on clear and transparent criteria and tools to identify new areas"*. Therefore, process, tools and criteria for the designation of AZAs should be clearly defined in legislation or regulation. The process should be transparent and science-based and consider all the conditions defined in section 2 to ensure the sustainability, acceptance and resilience of aquaculture activities in the area designated. This includes the evaluation of impacts on the ecosystem and the determination of the ecological carrying capacity in each selected area. The process therefore requires the analysis and sharing of a large amount of environmental, technical, social and economic data. As stressed in the Strategic Guidelines, the early involvement of relevant stakeholders is crucial. The process of designation of AZAs should therefore also be participatory, involving a wide range of stakeholders at all stages through targeted consultations (see section 4.5).

([46]) An allocated zone for aquaculture (AZA) is a marine area where the development of aquaculture has priority over other uses, and therefore will be primarily dedicated to aquaculture. The identification of an AZA will result from zoning processes through participatory spatial planning, whereby administrative bodies legally establish that specific spatial areas within a region have priority for aquaculture development.

To the extent possible, regulation could also include general conditions for the use of an AZA. The designation of AZAs would also define what type of aquaculture activity is permitted within a zone, the species and/or combinations of species that can be farmed, and any other conditions of use and technical criteria (e.g. water quality requirements in particular for farming molluscs). This means that conditions for the use of AZAs are clearly understood from the start of the process.

The Strategic Guidelines note "*the designation should be accompanied by setting up an appropriate mechanism to (i) monitor and collect data on the environmental impact of aquaculture activities; and (ii) monitor water quality (notably for areas used to farm molluscs)*".

The designation of AZAs can have different consequences. They can be defined as vocational areas for aquaculture development (with licensing based on a case-by-case assessment), as exclusive areas (the only areas where aquaculture can be developed), or be part of a 'flexible approach', allowing for new areas to be identified afterwards. Within an AZA, regulators and licensing authorities can manage the planning process for individual sites in different ways. The licensing authority can identify the number of sites available, perform the impact assessment and determine the biomass allowed, and sell or auction the sites to producers. Alternatively, prospective applicants can identify sites within a zone and carry out the analysis, feasibility assessment and impact assessment and then apply for a licence with the relevant authority.

Table 2 provides examples of practices in the identification of AZAs at national and regional level.

Table 2. Examples of identification of AZAs in EU Member States

Spain 	Spain's regional governments (*Comunidades Autónomas*) are responsible for coastal spatial planning. AZAs are therefore at various stages of development depending on the region. In Andalucía, the mapping and identification of AZAs included: • analysis of the current situation of marine cultures developed in the maritime-terrestrial zone; • identification of potential areas for marine farming as study zones; • identification of the indicator parameters that influence the development of the activity; • location of uses, activities and occupations that converge in the study area; • consultation with the administrations, agents and bodies with competence in the study areas; • determination of the degree of interference between the aquaculture activity and other activities in the study area and its effects; • cartographic representation of the information generated and analysed; • drawing up a zoning proposal for the maritime-terrestrial zone under study according to the degree of administrative compatibility between the conditions found and aquaculture.

	All the information is currently available in the Andalusian Aquaculture Geographic Information System viewer ([47]).
Finland 	In 2014, the Ministry of Agriculture and Forestry and Ministry of the Environment, with the support of the Natural Resources Institute of Finland (LUKE), developed a **national plan for the localisation of aquaculture**, working as a specialised complement to the MSP plan ([48]). This specific plan aims at steering aquaculture production towards marine areas that are suitable for both the environment and the needs of the aquaculture industry and other forms of water use.
Italy 	In Italy, the Italian Institute for Environmental Research and Protection (ISPRA) developed two complementary tools for the establishment of AZAs: (a) a technical guide on zoning of AZAs; and (b) a Geographic Information System tool for the identification of suitable marine areas ([49]). The '**Technical Guide on Allocated Zones for Aquaculture**' ([50]) is the result of a broad consultation of public authorities, aquaculture producers and scientific experts. This guide is the reference document for AZAs on maritime spatial planning, dealing with the key aspects related to legislation, zoning and siting in Italy. It has been used for AZA allocation in public decrees by several coastal regions (e.g. Lazio, Campania). It provides methodologies for the zoning of AZAs, siting and environmental monitoring and guidance for the sustainable development and integration of marine aquaculture into MSP. It also includes the environmental monitoring programme for marine aquaculture developed by ISPRA for the FAO's General Fisheries Commission for the Mediterranean and the Black Sea.
Romania 	The paper '**Allocating Zones for Marine Aquaculture (AZA) in Romania'** was developed within the framework of the 'Scientific and Informational Support Aiming at Fostering Blue Growth by Allocating Zones for Aquaculture in the Black Sea (CreAZA)' project funded by the European Maritime and Fisheries Fund. It compiles methodological guidelines and practical examples on Romanian AZAs ([51]).

([47]) https://www.juntadeandalucia.es/agriculturaypesca/sia/index.jsf. See also https://www.juntadeandalucia.es/organismos/agriculturapescaaguaydesarrollorural/areas/pesca-acuicultura/acuicultura/paginas/ZIA.html

([48])https://mmm.fi/documents/1410837/1801200/Kansallinen+vesiviljelyn+sijainninohjaussuunnitelma/55a022d6-054b-4136-b8b3-bcae09e53379

([49]) For Geographic Information Systems, see section 4.3.

([50]) Italian Technical Guide on Allocated Zone for Aquaculture: https://repository.oceanbestpractices.org/handle/11329/1570

([51]) Establishing the Suitability of the Agigea - Eforie Area for Designation as Allocated Zone for Aquaculture (AZA) and for Unlocking the Potentiality of Mariculture in Romania: https://www.researchgate.net/publication/350967112_establishing_the_suitability_of_the_agigea_-

Estonia 	In Estonia, where the aquaculture sector is not well developed and mainly land-based, there is a strong willingness to boost marine aquaculture (mainly fish production). The costs and with it the need for investment from the private sector are significant and represent an obstacle to the development of the sector. Also, the licensing procedure is quite long (2 years or more) mainly due to the required environmental impact assessment process. To address these issues, the government plans to identify and select specific areas at sea suitable for marine aquaculture to conduct studies as well as environmental impact assessments. These areas will be subject to public calls for tender for the establishment of marine aquaculture production and aim to provide a 'turnkey' system for start-ups and companies. This will make it easier for the sector to access space and development.
Greece 	In 2011, following several studies, including a strategic environmental assessment, the **Special Framework of Spatial Planning for Aquaculture** was issued. This strategic plan is characterised by two main components: planning and space. It introduces integrated spatial planning for aquaculture at national level. It aims to provide guidelines, rules and criteria for the spatial structure, organisation and development of aquaculture units in a way that their operation does not conflict, as far as possible, with the development of other activities and does not irreversibly damage the environment. This also ensures that the aquaculture sector remains competitive ([52]).

4.3. DECISION SUPPORT, GEOGRAPHIC INFORMATION SYSTEMS AND DEFINITION OF ECOLOGICAL CARRYING CAPACITY

As explained above, the designation of areas suitable for aquaculture taking into consideration the ecosystem approach to aquaculture is a complex process. It requires the management of a considerable amount of data, analysis and modelling. This includes the assessment of the ecological carrying capacity, i.e. the magnitude of aquaculture production (stocking or farming density) that can be supported at site scale without leading to significant changes to ecological processes, species, populations or communities in the environment, taking into account the state of the marine environment at local or regional level and the array of pressures that affect its state. Large-scale environmental carrying capacity analysis should ideally be done at MSP level or AZA level. This potentially reduces the administrative burden of aquaculture site licensing as much of the environmental impact assessment and other site-related data will have already been collected and analysed.

Knowledge of the marine environment and the impacts of aquaculture has increasingly improved in recent years. Thanks to advances in IT, more accurate mathematical models are

eforie_area_for_designation_as_allocated_zone_for_aquaculture_aza_and_for_unlocking_the_potentiality_of_mariculture_in_romania

([52]) Ministerial Decision No. 31722/2011 (G.G. 2505 B) of the Governmental Policy Coordination Committee on Spatial Planning and Sustainable Development: 'Approval of a Special Spatial Planning Framework and its Strategic Environmental Impact Assessment'.

available that improve predictions of the extent to which it is possible to increase the biomass of aquaculture facilities without affecting the aquatic environment.

A **decision support system** ([53]) is necessary to implement methods for site selection and the estimation of ecological carrying capacities. This should include the consistent use of geographic information systems (GIS) ([54]) and ecosystem modelling ([55]). These methods are based primarily on results of dynamic models supplemented with in situ measurements and remote sensing information.

The **AquaSpace** project provides examples of mathematical modelling to determine the capacities for aquaculture development, supported by cartographic representations. The project presents, among other case studies, two case studies implemented in the Northern Adriatic Sea (Italy, clams) ([56]) and in the Atlantic (Scotland, multiple species) ([57]), respectively. Both examples show how aquaculture interferes with many other activities and the complexity of prioritising uses when GIS tools are used for planning.

In terms of challenges in using these tools, it is worth mentioning the following: the weighting of criteria for suitability in the identification of aquaculture areas, the complexity, cost and updating of the assessment, and the level of integration between sectoral GIS (e.g. for recording aquaculture licensing and permitting information) and national MSP GIS (which compiles data layers from multiple sectors). On the latter, there are some advanced systems being developed to both support aquaculture growth (e.g. movement offshore) and ensure that the risk of spatial conflict with other maritime economic activities is minimised. The adaptive nature of GIS also allows spatial planners to rapidly update mapping to new developments and constraints.

Several Member States have developed GIS tools, whether for aquaculture licensing or for national MSP, to provide a general overview of the spatial allocation to maritime economic activities and a visualisation of both socio-economic and environmental issues.

Table 3 gives some examples of decision support systems and related tools in the identification of AZAs used by Member States.

([53]) A decision support system is a software application that brings together data, models and analytical tools to help individuals and organisations solve complex problems. Its primary purpose is to provide timely and relevant information and facilitate analysis to help decision makers evaluate potential outcomes.

([54]) GIS are an integrated collection of computer software and data used to layer a wide range of spatial and associated data across a wide range of areas, including essentially static information such as bathymetry, shoreline topography and jurisdictional boundaries and more dynamic information such as environmental conditions (e.g. tidal currents, water temperatures, benthic habitat mapping) and infrastructure development (e.g. roads, ports, pipelines, undersea cables). On top of this, GIS can layer spatial information on maritime economic activities, e.g. the boundaries of aquaculture operations with their associated metadata (e.g. ownership, characteristics). GIS data layers can be shared within organisations as well as with the public, often through online data portals. Allocated zones for aquaculture - A guide for the establishment of coastal zones dedicated to aquaculture in the Mediterranean and the Black Sea (fao.org).

([55]) An ecosystem model is an abstract, usually mathematical, representation of an ecological system that is studied to gain understanding of the real system. It helps create scenarios and know the evolution as well as these limits.

([56]) http://www.aquaspace-h2020.eu/?page_id=12731

([57]) http://www.aquaspace-h2020.eu/?page_id=12050

Table 3. Examples of GIS and site modelling use in EU Member States	
Finland 	The **FINFARMGIS modelling method** developed by Finland's Natural Resources Institute ([58]) can be used to identify the areas best suited to various stages of fish farming using a spatial data tool. This model considers the eight environmental criteria (water flow, depth, openness of the marine area, distance to the bird islands in the Natura 2000 areas, distance to underwater reefs in the Natura 2000 areas, ecologically important areas, distance to other fish farming facilities, ecological classification of coastal waters), one economic criterion (operational distance) and two social criteria (areas excluded from fish culture, denseness of holiday settlement). Currently focusing on pen-based rainbow trout production in the Baltic Sea, it is aimed mainly at private companies developing marine fish farms. However, it links to the national MSP GIS. FINFARMGIS has been used to designate potentially suitable areas for marine aquaculture for the national MSP GIS. It also shares some data layers from the national MSP to help exclude areas where fish farming is not possible, for example national parks, conservation areas or shipping lanes, and outputs generated by the model for specific sites are a primary form of evidence considered by the seven regional administrative agencies in licensing and environmentally permitting ([59]) aquaculture in Finland.
Italy 	The **AquaGIS model**, designed with several partners at national and European level (European Marine Observation and Data Network, Copernicus), gathers more than 132 layers (including environmental and infrastructural constraints, anthropogenic pressures, areas of exclusions, etc.) to identify available zones for marine aquaculture. Within these zones, a second analysis highlights 'priority areas' based on suitable criteria (including social aspects) for the development of both fish and shellfish farming. The tool is currently being developed on a national scale but allows for the identification of new areas for aquaculture development on a regional scale. AquaGIS meets both demand from regions to have the best available information to develop AZAs and the need for MSP to include aquaculture activities ([60]).
Spain 	**ACUIVISOR**, the national GIS viewer of Spanish aquaculture ([61]), structures the information on aquaculture activity in the different 'Autonomous Communities' under the same format. This application allows the user to visualise the location and consult the descriptive information of more than 5 000 aquaculture establishments. Information can also be obtained on the mollusc production areas declared in Spain and areas of interest for aquaculture. The areas of interest, classified into four categories depending on the type of area and its administrative

([58]) https://www.luke.fi/sites/default/files/2021-12/Finfarmgis%20esite.pdf

([59]) Licences tend to be long-term, non-restrictive permissions to operate. Permits are shorter-term and often come with conditions and requirements.

([60]) See AquaGIS Webapp: https://sinacloud.isprambiente.it/portal/apps/sites/#/acquacoltura-1-1

([61]) https://servicio.pesca.mapama.es/acuivisor/

	situation, represent a first approximation to the future spatial planning of aquaculture in each Autonomous Community. Thanks to the work carried out and its implementation, ACUIVISOR is expected to promote the visibility of aquaculture activity and improve its integration into planning and management instruments such as MSP, management of the public domain, hydrological and territorial planning, management of natural areas and rural development. The application also has tools that allow spatial analysis to be carried out based on different operational and technical administrative variables to measure, select new sites and generate reports.
Portugal 	Portugal developed a geoportal for the PSOEM ([62]).
Greece 	In 2009, a Joint Circular of the Ministry of Environment and the Ministry of Rural Development & Food (No 121570/1866/2009) was issued. Among other regulations, it introduced the **carrying capacity formula for marine fish farms** ( ). Based on a multi-year scientific research programme financed by the operational programme of the European Fisheries Fund from 2000-2006, a formula calculating the maximum allowed annual production capacity for any given floating marine fish farm and for Mediterranean fish species was developed. The formula consists of four parameters: 1) occupied marine area; 2) distance from shore; 3) average sea depth at the occupied area; and 4) sea current velocity. The study remains relevant today.

Table 4 describes methods for the assessment of the ecological carrying capacity applied in some EU and non-EU countries:

([62]) https://webgis.dgrm.mm.gov.pt/portal/apps/webappviewer/index.html?id=102537ae49554da99ba0141e7cc60b52
([63]) Greece Carrying Capacity: Karakassis et al. Aquaculture 408-409 (2013) 184-190, https://www.sciencedirect.com/science/article/abs/pii/S0044848613002755?via%3Dihub

Table 4. Examples of methods defining ecological carrying capacity in EU Member States and non-EU countries	
UK 	The **model system FVCOM-CSTM-ERSEM-ShellSIM** ([64]) simulates the major interactions between mussel farms and the environment to make it easier to estimate the production and ecological carrying capacity of an area without the need for site specific calibration of parameters. The tool addresses planning needs for large-scale offshore mussel farms using rope cultured mussels at low densities. It can produce estimates of the long-term cumulative impact as well as identify potential multi-year production fluctuations. It also facilitates small-scale interactions at farm level with sub-km model resolution. This solves the spatial configuration of the farm within the environmental variability. The tool has been applied to a rope cultured blue mussel farm in Lyme Bay, but the system can be applied to a wide range of commercial shellfish species and aquaculture practices as well as other geographical areas.
Spain 	Two models are being used for the planning and management of Mediterranean aquaculture: i) **MERAMOD** ([65]), a particle tracking model used for predicting the flux of particulate waste material and associated benthic impact of fish farms; and ii) the **RAC package** ([66]) to model the individual bioenergetic balance for certain fish and shellfish species. Particulate waste dispersion models can be helpful in supporting decision-making for environmental regulation and management by testing several pre-production scenarios for given environmental situations.
Greece 	The **Aquaculture Integrated Model** ([67]) is a modelling tool that consists of a high-resolution 3D coupled hydrodynamic/biogeochemical model with a mass balance model. This model is being used to calculate nutrient inputs from the fish cages based on fish feed data. It examines the impact of aquaculture waste on the environmental status of an AZA under different scenarios (fish production, changing climate). The tool has been implemented for an AZA in the Gulf of Argolis in the eastern Mediterranean, assessing the impact of fish farm waste on the environmental status of the area under different scenarios.

([64]) See https://www.aquaculturetoolbox.eu/media/1235/large-scale-offshore-production-of-mussels-in-lyme-bay.pdf. See also 'ERSEM 15.06: a generic model for marine biogeochemistry and the ecosystem dynamics of the lower trophic levels', https://gmd.copernicus.org/articles/9/1293/2016/.

([65]) MERAMOD: predicting the deposition and benthic impact of aquaculture in the eastern Mediterranean Sea, https://www.int-res.com/articles/aei2012/2/q002p157.pdf

([66]) RAC - R package for Aquaculture: https://cran.r-project.org/package=RAC

([67]) See www.aquaculturetoolbox.eu/modelling tools/aquaculture-integrated-model-aim/. See also Lifewatch Greece Portal - Cases studies of the AIM tool: https://portal.lifewatchgreece.eu .

4.4. AQUACULTURE MANAGEMENT AREAS

An aquaculture management area (AMA) can be any area (defined by relevant authorities or identified by stakeholder groups) where farms share a common waterbody or water source and that may benefit from common strategies to minimise environmental, social and animal health risks ([68]). There can be single or multiple aquaculture management areas within an AZA or the zone itself can be a management area. Action may be coordinated between farms such as treatment plans, water abstraction/discharges or limits for maximum biomass in the area. The establishment of an AMA therefore facilitates the coordination of relevant public authorities and collective action and joint management by aquaculture producers in the same area. Farms may be owned by more than one company, and there may also be agreements with other users of the environment. Stakeholder engagement and cooperation is key for the success of an AMA.

The coordinated local aquaculture management initiative in Ireland is an example of joint management of an aquaculture area in the AMA approach. **Table 5** describes this initiative.

Table 5. Example of applications of the AMA approach in Ireland

Ireland 	Coordinated Local Aquaculture Management (CLAMS) was introduced by Ireland's Seafood Development Agency (Bord Iascaigh Mhara) and has been in use in Ireland for more than 20 years. This initiative sought to establish greater cooperation among local aquaculture producers, with the agency providing support to coordinating officers and expertise. It is both a management system and a formal collective of the fish and shellfish farmers. It provides the framework to draw up aquaculture management and development plans, while also looking in local communities to quickly identify and address issues that affect or are affected by aquaculture activities. Best practice examples include: • the development of biosecurity area management protocols to resolve the management of disease and the spread of invasive species; • the development of a rational and unified marking scheme for aquaculture, including protocols for deployment and maintenance of aids to navigation to resolve inconsistent navigation marking of aquaculture; • facilitated dialogue with local authorities to clearly understand the needs of aquaculture operators and their social and economic contribution to the local economy; • dialogues with other infrastructure users to have a mutual understanding and agreements on use to resolve access challenges (harbours, marinas, piers); • shared agreement on local implementation of the WFD, considering for example the protection of shellfish waters to address effluent discharge and treatment; • shared agreement on improvement strategies and actions to reduce plastic litter.

([68]) AMAs can also be quite beneficial for groups of small farmers seeking joint access to feed, seed, technical support services, markets and post-harvest services.

4.5. INTEGRATED AND MULTI-STAKEHOLDER DECISION-MAKING PROCESS FOR SPACE ALLOCATION

As explained in section 2, spatial planning and its implementation are complex and multi-level processes. The Strategic Guidelines note that *"Spatial planning should be based on the designation of areas suitable for aquaculture through a process involving coordination among different relevant authorities at different levels."* It should therefore ensure the involvement, coordination and communication between different authorities and stakeholders, including national MSP and aquaculture authorities, but also other relevant authorities at both central government and regional/local level ([69]).

Spatial planning of aquaculture should also ensure the **integration of planning at national level, with regional and local plans** in a hierarchical system that provides a common, top-down framework. National level planning can provide consistency and predictability, both favoured by developers. At the same time, local level planning will allow the specific planning characteristics of local conditions to be accounted for and representative stakeholders to be consulted, without compromising national aquaculture spatial planning and strategic objectives. Finer-scale spatial planning at local level therefore needs to be developed hierarchically under the technical and political framework of national MSP. At the same time, a finer-scale, higher-resolution national MSP focusing on specific zones, areas and even bay areas facilitates the local development of marine aquaculture.

In addition to the coordination of different relevant authorities, the Strategic Guidelines also note that "*the early involvement of relevant stakeholders"* is essential. The **involvement through targeted consultations of the sector and other relevant regional and local stakeholders** (e.g. environmental non-governmental organisations, local communities, fishers, tourism associations) in spatial planning for aquaculture is also important to collect feedback on site selection. This will make MSP more robust and potentially reduce the time and complexity of licensing and permitting of aquaculture sites. It can also support the development of small businesses (e.g. creation of aquaculture cooperatives) strongly rooted in the local socio-economic context. There should be consideration of the relevant EU framework and whether the SEA Directive is applicable to ensure also appropriate identification of options and involvement of the public.

Stakeholder involvement requires a scoping exercise to understand the broader issues in the multi-stakeholder context in which aquaculture might develop and the establishment of working groups as early in the planning process as possible ([70]). This can be facilitated by the development of local blue economy strategies that should be developed as adaptive declinations of the national MSP.

([69]) On good practices to ensure the coordination of different relevant authorities, see the document on regulatory and administrative framework for aquaculture (section 3.1.2. Establishment of a single national aquaculture entity).
([70]) For more details on good practices for involving stakeholders, see section 3.3.1. Consultation of stakeholders of the document on regulatory and administrative framework for aquaculture.

4.6. STRATEGIC ENVIRONMENTAL ASSESSMENT AND APPROPRIATE ASSESSMENT UNDER THE BIRDS AND HABITATS DIRECTIVE

In application of the ecosystem approach to aquaculture, and as indicated in the Strategic Guidelines, the assessment of the environmental impact of different forms and scales of aquaculture should be made at strategic level through a strategic environmental assessment (SEA). The SEA aims to identify, describe and evaluate the possible significant effects on the environment that the implementation of a proposed plan may have, as well as present reasonable, technically and environmentally viable alternatives that take into account the objectives and geographical scope of the plan. This could be part of the MSP process or the designation of AZAs. This assessment should also take into consideration any positive impact of aquaculture activities.

The benefits of this assessment are as follows: (i) it provides the means for looking at cumulative effects and duly addressing them at the earliest stage of decision-making alongside economic and social considerations; (ii) it can make it easier to apply for a specific licence for particular operations since it can contribute to the undertaking of EIA at project level and accelerate the licensing process; and (3) it ensures an early involvement of the public when all options are open. Undertaking an assessment for the planning of aquaculture activities should therefore be done in cases beyond those for which EU legislation establishes a specific sectoral requirement ([71]).

Likewise, plans such as MSP plans or possible plans for designation of AZAs must be subject to the procedure required by Article 6 of the Habitats Directive if they may have a likely impact on Natura 2000 sites. This is not only a requirement of environmental legislation, but an opportunity to ensure integration of the necessary measures to avoid or reduce the environmental impacts of aquaculture activities on protected areas at an early stage in the planning process, leading to reduction of conflicts in later stages, for example in permitting procedures for individual projects. This assessment needs to take into account the conservation objectives of all Natura 2000 sites in the areas where aquaculture activities are planned. To support this process, sensitivity maps can be prepared taking into account the type of aquaculture activities that are planned and the habitats and species protected in the area ([72]).

([71]) The SEA Directive (Directive 2001/42/EC of the European Parliament and of the Council of 27 June 2001 on the assessment of the effects of certain plans and programmes on the environment (OJ L 197, 21.7.2001, p. 30) requires an environmental assessment of public plans and programmes (as well as their amendments) that are likely to have significant environmental effects. These include plans and programmes that are prepared for specific sectors and set the framework for development consent of projects under the EIA Directive (Directive 2011/92/EU of 13 December 2011 on the assessment of the effects of certain public and private projects on the environment). Annex II of that Directive includes projects on intensive fish farming. In addition, an environmental assessment is required for plans and programmes for which an assessment is required under the Habitats Directive (Council Directive 92/43/EEC of 21 May 1992 on the conservation of natural habitats and of wild fauna and flora). According to recital 23 of the MSP Directive, where MSP plans are likely to have significant effects on the environment, they are subject to Directive 2001/42/EC. Where MSP plans include Natura 2000 sites, such an environmental assessment can be combined with the requirements of Article 6 of the Habitats Directive to avoid duplication.

([72]) The guidance on aquaculture and Natura 2000 contains some examples of good practice (see footnote 29).

4.7. MULTI-USE OF SPACE AND CO-LOCATION

The Strategic Guidelines note that spatial planning *"should also seek to promote synergies between different activities and multiple uses of space, such as encouraging aquaculture development in combination with the development of offshore wind power"*. Therefore, when defining zones for marine aquaculture, co-location with other activities at sea and on the coast should be encouraged. This allows for more efficient use of marine space and resources and creates new opportunities for socio-economic development along with potential environmental benefits.

To the extent possible, multi-use should already be encouraged in **MSP** through the **designation of multi-use areas** to provide better visibility of spatial synergies between existing/potential maritime activities. The definition of multi-use areas should be based on the assessment of the drivers and added value of the sharing of space among maritime economic activities, as well as the implications that it entails (legal and governance, local environmental and socio-economic conditions, technology, risks), especially when one sector is already established. This requires the involvement of all relevant stakeholders and the assessment of the impact of multi-use combinations. The creation of a national task force to determine the strategy and conditions surrounding the development of multi-use could be contemplated.

A clearer example of multi-use is the combination of **offshore wind farms** and marine aquaculture ([73]). However, for this concept to succeed a functioning full-scale pilot project (Technology Readiness Level 8) to showcase the combination still needs to be launched ([74]). Furthermore, combining offshore wind farms and aquaculture requires a legal framework that would allow secondary users of the area to have a legal claim against primary users. It would also require clear and open communication between all involved stakeholders to promote the sharing of all available information in order to address safety as well as environmental concerns. In addition, it is necessary to develop proof of concept and business models in order to encourage financial and investment interest, proving that clear economic, commercial benefits exist for all sectors involved and that the environment and socio-economic development of the local community are not compromised.

Other ways of promoting multi-use of space include (i) setting specific requirements for multi-use in national public calls for tender for the development of marine renewable energy; (ii) the support/development of multi-use pilot projects targeting aquaculture; (iii) the use of incentives, such as taxation, to encourage multi-use; and (iv) the creation of dedicated multipurpose platforms ([75]).

([73]) Synergies of aquaculture with other sectors such as tourism will be the subject of the future document on good practices on the integration of the aquaculture sector in local communities (see footnote 25).

([74]) Though this pilot project needs to focus on safety concerns, environmental compatibility, integration of operations as well as economics, it also needs to take an overall integrated approach and also address aspects such as relationships between users and risk insurance. Pilot projects also need to assess the impact of offshore wind farms on farmed fish populations.

([75]) See for example PLOCLAN, the Oceanic Multi-use Platform in Gran Canaria: https://plocan.eu/en. There are other ongoing projects dedicated to multi-use platforms such as SPACE@SEA About SPACE@SEA - SPACE@SEA (spaceatsea-project.eu) or TROPOS (TROPOS - nexa (forward-h2020.eu).

Another example of multi-use is the combination of marine aquaculture and **nature conservation** by developing suitable aquaculture activities in MPAs such as Natura 2000 sites. Given the objective of expanding the network of MPAs to cover 30% of EU's marine area under the EU Biodiversity Strategy, this is increasingly important. In France, for example, marine parks already include marine aquaculture activities (e.g. mussels and oysters farming in the Parc naturel marin de la Gironde et de la mer des Pertuis). However, this may require an additional environmental impact assessment to ensure that the activity is fully compliant with the legal framework for protected areas.

Several EU-funded projects have presented multi-use considerations. The **MUSES project** ([76]) developed the Ocean Multi-Use Action Plan ([77]). This project provides concrete recommendations on how to combine aquaculture with tourism and offshore wind farms. The **UNITED project** ([78]) has developed demonstrators in the marine environment to support multi-use of maritime activities, including marine aquaculture in several pilots ([79]).

As part of the project 'Emerging ecosystem-based maritime spatial planning topics in the North and Baltic Sea Regions' (**eMSP NBSR Project**)([80]), the concept of 'maripark' for aquaculture is being developed ([81]). This aims to support the designation by public authorities of offshore zones for public/private cooperation and partnerships, including the provision of infrastructure, in order to develop commercial activities. Even though this concept is still under development, mariparks could support the development of aquaculture in combination with other maritime economic activities.

There are also several ongoing demonstration projects on the combination of offshore wind farms and aquaculture, including two on low-trophic aquaculture in offshore wind farms in the North Sea and the Baltic Sea ([82]) (molluscs and seaweed), **OLAMUR** and **ULTFARMS**, and one project combining an existing marine renewable energy production prototype with finfish aquaculture, **Aquawind** ([83]).

([76]) MUSES – Multi-Use in European Seas (muses-project.com)

([77]) MUSES OCEAN MULTI-USE ACTION PLAN – Executive summary: https://sites.dundee.ac.uk/muses/wp-content/uploads/sites/70/2020/06/MUSES-Multi-Use-Action-Plan-Executive-Summary.pdf. - Full document: https://muses-project.com/wp-content/uploads/sites/70/2018/10/MUSES-Multi-Use-Action-Plan.pdf

([78]) UNITED project.

([79]) These pilots are on aquaculture and tourism in Italy (https://muses-project.com/wp-content/uploads/sites/70/2018/02/ANNEX-9-CASE-STUDY-6.pdf), blue mussels, seaweed and offshore wind energy in Germany (https://muses-project.com/wp-content/uploads/sites/70/2018/02/ANNEX-3-CASE-STUDY-1C.pdf), marine renewable energy and marine aquaculture in Scotland (Modello Documento in Italinao (muses-project.com), Denmark https://muses-project.com/wp-content/uploads/sites/70/2018/02/ANNEX-8-CASE-STUDY-5.pdf and Sweden (annex-7-case-study-4.pdf (europa.eu)), and offshore wind and flat oyster aquaculture and restoration in Belgium.

([80]) eMSP NBSR Project.

([81]) https://www.emspproject.eu/how-to-build-maripark/

([82]) The OLAMUR project, running from January 2023 to December 2026, will establish three pilot demonstration sites where seaweed and blue mussels will be grown on wind farms or in the vicinity of a trout farm. ULTFARMS will establish six low-trophic aquaculture pilots located in different areas across the North and Baltic Seas.

([83]) https://aquawind.eu .

In 2024, the Commission has launched an online compendium of multi-use practices across the EU and in the world ([84]). It aims mainly to support decision-makers and MSP practitioners on current initiatives, challenges and levers for developing multi-use between maritime activities at sea.

Table 7 provides some examples of planning of multi-use of marine space in EU Member States.

Table 7. Examples of multi-use planning in EU Member States

Poland 	In **Poland**, the marine aquaculture sector is poorly developed as aquaculture is focused mainly on land. Planners have therefore not allocated spaces dedicated to aquaculture but considered **marine aquaculture development within the framework of multi-use areas**, where the activity is allowed in several basins in the Polish MSP, taking into account that the sector's development will require infrastructure that can be shared with other maritime activities ([85]). The regulation for the licensing process for offshore wind farms includes a specific selection criterion for enabling other activities to take place in the same space. This criterion is not mandatory but will provide positive scoring to the applicant, aiming to encourage investors to include multi-use in their offshore wind farms. If investors declare that their offshore wind farms will allow other activities, this will be written in the permit to make sure the declaration will be fulfilled. These co-located activities can include marine aquaculture, as marine aquaculture is an activity allowed in the MSP. To ensure opportunities for the sector's development, but also for other sectors, the MSP plan defines areas for future uses in which marine aquaculture could be potentially developed.
Portugal 	The PSOEM includes three zones for multipurpose platforms where marine aquaculture could be developed

([84]) Co-existence and multi-use of activities | The European Maritime Spatial Planning Platform (europa.eu)

([85]) https://sipam.gov.pl/english/maritime-spatial-planning .

4.8. SHARING OF DATA RELEVANT TO AQUACULTURE ACTIVITIES

The Strategic Guidelines stress the importance of collecting accurate data for the planning and monitoring of aquaculture activities. Under the MSP Directive, Member States are required to organise the sharing of information necessary for MSP plans ([86]). Sharing of data across government departments and also with stakeholders is necessary to get a good overview of spatial allocation to maritime economic activities and visualise both socio-economic and environmental issues. It is also important for monitoring the impact (biological, social and economic) of all maritime economic activities on the wider marine environment as it enables better consideration of cumulative impacts in a given area, supporting decision-making for permitting. Furthermore, data sharing can support relevant authorities and applicants in the permitting and licensing of maritime economic activities, ensuring that they are consistent with MSP at both national and local level.

As explained in section 4.3, several Member States have developed GIS. GIS allow them to share and rapidly update data (e.g. on areas for which an application for a licence/permit has been made or a licence/permit granted). The use of GIS data portals should therefore be mainstreamed and not only used on an ad hoc basis. Member States should implement **common GIS** shared by different public authorities and accessible to stakeholders.

However, Member States need to develop a suitable strategy to address the following challenges related to the collection and sharing of GIS data: (i) technical aspects (need to agree protocols for data gathering, data input and information outputs); (ii) data protection and privacy issues (management of private or commercially or nationally sensitive data); and (iii) cost (larger data systems are expensive to both set up and maintain as larger data sets need to be stored on servers and will require specialised technicians for constant update and data quality assurance). This strategy should identify data providers, data users and associated service providers across the public and private sectors and ensure the most cost-effective and efficient solution possible.

In addition, the development of a **single cross-sector environmental data portal** is encouraged. This would provide relevant authorities with updated information in existing databases that is necessary for site selection, in particular for site modelling and the definition of carrying capacity (e.g. contaminant load from public infrastructure – drainage, sewage). In addition, this portal would provide data to facilitate compliance by operators with environmental requirements and support new applications for a licence in the same zone or area.

Furthermore, data collection and sharing can also be improved by creating **collaborative aquaculture platforms** between public bodies and private stakeholders.

Table 8 describes data sharing in Ireland. Other GIS tools described in section 4.3 also provide this service.

([86]) MSP Directive (Article 10): 'Member States shall organise the use of the best available data, and decide how to organise the sharing of information, necessary for maritime spatial plans. 2. The data referred to in paragraph 1 may include, inter alia: (a) environmental, social and economic data collected in accordance with Union legislation pertaining to the activities referred to in Article 8; (b) marine physical data about marine waters.'

Table 8. Data sharing relevant for marine aquaculture in Ireland	
Ireland 	The Marine Institute is the accepted marine data manager in Ireland and has (i) developed the Marine Atlas (https://atlas.marine.ie) ([87]) as part of national reporting for the Marine Strategy Framework Directive on the environmental status of the seas and oceans around the country; (ii) participated in the SIMCelt project on MSP in the Celtic Seas, developing a framework for the assessment of the cumulative impact of human activities in the Irish Sea; and (iii) developed the Marine Renewable Energy Portal in association with the Sustainable Energy Authority. During the summer of 2022, the Department of Agriculture, Food and the Marine announced the launch of the first phase of the Aquaculture Information Management System (AQUAMIS) consisting of a publicly accessible viewer portal. The second phase (currently being developed) will deliver an online system with all applications and support data being submitted electronically by the applicant. AQUAMIS will also be integrated into other government systems, including the National Marine Planning Framework online portal and the wider marine spatial planning system.

4.9. MONITORING OF THE USE OF SPACE ALLOCATED TO AQUACULTURE

It is important to establish a system to regularly monitor the impact and progress of the spatial development of aquaculture, identifying appropriate baseline indicators. This could include the number of operating sites, the number and area of allocated zones, and total production in volume and value. These data should be shared electronically to allow near real-time representation of the spatial extent of aquaculture. This could be linked to time-series data, allowing spatial trends in aquaculture development to be determined and used in cross-sectoral planning.

Specific monitoring of aquaculture space allocation has in some cases been included in the MSP plans. See for example the case of Spain in **Table 9**.

Table 9. Examples of systems monitoring space allocation in EU Member States	
Spain 	A common document for the five (draft) MSP plans defines a 'Programme for monitoring the planning objectives and effectiveness of these plans' and

([87]) See IODE ICAN's dedicated page on Ireland's Marine Atlas.

identifies several indicators related to space allocation. These indicators are both sectoral and multi-sectoral ([88]).

Sectoral and cross-sectoral indicators in the Spanish (draft) MSP plan related to the monitoring of space allocated to aquaculture:

Aquaculture-specific

• evolution of the area of the marine boundary used by the aquaculture sector;

• number and area of new authorised aquaculture sites within areas of high potential for aquaculture;

• area of new authorised aquaculture sites outside areas of high potential for aquaculture.

Multi-sectoral

• number of new authorised uses that are multi-use or multi-platform;

• number of new authorised uses that experience interactions with other uses and activities that can be considered as conflicts;

• number of new authorised uses that experience interactions with other uses and activities that can be considered as synergies;

• area within each area defined as 'priority use' for certain future uses, in which the activity for which it has been defined has finally been developed;

• area within each zone identified as 'high potential' for certain future uses, in which the activity for which it has been identified has finally been developed.

([88]) Anexo I: Planes de ordenación: Parte común a las cinco demarcaciones marinas, correspondiente a los bloques I, II, IV y V, incluyendo la representación cartográfica del ámbito de aplicación y la zonificación: https://www.miteco.gob.es/es/costas/temas/proteccion-medio-marino/anexoipoem_r_tcm30-528994.pdf

ANNEX 1

METHODOLOGY

This document has been prepared on the basis of the following:

The **Technical study on access to space and water for marine aquaculture** produced by the European Maritime Spatial Planning Platform ([89]). This study focused on the allocation of space to aquaculture in the context of maritime spatial plans (MSP plans). Its objective was to identify the main trends and practices for allocating marine space for the development of aquaculture across the EU within the MSP plans. It identified aspects of the MSP process that need improvement and produced a set of recommendations for the effective and streamlined planning of marine space for aquaculture and the integration of aquaculture into MSP. Section 2 of this study describes the methodology used.

The **work of the EU Aquaculture Assistance Mechanism to provide guidance on access to marine space**. This work aimed to complement the above-mentioned technical study by identifying specific phases and aspects of the planning process and producing factsheets of good practices that include examples in different EU and non-EU countries. To provide relevant and updated information on the processes and key aspects of the planning process, a literature review/desk study was performed. In addition, outputs of EU projects funded under Horizon 2020 and having direct relevance to the topic were analysed. Of these, the Tools for the Assessment and Planning of Aquaculture Sustainability (TAPAS) project and the Ecosystem Approach to making Space for Aquaculture (AquaSpace) project were used as the key sources. In-depth interviews were conducted with the coordinators of both projects to validate and consolidate the approach and help identify good practice examples. The result of this work was presented to Member State experts on aquaculture and the Aquaculture Advisory Council for their comments on issues of high priority and solutions and on ongoing actions to address these issues.

([89]) https://maritime-spatial-planning.ec.europa.eu/sites/default/files/access_to_space_and_water_for_marine_aquaculture.pdf.

ANNEX 2

EU-FUNDED PROJECTS

(in alphabetical order)

AquaSpace (Making Space for Aquaculture): http://www.aquaspace-h2020.eu/

AquaWind (Innovative multi-use prototype combining offshore renewable energy and aquaculture in the Atlantic Basin): Home - Aquawind.

eMSP NBSR (Emerging ecosystem-based maritime spatial planning topics in the North and Baltic Sea Regions) (eMSP NBSR Project).

MARSPLAN-BS I & MARSPLAN-BS II: Cross-Border MARitime Spatial PLANning in the Black Sea | The European Maritime Spatial Planning Platform (europa.eu) and Cross-border Maritime Spatial Planning for Black Sea, Bulgaria and Romania | The European Maritime Spatial Planning Platform (europa.eu)

MUSES (Multi-Use in European Seas): MUSES – Multi-Use in European Seas (muses-project.com)

OLAMUR (Offshore Low-Trophic Aquaculture in Multi-use Scenario Realisation in North and Baltic Seas): OLAMUR.

SIMCelt (Supporting Implementation of Maritime Spatial Planning in the Celtic Seas): SIMCelt - MaREI

SHoCMed: Developing site selection and carrying capacity for Mediterranean aquaculture within aquaculture appropriate areas ([90]).

TAPAS (Tools for Assessment and Planning of Aquaculture Sustainability). Guidance document on spatial planning and developing zones: https://www.aquaculturetoolbox.eu/media/1203/tapas-guidance-document-zoning.pdf

ULTFARMS (Circular Low Trophic Offshore Aquaculture In Wind Farms And Restoration Of Marine Space): ULTFARMS

UNITED (Multi-Use offshore platforms demoNstrators for boostIng cost-effecTive and Eco-friendly proDuction in sustainable marine activities): h2020united.eu.

([90]) Based on the findings of this project, the General Fisheries Commission for the Mediterranean and the Black Sea published a 'Guide for the establishment of coastal zones dedicated to aquaculture in the Mediterranean and the Black Sea': https://www.fao.org/3/ca7041en/CA7041EN.pdf.