

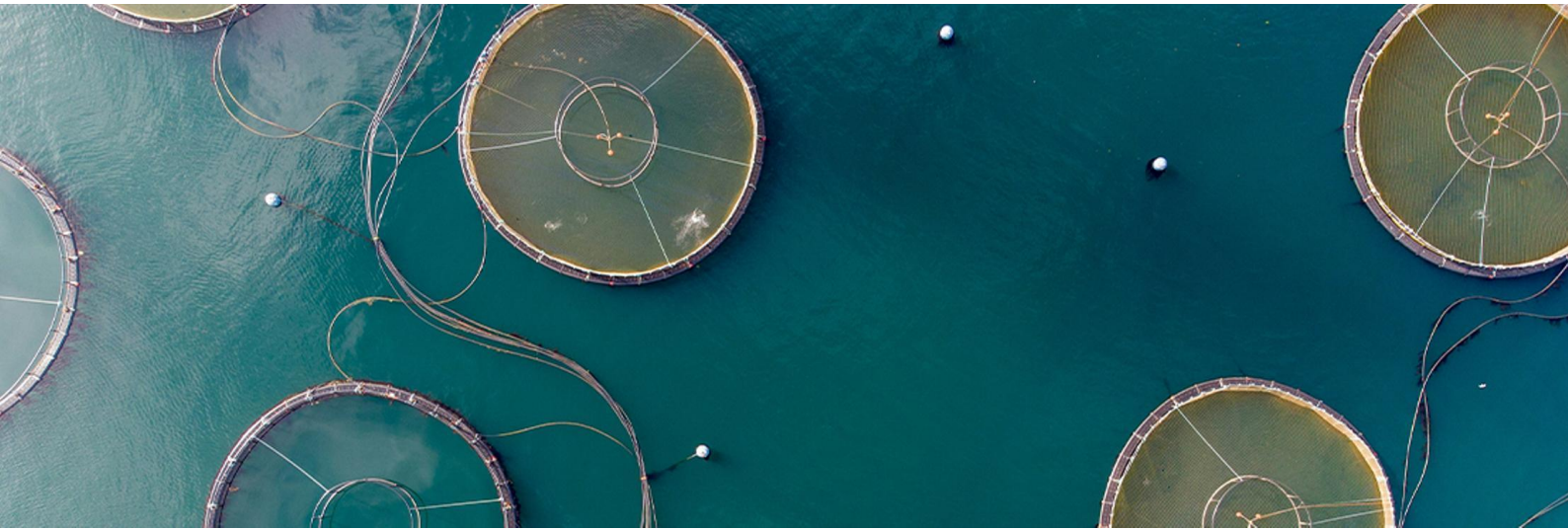


AZA4ICE

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## Output 3.1 AZA4ICE Action Plans for the transition to an Inclusive and Circular Economy in aquaculture sector

### *AZA4ICE Action Plan for Varna Bay, Bulgaria*

<https://aza4ice.interreg-euro-med.eu>



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## Abbreviations

<b>AZA</b>	Allocated Zone for Aquaculture
<b>C-AZA</b>	Circular Allocated Zone for Aquaculture
<b>C-AZAi</b>	C-AZA Index
<b>GES</b>	Good Environmental Status
<b>HAPO</b>	Hellenic Aquaculture Producers Organisation
<b>IMTA</b>	Integrated Multi-Trophic Aquaculture
<b>LIRRIE</b>	Living Responsible Research & Innovation Ecosystems
<b>NECCA</b>	Natural Environment and Climate Change Agency
<b>SAC</b>	Special Area of Conservation
<b>SiSI</b>	Site Suitability Index
<b>SPA</b>	Special Protection Area



## 1. Executive Summary

The **Action Plan for Bulgaria** has been developed within the framework of the project “*Allocated Zones for circular Aquaculture to trigger the transition to an Inclusive and Circular Economy in aquaculture sector fostering new business opportunities and eco-consciousness society*” (AZA4ICE). Its purpose is to support the sustainable development of marine aquaculture through the application of the Allocated Zones for Circular Aquaculture (C-AZA) methodology. The plan focuses on realistic and implementable steps that build upon existing aquaculture activities rather than proposing large-scale expansion or the creation of new zones disconnected from current practice.

The analysis of the current situation shows that marine aquaculture in Bulgaria operates under conditions of limited marine space, strong competition with other maritime uses, and a complex regulatory framework, while at the same time demonstrating clear potential for diversification and the adoption of circular and multi-trophic production models. Results from BLUEfasma Circularity self-assessment tool and consultations within the LiRRIE group confirm a high level of investment readiness, provided that greater spatial and regulatory predictability is ensured.

The application of the C-AZA methodology in Bulgaria was carried out in areas with already established aquaculture activities, enabling both verification of the methodology and identification of opportunities to upgrade existing businesses. The results indicate that multi-trophic aquaculture is assessed as suitable (good), though not universally optimal, while Recirculating Aquaculture Systems (RAS) show high potential at appropriate coastal locations. Diversification beyond mussel farming — including oysters and combined systems with finfish (e.g., seabass) — is realistic under certain conditions.

The Action Plan proposes a set of priority measures aimed at:

- improving existing marine aquaculture through the C-AZA approach;
- piloting Integrated Multi-Trophic Aquaculture (IMTA) systems;
- developing land-based RAS units for specific species (e.g., turbot);
- better coordination between C-AZA and the Maritime Spatial Plan;
- strengthening capacity-building and stakeholder dialogue.



The Action Plan is a practical tool that can be used in consultations, pilot initiatives, and future planning processes. It is fully aligned with the National and European strategic frameworks for aquaculture development.

## 2. Introduction

The Action Plan has been developed within the framework of the Interreg Euro-Med project “*Allocated Zones for Circular Aquaculture to trigger the transition to an Inclusive and Circular Economy in the aquaculture sector fostering new business opportunities and eco-consciousness society (AZA4ICE)*”. The Plan aims to support the implementation of the Circular Aquaculture Zones (C-AZA) approach in Bulgaria, with a focus on marine aquaculture along the Bulgarian Black Sea coast. The document serves as an operational framework designed to translate the overarching transnational strategy of the AZA4ICE project into the specific national and regional context.

The geographical scope of the Action Plan covers the territorial waters of the Republic of Bulgaria, with particular attention to the pilot areas analysed within the project (the area north of Varna Bay), without limiting the applicability of the proposed measures to other suitable coastal zones.

The main objectives of the Action Plan are to:

- identify the key challenges, needs, and opportunities for **the development of circular marine aquaculture** in Bulgaria;
- integrate the results from the stakeholder engagement process (LiRRIE forum), **the regulatory analysis**, and the assessment of circular business models among aquaculture operators;
- propose concrete actions and measures aimed at **implementing the C-AZA methodology**;
- support dialogue and coordination among public authorities, businesses, research organisations, and other stakeholders.

### ***Aquaculture sector in Bulgaria***

The development of aquaculture in Bulgaria is closely linked to the country’s long-term economic and institutional transformations. The sector experienced strong growth during the period 1960–1990, when production was based on large pond systems, targeted public investments, and stable domestic demand.



This upward trend reached its peak in the 1980s, with Bulgaria recording its highest historical aquaculture output in 1984 — **14,571 tonnes** (FAO data). The subsequent political and economic changes of the late 1980s and early 1990s led to a sharp decline in the sector, driven by lack of financing, fragmentation of production structures, and deteriorating management of existing infrastructure. Since the late 1990s, the Bulgarian aquaculture sector has entered a period of partial recovery and structural transformation. After 2000, moderate growth is observed, reaching between **14,000 and 16,000 tonnes** in the period 2015–2019, followed by a new decline in recent years.

As of 2023, total aquaculture production is estimated at **approximately 10,000–11,000 tonnes**, comprising a variety of freshwater and marine species. The species composition has shifted over time, with rainbow trout becoming the dominant species and accounting for a significant share of production, alongside traditional carp species. Bulgaria is also characterized by the presence of marine aquaculture, primarily through the cultivation of the Black mussel (*Mytilus galloprovincialis*), which in recent years represents around one-seventh of total production but remains highly sensitive to environmental conditions and market dynamics. This long-term trajectory reflects both the structural constraints of the sector and the development opportunities arising from European policies and financial instruments supporting sustainable and circular aquaculture.

Freshwater production is relatively more diversified and stable, whereas marine aquaculture in Bulgaria remains highly concentrated, primarily around the cultivation of the Black mussel (*Mytilus galloprovincialis*) along the Bulgarian Black Sea coast. Such single-species production ensures economic viability but simultaneously limits opportunities for diversification, benefit, and broader adoption of innovative and circular production systems.

The Bulgarian Black Sea coast is characterised by a limited number of naturally sheltered marine areas and by competition among various maritime and coastal activities, including tourism, maritime transport, fisheries, military zones, and nature conservation. This places marine aquaculture in a context of heightened spatial and environmental sensitivity and underscores the need for more targeted and coordinated spatial planning.

At the national level, the development of the sector is framed by the Multiannual National Strategic Plan for Aquaculture, as well as by the



relevant European policies related to the Blue Economy, the Green Deal, and the transition to a circular economy.

Nevertheless, the practical implementation of circular approaches in marine aquaculture remains limited, with businesses and institutions often facing regulatory, spatial, and investment uncertainties.

Within the AZA4ICE project, the application of the Living Responsible Research Innovation Ecosystems (LiRRIE) methodology enabled the establishment of a structured dialogue process among science, industry, public authorities, and other stakeholders. This process highlighted the need for an integrated approach that combines spatial planning, environmental requirements, and economic sustainability.

In this context, the Circular Aquaculture Zones (C-AZA) methodology is considered a practical tool to support the development of marine aquaculture in Bulgaria. It aims to promote more efficient use of marine space, reduce conflicts between different maritime activities, and create favourable conditions for the adoption of circular and multi-trophic aquaculture production models.

### 3. Role and Responsibilities of Key Stakeholders

The implementation of the Circular Aquaculture Zones (C-AZA) methodology in Bulgaria requires coordinated participation from a wide range of public institutions, regulatory authorities, research organisations, business operators, and other stakeholders. These actors hold direct or indirect responsibilities related to the management, control, and planning of the use of marine and coastal space.

The aquaculture sector is closely linked to policies on land use, maritime spatial planning, environmental protection, food safety, and regional development. For this reason, clear distinction of roles and effective inter-institutional coordination are critical prerequisites for the successful application of the C-AZA approach.

Organisation	Main role and responsibilities
Ministry of Agriculture and Food (MAF)	Development and implementation of national aquaculture policy; management of the Maritime, Fisheries and Aquaculture Programme as an EU financial instrument; strategic planning and coordination with European policies.



Executive Agency for Fisheries and Aquaculture (EAFA)	Registration, licensing, and control of aquaculture activities; enforcement of the regulatory framework; monitoring and reporting of production.
Bulgarian Food Safety Agency (BFSA)	Control of food safety and animal health; approval and supervision of aquaculture facilities; veterinary and sanitary requirements.
Ministry of Environment and Water (MEW)	Policies and regulations in the field of environmental protection; Environmental Impact Assessment (EIA) and Appropriate Assessment procedures; implementation of EU environmental legislation.
Environment Executive Agency (EEA)	National environmental monitoring; collection and analysis of data on the status of waters and the marine environment; information support for planning and regulatory control.
Regional Inspectorates for Environment and Water (RIEW)	Territorial enforcement of environmental legislation; participation in EIA procedures and oversight of activities at the local level.
Basin Directorates	Water management at river basin level; permitting regimes for water abstraction and discharge; control of water quantity and quality, including in coastal areas.
Ministry of Regional Development and Public Works (MRDPW)	Development and coordination of the Maritime Spatial Plan of the Republic of Bulgaria 2021–2035; integration of sectoral interests, including aquaculture, into spatial planning.
Aquaculture operators and business	Implementation of production activities; investments in infrastructure and technology; application of circular and multi-trophic models; participation in pilot initiatives.
Institute of Fisheries and Aquaculture	Scientific research and development; development and testing of technologies; expert support for policies and projects.
Institute of Fish Resources	Research on marine ecosystems and resources; scientific support for spatial analysis, monitoring, and sustainable management of marine aquaculture.



Non-governmental organization (NGOs) and Fisheries Local Action Groups (FLAGs)	Representation of local and sectoral interests; support for local development; participation in consultations and community engagement.
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## 4. Key Challenges and Opportunities for Development

This section summarises the main issues, challenges, and development opportunities for marine aquaculture in Bulgaria, identified during expert meetings held under the AZA4ICE project. The analysis is based on expert discussions and consultations with stakeholders from the public sector, industry, academia, and non-governmental organisations. It reflects the real constraints and potential for applying the **C-AZA methodology** under Bulgarian conditions.

### 4.1 Main challenges

A key challenge is the need for better coordinated spatial planning for marine aquaculture. The absence of clearly defined and pre-agreed zones for aquaculture development creates uncertainty for investors and increases the risk of conflicts with other maritime activities.

Additionally, stakeholders emphasise the need for greater regulatory clarity and predictability, particularly regarding permitting procedures and their timelines, environmental assessments, and the interaction between different competent authorities. This is especially important for new or innovative production models, including multi-trophic and circular aquaculture.

From the perspective of both industry and the scientific community, there is also a recognised need to strengthen capacity and technical expertise related to the implementation of circular models, environmental risk management, and adaptation to climate change.

### 4.2 Key challenges

The development of marine aquaculture in Bulgaria faces a combination of spatial, environmental, regulatory, and economic challenges.

Among the main spatial challenges are:



- a limited number of suitable and naturally sheltered marine areas;
- competition with tourism, shipping, commercial fisheries, defence activities, and other maritime uses;
- insufficiently detailed spatial analyses tailored to the needs of the sector.

The environmental challenges include:

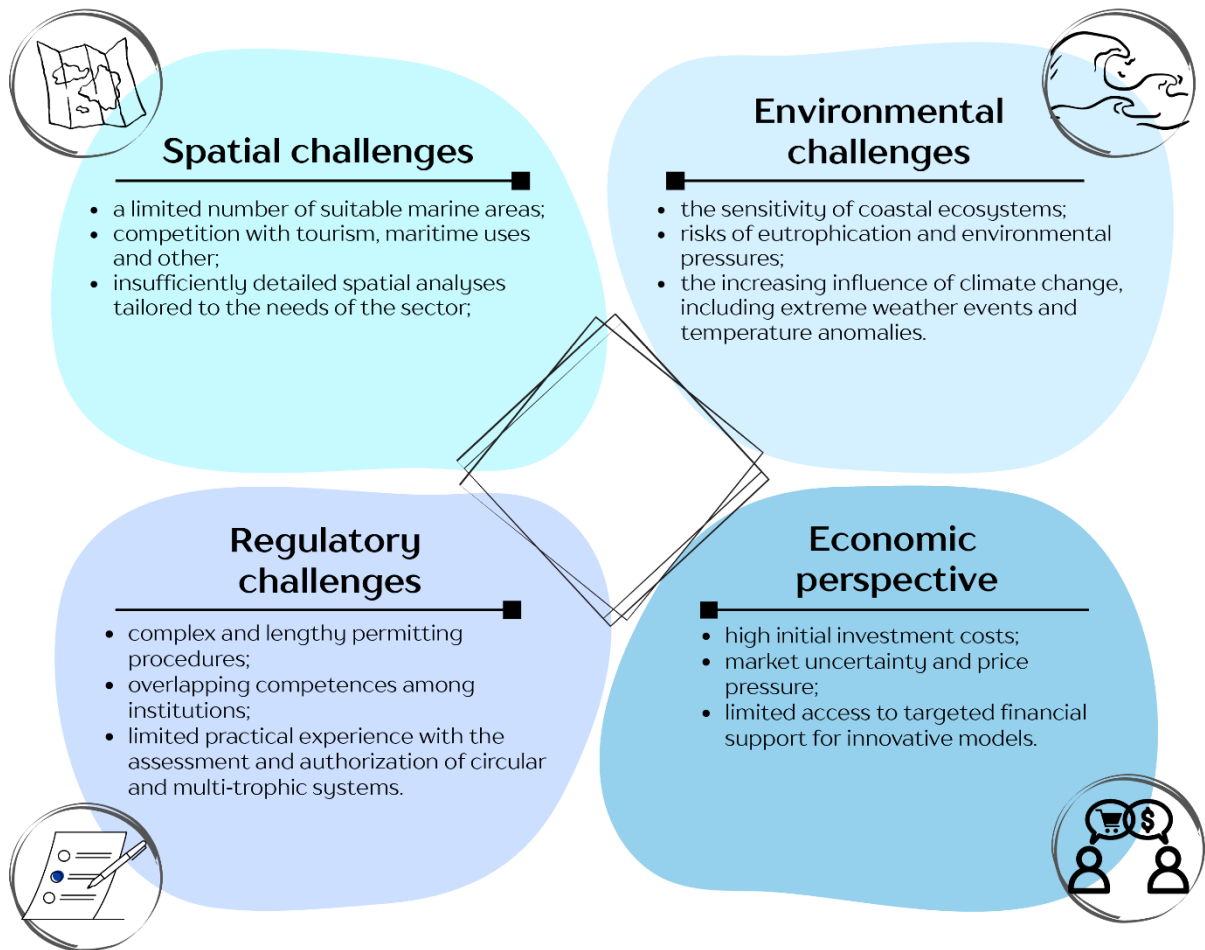
- the sensitivity of coastal ecosystems;
- risks of eutrophication and localised environmental pressures;
- the increasing influence of climate change, including extreme weather events and temperature anomalies.

The regulatory and administrative challenges are reflected in:

- complex and lengthy permitting procedures;
- overlapping competences among institutions;
- limited practical experience with the assessment and authorisation of circular and multi-trophic systems.

From an economic perspective, businesses highlight:

- high initial investment costs;
- market uncertainty and price pressure (lack of competitiveness);
- limited access to targeted financial support for innovative models.



### 4.3 Opportunities for Development

There are significant opportunities for the development of marine aquaculture in Bulgaria, particularly in the context of the circular economy.

One of the key opportunities is the application of the C-AZA methodology as a tool for planning and coordination, which can reduce conflicts between different maritime activities and create a more favourable investment environment.

Additional opportunities include:

- development of Integrated Multi-Trophic Aquaculture (IMTA) systems combining species from different trophic levels;
- increasing added value through species diversification;
- leveraging national scientific and research capacity to test and adapt innovative solutions;



- better utilisation of European policies and financial instruments supporting sustainable and circular models.



Collaboration between the public sector, industry, and the scientific community, supported by consultative mechanisms such as the **Living Responsible Research and Innovation Ecosystem (LiRRIE)** — is considered a key factor for transforming these opportunities into practical and implementable solutions.

## 5. Regulatory Framework

This section presents an extended analysis of the current legal, regulatory, and administrative framework governing the aquaculture sector in Bulgaria, with a particular focus on marine aquaculture. The analysis is based on the results of the regulatory review carried out under the AZA4ICE project, as well as on expert discussions within the LiRRIE working group.

The purpose of this section is not only to summarise the applicable laws, regulations, and EU acts, but also to outline the practical implications of their implementation, the main regulatory challenges, and the opportunities for improving predictability and coordination through the application of the C-AZA approach.



## ***5.1 Characteristics of the Regulatory Framework***

The regulation of the aquaculture sector in Bulgaria is carried out through a multi-level and sectorally fragmented legal system, comprising national legislation, secondary regulations, and applicable European Union directives and regulations. Marine aquaculture simultaneously falls under the scope of policies and regimes related to:

- agriculture, fisheries, and aquaculture;
- environmental protection and biodiversity conservation;
- water management;
- maritime spatial planning;
- food safety and veterinary control.

As a result of this complexity, numerous competent authorities are involved in management, permitting, control, and monitoring processes, including the Ministry of Agriculture and Food, the Executive Agency for Fisheries and Aquaculture, the Ministry of Environment and Water and its regional structures (Regional Inspectorates of Environment and Water, River Basin Directorates), as well as the Bulgarian Food Safety Agency (BFSA).

Although the mandates of individual institutions are clearly defined, the lack of an integrated and coordinated approach often leads to complicated and long procedures, particularly in the case of marine aquaculture.

## ***5.2 Key Sectoral Legislation and Regulatory Regime***

### **Fisheries and Aquaculture Act (FAA)**

The Fisheries and Aquaculture Act is the primary legislative act regulating the breeding and rearing of fish and other aquatic organisms. The Act provides the legal definition of “aquaculture” and establishes registration regimes, administered by the Executive Agency for Fisheries and Aquaculture (EAFA):

- persons engaged in the breeding and rearing of fish and other aquatic organisms;
- the production of carriers of genetic material from hydrobionts.

When technical installations are placed in the waters of the Black Sea, registration is carried out following additional approvals, where applicable. The FAA also requires the maintenance of specialised registers and the submission of a technological description and production flow scheme.



## Water Act (WA)

The Water Act introduces permitting regimes for the use of water bodies for aquaculture and related activities, administered by the River Basin Directorates. These regimes are directly linked to:

- conditions for water use and/or wastewater discharge;
- compliance with the environmental objectives for water bodies;
- requirements for preventing negative and cumulative impacts.

The WA is really important for marine aquaculture, as its requirements are often applied jointly with environmental procedures under the Environmental Protection Act (EPA) and the Biodiversity Act (BDA).

## Veterinary Medical Activity Act (VMAA)

The VMAA regulates the registration of livestock establishments under Article 137 and introduces veterinary and biosecurity requirements, as well as hygiene standards for aquaculture production facilities. The competent authority is the **Bulgarian Food Safety Agency (BFSA)**. The requirements under this Act are essential for ensuring animal health status and the safety of aquaculture products.

### ***5.3 Secondary Legislation and Practical Implementation***

The practical requirements for aquaculture activities are specified in secondary legislation, including:

- **Ordinance No. 37 of 10 November 2008 on the use of state-owned reservoirs for fisheries purposes and the rules for commercial and recreational fishing and aquaculture in state-owned water bodies under Article 3(1) of the Fisheries and Aquaculture Act** – regulates the rules for conducting aquaculture in state-owned water bodies, including the Black Sea.
- **Ordinance No. 7 of 21 November 2019 on maintaining the registers under Article 16(1) of the Fisheries and Aquaculture Act** – sets out the procedures for maintaining the registers under the FAA.
- **Ordinance No. 18 of 4 November 2016 on the content of the technological description and the technological production**



- scheme for aquaculture** – defines the requirements for the technological description and production scheme.
- **Ordinance No. 4 of 20 October 2000 on the quality of waters for fish farming and for the cultivation of shellfish** – establishes water quality requirements for fish farming and shellfish cultivation, directly relevant to mussels and oysters.
  - **Ordinance on the conditions and procedures for Environmental Impact Assessment (EIA), adopted under the Environmental Protection Act** – regulates the conditions and procedures for conducting Environmental Impact Assessments, including screening rules, reporting requirements, and annexes.
  - **Ordinance on the conditions and procedures for Appropriate Assessment of plans, programmes, projects, and investment proposals for compatibility with the conservation objectives of protected areas (Article 31 of the Biodiversity Act, Natura 2000)** – regulates the Appropriate Assessment under Article 31 for Natura 2000 compatibility.
  - **Ordinance No. 44 of 20 April 2006 on veterinary requirements for livestock establishments** and **Ordinance No. 36 of 23 March 2006 on specific requirements for the production, transport, and placing on the market of raw materials and foods of animal origin** – regulate veterinary and hygiene requirements for establishments and products of animal origin.

This set of secondary legislation provides detailed regulation but also increases administrative complexity, particularly when several regimes must be applied simultaneously.

## **5.4 EU directives with direct impact on marine aquaculture**

### Water Framework Directive (2000/60/EC)

The Water Framework Directive establishes the objectives for achieving and maintaining “good ecological status” of water bodies. In Bulgaria, the directive is integrated into the national legislative framework through the Water Act and implemented through the River Basin Management Plans. For marine aquaculture, the Directive is relevant in terms of the permissible scale and intensity of activities and the assessment of cumulative impacts.



## Habitats and Birds Directives (Natura 2000)

The Habitats Directive and Birds Directive, transposed through the Biodiversity Act, are of key importance for marine aquaculture, as a significant share of Bulgaria's coastal and marine areas falls within Natura 2000 sites. Investment proposals are subject to Appropriate Assessment, which often represents a major source of uncertainty and delays, including for innovative or circular production models.

### **5.5 Key Regulatory Challenges**

With regard to the regulatory framework, the analysis and the work of the LiRRIE group identify the following key challenges:

- fragmentation of the legislative and institutional framework;
- sequential and lengthy procedures with limited predictability;
- absence of certain secondary legislation foreseen in primary laws;
- insufficiently specific guidance for circular and multi-trophic systems;
- limited link between spatial planning and permitting regimes.

These factors do not constitute insuperable barriers, but they require targeted coordination and planning solutions.

### **5.6 Role of the Circular Aquaculture Zones (C-AZA) Methodology**

The C-AZA methodology does not replace existing legal regimes, but it can function as a preparatory and coordination tool that:

- supports preliminary assessment of spatial and environmental suitability;
- reduces the risk of substantial revisions during EIA and Appropriate Assessment procedures;
- facilitates coordination between institutions through a shared analytical basis;
- assists in selecting realistic technologies and species adapted to local conditions.

In this way, C-AZA contributes to more predictable and efficient implementation of investments in marine aquaculture, fully aligned with the national and European legal framework.



## 6. Circular Aquaculture in Bulgaria

This section summarises the current state of the aquaculture sector in Bulgaria in terms of its readiness and capacity to apply the principles of the circular economy. The analysis forms on the results of the **BLUEFasma self-assessment tool** (<http://BLUEFasma.upatras.gr/>) applied within the AZA4ICE project, as well as on expert discussions with sector representatives.

### 6.1 Circular Economy in Aquaculture

The assessment results show that the aquaculture sector in Bulgaria is at a relatively low level of actual implementation of circular practices, despite the reported high interest and readiness to invest. In most cases, businesses apply basic environmental measures related to resource efficiency and compliance with regulatory requirements, but lack systematically developed circular models that reduce material and/or energy consumption.

This characteristic is particularly evident in marine aquaculture, where production is concentrated on a limited number of species and technologies, and opportunities for diversification and integration with other activities remain underdeveloped.

### 6.2 Main Limitations Identified by Business Operators

Several groups of constraints have been identified that hinder the wider application of circular approaches in aquaculture:

- Structural and spatial constraints, including the absence of pre-planned and pre-agreed zones for aquaculture development and limited opportunities for expansion or combination of activities;
- Regulatory uncertainty, related to permitting procedures for new or innovative production models, including multi-trophic systems;
- Investment barriers, including high initial capital costs and limited access to targeted financial instruments for innovative (circular) solutions;
- Insufficient technical and managerial capacity, particularly regarding the design, operation, and monitoring of more complex circular systems.



### **6.3 Readiness for Change and Investment in the Sector**

Despite the identified constraints, the results of BLUEFasma clearly indicate a high level of readiness to invest in circular economy practices. A significant share of surveyed enterprises expressed interest in:

- implementing more efficient technologies;
- combining different types of production;
- participating in pilot projects and demonstration initiatives;
- collaborating with research organisations and public institutions.

This gap between strong motivation and limited practical implementation highlights the need for a supportive environment that includes clear spatial planning, coordinated regulatory procedures, and targeted capacity-building measures.

### **6.4 Importance of the Circular Aquaculture Zones (C-AZA) Methodology**

The identified state of the sector confirms that the C-AZA approach has the potential to act as a catalyst for the transition to circular models by:

- reducing spatial and regulatory uncertainty;
- creating conditions for combining different activities and species;
- facilitating access to financing and public support;
- stimulating cooperation between industry, science, and public institutions.

Thus, the results of the BLUEFasma tool represent an important starting point for formulating targeted actions and measures within this Action Plan.

## **7. Vision**

The vision for the development of the marine aquaculture in Bulgaria, formulated within the LiRRIE forum, is oriented towards a gradual but purposeful transition from limited and sector-isolated production practices to a sustainable, spatially planned, and circular-oriented development model.

At the core of this vision lies the understanding that marine aquaculture in Bulgaria should not expand rapidly in terms of production capacity, but should instead improve the quality, sustainability, and added value of existing and future activities. This requires a combination of spatial



planning, regulatory predictability, scientific support, and active engagement of the business sector.

The development of the sector can be supported and guided through the following key directions:

### **7.1 Strategic Positioning of Marine Aquaculture**

Marine aquaculture should be clearly recognised and integrated as a legitimate maritime activity within the framework of maritime spatial planning. This includes:

- identifying and pre-agreeing suitable zones for aquaculture development;
- reducing conflicts with other activities through spatial zoning;
- creating greater investment predictability.

Allocated Zones for Aquaculture (AZA) should be compatible with and potentially integrated into the **Maritime Spatial Plan of the Republic of Bulgaria 2021–2035 (MSP)**, serving as an operational tool for implementing spatial priorities in the aquaculture sector.

While the MSP defines the strategic framework and the balance among different maritime activities, AZA provides a more detailed regulatory and management framework for specific aquaculture activities, including monitoring conditions, spatial allocation, and technological requirements.

The **C-AZA methodology** is viewed as the instrument through which this vision can be operationalised, linking strategic planning with concrete production models.

### **7.2 Diversification and Transition to Circular and Multi-Trophic Models**

The development of marine aquaculture in Bulgaria should be based on diversification of species and production systems, building upon the existing experience with mussel cultivation. The vision includes:

- promoting Integrated Multi-Trophic Aquaculture (IMTA) systems;
- combining different trophic levels to improve resource efficiency;



- gradually introducing circular solutions adapted to local environmental conditions.

This approach is viewed not only as an ecological necessity but also as an opportunity to enhance the economic resilience and added value of the sector.

### ***7.3 Improving the Regulatory Framework***

The development vision clearly emphasises that the sector requires a more predictable and coordinated regulatory environment that:

- facilitates the implementation of innovative production models;
- streamlines and coordinates administrative procedures;
- provides clear guidance for the assessment and authorisation of circular and multi-trophic systems, as well as adequate timelines for implementation.

This does not imply lowering environmental standards, but rather improving institutional coordination and sector-level planning.

### ***7.4 Role of Science, Innovation, and Capacity Building***

Research and scientific organisations are seen as key partners in implementing the vision through:

- scientific support for spatial analysis and the selection of suitable zones;
- adaptation and testing of technologies under real conditions;
- training and capacity building for operators and public administration.

The vision proposes close cooperation between science and industry, including through pilot projects and demonstration activities that should stimulate the development of the aquaculture sector.

### ***7.5 Social Acceptability and Cross-Sector Dialogue***

The development of marine aquaculture should be socially acceptable and aligned with the interests of other maritime sectors, including tourism,



transport, and defence. The work of LiRRIE demonstrates that timely dialogue and transparency are essential for:

- reducing public tension;
- building trust among different users of the marine space;
- ensuring the sustainable integration of aquaculture into coastal regions.

## 8. Significance of Allocated Circular Aquaculture Zones

The application of the Circular Aquaculture Zones (C-AZA) methodology within the AZA4ICE project in Bulgaria has a distinctly practical character, as the analyses were carried out in areas with already established aquaculture activities. This allows for simultaneous verification of the methodology under real conditions and assessment of the potential for upgrading, modernisation, and diversification of existing businesses, rather than planning entirely new zones. Such an approach is particularly suitable for the Bulgarian context, where marine aquaculture is spatially constrained and strongly dependent on the local hydrodynamic and ecological characteristics of the coastline.

The results of applying C-AZA in zones with active aquaculture farms show that the methodology reflects the real constraints and opportunities of the marine environment. In cases where production activities already exist, the methodology confirms the suitability of the zones for certain species and technologies and identifies opportunities for improving the spatial organisation of installations.

Moreover, it outlines the potential for introducing more complex, circular, and integrated production models with higher added value. This provides grounds for considering C-AZA not only as a tool for planning new investments but also as a supportive instrument for the development and modernisation of existing aquaculture farms.

Regarding Integrated Multi-Trophic Aquaculture (IMTA), the analyses show that such systems are assessed as applicable and environmentally justified, but not as a universally optimal solution for all evaluated zones. The effectiveness of IMTA models depends significantly on local hydrodynamic conditions, ecological capacity, and the spatial configuration of the coastline. In this sense, multi-trophic systems emerge as a realistic but



gradually implementable option that should be adapted to the specific characteristics of each zone rather than applied identically.

The analyses also show that Recirculating Aquaculture Systems (RAS) achieve strong scores in terms of circularity, impact control, and production efficiency, but their potential is highly dependent on spatial conditions. In the Bulgarian context, RAS systems are most suitable as land-based facilities located near the sea or in constrained coastal environments that provide access to seawater and infrastructure. The lack of large, naturally sheltered coastal systems along the Bulgarian Black Sea coast limits the potential for large-scale offshore RAS development, but with careful site selection, RAS remains an important component of the sector's future development.

From a species-specific perspective, the C-AZA results clearly confirm that the Black mussel (*Mytilus galloprovincialis*) remains the most suitable and stable species for open-sea aquaculture in Bulgaria. In addition, the analyses identify further potential for oyster cultivation, which shows favourable results in some of the evaluated zones. Within circular and multi-trophic models, combinations of mussels, oysters, and fish (e.g., sea bass) emerge as a promising opportunity, provided they are carefully adapted to local ecological and spatial constraints.

Regarding turbot (*Scophthalmus maximus*), the results indicate that open-sea aquaculture for this species is difficult to realise under Bulgarian conditions due to the hydrodynamic characteristics of the coastline, exposure of sites to waves and storms, and the species' specific biological requirements. In this context, turbot aquaculture should be directed primarily towards land-based recirculating systems located near the sea, which provide a more controlled environment and higher production security.

Overall, the results of applying the methodology show that it is applicable and appropriate for Bulgarian conditions, but requires a territorially differentiated approach, realistic expectations regarding the technologies used, and a focus on species and technological upgrading rather than rapid expansion of production volumes. This approach provides a solid foundation for formulating concrete, feasible, and prioritised actions aimed at the sustainable development of marine aquaculture in Bulgaria.



## 9. Programme of measures

Nº	Measure	Scope and contents	Lead Responsible Institution	Supporting stakeholders	Time horizon	Funding resources
1	Application of the C-AZA methodology as a tool for upgrading existing marine aquaculture	Use of C-AZA results to analyse and optimise already active aquaculture zones (e.g., restructuring, diversification opportunities, spatial arrangement of installations).	Ministry of Agriculture and Food; Executive Agency for Fisheries and Aquaculture	Aquaculture operators; Institute of Fish Resources; NGOs	Short-term (< 3 years)	National funds; Maritime, Fisheries and Aquaculture Programme (MFAP); limited private investments
2	Pilot introduction of Integrated Multi-Trophic Aquaculture (IMTA)	Pilot-scale implementation of IMTA (mussels–oysters; mussels–fish such as sea bass) in zones with established aquaculture and proven ecological potential.	Aquaculture operators	Institute of Fisheries and Aquaculture; Institute of Fish Resources; Fisheries Local Action Groups (FLAGS)	Short-term (< 3 years)	MFAP; pilot projects; research and demonstration budgets
3	Pilot introduction of land-based Recirculating Aquaculture Systems (RAS) in suitable zones	Support for land-based RAS facilities near the sea as an alternative to open-sea farms for sensitive species (e.g., turbot).	Aquaculture operators	Ministry of Environment and Water; research organisations	Medium-term (3–5 years)	Private investments; MFAP; other EU instruments



4	Coordination between C-AZA and the Maritime Spatial Plan	Using the C-AZA results as an analytical basis for updating and implementing the Maritime Spatial Plan, with the aim of more clearly positioning aquaculture.	Ministry of regional development and works	Ministry of Environment and Water; research organisations	Medium-term (3–5 years)	Public investments; MFAP; other EU instruments
5	Capacity building and stakeholder dialogue	Trainings, workshops, and consultations with businesses, local communities, and other maritime sectors (tourism, shipping), focused on circular aquaculture.	Institute of Fish Resources; Fisheries Local Action Groups (FLAGs)	Ministry of Agriculture and Food; business sector; NGOs	Ongoing	MFAP; small project budgets; own resources



## 10. Monitoring and Evaluation

The monitoring and evaluation of the implementation of this Action Plan aim to track the progress of the proposed measures and enable timely adjustments when necessary. The approach is oriented towards realistic and easily measurable indicators that reflect both the process and the achieved results.

### 10.1 Success indicators

Progress in implementing the Action Plan can be monitored through the following groups of indicators:

- **Process indicators**

- number of zones where the C-AZA approach has been applied or updated;
- number of coordination meetings and stakeholder consultations conducted;
- number of pilot initiatives or demonstration activities;
- number of capacity-building events (trainings, workshops, information sessions).

- **Output indicators**

- implemented or tested multi-trophic systems;
- new or modernised aquaculture installations, including land-based RAS facilities;
- improved institutional coordination in planning and permitting processes.

- **Qualitative Indicators**

- increased predictability of procedures for businesses;
- strengthened dialogue between the aquaculture sector and other maritime activities;
- enhanced trust and public acceptance of marine aquaculture.



## 10.2 Follow-up and adaptation

Monitoring of implementation should be carried out periodically, with a focus on practical results and emerging challenges. When necessary, the Action Plan may be updated or supplemented, taking into account:

- new data and analyses;
- results from pilot activities;
- changes in the regulatory framework.

## 11. Conclusions and Recommendations

This Action Plan aims to support the targeted and sustainable development of marine aquaculture in Bulgaria, with emphasis on applying circular economy principles, introducing innovations, and developing integrated production models. The analysis of the sectoral context, the regulatory framework, and the outcomes of the LiRRIE process shows that the sector has realistic development opportunities, which should be realised primarily through upgrading and modernising existing activities rather than through uncontrolled spatial expansion.

The application of the C-AZA methodology in areas with already established aquaculture activities creates conditions for practical testing and refinement of the approach, as well as for identifying concrete opportunities for diversification, integration of different trophic levels, and optimisation of the spatial arrangement of installations. The results indicate that multi-trophic systems (IMTA) represent a promising development direction, although applicable under clearly defined ecological and technological conditions, while recirculating aquaculture systems (RAS) demonstrate strong innovation potential at suitable coastal and land-based locations. In addition, diversification beyond traditional mussel farming — including oysters and combined systems with fish — emerges as a realistic and economically justified opportunity in certain zones.



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In this context, the C-AZA methodology is established not as an alternative, but as a supporting and enhancing tool within the existing regulatory and institutional framework. Through preliminary spatial and environmental analysis, the approach contributes to better investment planning, reduced potential conflicts, and improved coordination among competent authorities, thereby creating more favourable conditions for the development of circular, innovative, and integrated marine aquaculture in Bulgaria.



## ANNEXES

### **Annex 1 - Key Legislative Acts, Competent Authorities and Practical Implications for Marine Aquaculture**

<b>Law / Directive</b>	<b>Competent Authority</b>	<b>Practical Implications for Marine Aquaculture</b>
<b>Fisheries and Aquaculture Act (FAA)</b>	Ministry of Agriculture and Food; Executive Agency for Fisheries and Aquaculture (EAFA)	Defines the legal right to conduct aquaculture activities; introduces registration regimes for facilities and operators; requires technological descriptions and maintenance of registers.
<b>Ordinance No. 37/2008</b>	EAFA	Regulates the conditions for conducting aquaculture in state-owned water bodies, including the Black Sea; sets rules for the use of marine space.
<b>Water Act (WA)</b>	Ministry of Environment and Water; River Basin Directorates	Introduces permitting regimes for water abstraction and discharge; sets conditions related to water quantity, quality, and cumulative impacts.
<b>Water Framework Directive (2000/60/EC)</b>	Ministry of Environment and Water; River Basin Directorates	Requires compatibility of activities with the objectives for “good ecological status”; influences permissible production intensity and scale.
<b>Environmental Protection Act (EPA)</b>	Ministry of Environment and Water; Regional Inspectorates of Environment and Water (RIEW)	Regulates Environmental Impact Assessment (EIA) procedures for investment proposals; may extend timelines when additional assessments are required.



<b>Biodiversity Act (BDA)</b>	Ministry of Environment and Water; RIEW	Introduces Appropriate Assessment for Natura 2000 compatibility, a key factor in marine and coastal areas with high conservation value.
<b>Habitats and Birds Directives (Natura 2000)</b>	Ministry of Environment and Water; RIEW	Restrict or guide the siting of aquaculture installations; require proof of no significant adverse impact.
<b>Veterinary Medical Activity Act (VMAA)</b>	Bulgarian Food Safety Agency (BFSA)	Registration of livestock establishments; requirements for biosecurity, animal health status, and disease control.
<b>Ordinance No. 44/2006 and Ordinance No. 36/2006</b>	BFSA	Define veterinary and hygiene requirements for aquaculture facilities and products.
<b>Ordinance No. 4/2000 (Water Quality)</b>	Ministry of Environment and Water	Sets minimum water quality requirements for marine and coastal waters used for mussel and shellfish cultivation.
<b>Maritime Spatial Plan of the Republic of Bulgaria (2021–2035)</b>	Ministry of Regional Development and Public Works	Provides the strategic framework for the spatial allocation of aquaculture; influences activity admissibility and spatial conflict management.
<b>Regulation (EU) 2021/1139 (EMFAF / PMDR)</b>	Ministry of Agriculture and Food (Managing Authority)	Provides financial instruments for investments, modernisation, and innovation; does not replace regulatory regimes but supports sustainable



## **ANNEX 2 – Alignment with the Multiannual National Strategic Plan for Aquaculture in Bulgaria 2021–2027**

This Action Plan for Bulgaria has been developed in full alignment with the objectives and priorities of the **Multiannual National Strategic Plan for Aquaculture (MNSPA)**. The national plan defines the strategic framework for sector development, while the AZA4ICE Action Plan provides practical tools and pilot approaches that support the implementation of these objectives, particularly in the field of marine aquaculture.

### **Alignment with Key Priorities**

#### 1. Simplification of Administrative Procedures

The MNSPA identifies administrative burden and lengthy procedures as key challenges for sector development. The AZA4ICE Action Plan does not propose changes to the regulatory framework but contributes by:

- conducting preliminary spatial and environmental assessments of potential zones;
- identifying constraints and sensitive areas at an early stage;
- supporting institutional coordination already during the planning phase.

#### 2. Coordinated Spatial Planning

The MNSPA emphasises the need to define aquaculture zones in the marine area and integrate them into maritime spatial planning. The C-AZA methodology directly addresses this priority by providing:

- an analytical basis for identifying and comparing suitable zones;
- a tool for reducing spatial conflicts;
- a link between strategic planning and concrete investment intentions.

#### 3. Enhancing Competitiveness and Sustainable Growth

The AZA4ICE Action Plan reinforces the strategic objective of the MNSPA for sustainable growth by focusing on:

- diversification of production;
- application of circular and multi-trophic models;



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- technological solutions with lower environmental risk.

### **Synergy Between the AZA4ICE Action Plan and the MNSPA 2021–2027**

The main added value of AZA4ICE is that it transforms the strategic objectives of the national plan into practical, spatially specific solutions that can be used by institutions, businesses, and the scientific community. In this sense, the Action Plan can be regarded as a pilot and complementary instrument that supports the implementation and future updating of the MNSPA.



## **ANNEX 3 – Recommendations for Improving the Regulatory Framework in Support of Innovative and Circular Aquaculture**

The development of the aquaculture sector in Bulgaria is linked to the objectives of sustainable production, reducing pressure on water bodies, efficient resource use, and minimising conflicts with other users of water bodies and the marine area. In this context, innovative production approaches such as Allocated Zones for Aquaculture (AZA), Integrated Multi-Trophic Aquaculture (IMTA) and Recirculating Aquaculture Systems (RAS) are key instruments for modernisation, investment predictability, and improved environmental management.

The following recommendations aim at minimal but strategically important adjustments to the existing regulatory framework, complemented by a new specialised ordinance regulating AZA/IMTA/RAS in a way that allows subsequent technical “upgrading” (criteria, monitoring, procedures) without requiring major legislative amendments.

### **1. Identified Gaps in the Existing Framework**

#### **1.1. Lack of unified terminology and recognisable regimes for innovation**

The current framework (Fisheries and Aquaculture Act, Water Act and secondary legislation) does not explicitly introduce concepts or mechanisms about:

- Allocated Zones for Aquaculture (AZA) as a priority tool for spatial planning/management of aquaculture areas;
- Integrated Multi-Trophic Aquaculture (IMTA) as a production model with ecological benefits and requirements for specific monitoring;
- Recirculating Aquaculture Systems (RAS) as a technological approach with a distinct water-use profile and controlled discharges (RAS is mentioned technically in Ordinance No. 18/2016, but is not systematically embedded in the overall regime and is not used as a policy instrument).

#### **1.2. “Zones” exist only fragmentarily, without a specific management framework (especially in the marine area)**

Ordinance No. 37/2008 contains provisions on “aquaculture zones”, but these relate mainly to the placement of installations, marking, and restrictions, without:



- a clearly defined concept for designation/modification/management of zones as a sectoral policy tool;
- a minimum set of monitoring requirements and environmental measures by system type (particularly for IMTA);
- clear integration with other regimes and plans (including Water Act, Environmental Protection Act, Biodiversity Act, and sectoral plans).

### **11.3. The Water Act treats “aquaculture” as a single category, without differentiating between systems**

The permitting regime under the Water Act includes “aquaculture and related activities”, but lacks a principle stating that permit conditions should reflect the nature of the system, its ecological effect, and its interaction with the water body — particularly important for marine systems, IMTA, and RAS with water abstraction/discharge.

### **11.4. Lack of an investment-oriented approach/mechanism**

When the regulatory framework does not clearly define how zones are determined, what the requirements for innovative systems are, and how their environmental effects are assessed, this results in:

- administrative uncertainty and reduced investment interest;
- limited ability of public authorities to guide investments towards suitable locations and technologies.

## **2. Motives for the Proposed Changes**

### **2.1. Sustainable development and improved environmental management**

IMTA and RAS can reduce ecosystem pressure through better utilisation of nutrients (IMTA) and limited water exchange/controlled discharges (RAS). To realise this potential, clearly defined minimum requirements are needed for technological descriptions, monitoring, and risk management.

### **2.2. Reducing conflicts and increasing predictability for businesses through AZA**

AZA as a spatial planning tool enables:

- prioritisation of aquaculture in specific parts of water bodies/marine areas;



- reduction of conflicts with other users;
- faster, more predictable, and more transparent investment procedures.

### **2.3. Alignment with European priorities and improved absorption of funding**

Introducing terminology and definitions related to AZA/IMTA/RAS supports:

- preparation of funding proposals and justification of projects as “sustainable/innovative”;
- prioritisation of measures for competitiveness, environmental protection, monitoring, and digitalisation.

Practically, this increases the sector’s “readiness” to utilise European funds (e.g., the European Maritime, Fisheries and Aquaculture Fund – EMFAF, as well as complementary opportunities under innovation, environment, and regional development programmes), as the regulatory framework will provide clear eligibility rules, criteria, and management requirements.

## **3. Proposed Changes**

### **3.1. Minimal Amendments to the Fisheries and Aquaculture Act (FAA)**

(A) Introduction of definitions in the Supplementary Provisions

- “Allocated Zone for Aquaculture (AZA)”
- “Integrated Multi-Trophic Aquaculture (IMTA)”
- “Recirculating Aquaculture System (RAS)”

(B) Expansion of Article 25, paragraph 5

In addition to production limits, the provision should also include:

- designation/modification/management of AZA;
- minimum content of monitoring plans and environmental measures, including for IMTA.

(C) New articles (e.g., Articles 25d and 25e)

- framework for determining AZA based on criteria (ecological capacity, compatibility with regimes, safety, planning instruments);



- possibility for IMTA within AZA and requirement for technological description + monitoring.

### 3.2. Amendment to the Water Act (WA)

Amendment to Article 46, paragraph 1, item 2, to emphasise the principle:

*“... and when determining the conditions of the permit, the nature of the production system, its ecological effect, and its interaction with the water body shall be taken into account.”*

This creates a legal basis for the competent authority to tailor permit conditions according to the different impact profiles (cages, IMTA, RAS).

### 3.3. Secondary Legislation

(A) Ordinance No. 37/2008 – adjustment/coordination

- terminological shift from “aquaculture zones” to “Allocated Zones for Aquaculture (AZA)” if such a definition is adopted in the FAA;
- references to the new specialised ordinance (see section 3.4) instead of overloading Ordinance 37 with complex new regimes.

(B) Ordinance No. 18/2016 – technical supplement for IMTA (without duplicating definitions)

- addition of minimum requirements for technological description/layout for IMTA (components, spatial arrangement, material flows, monitoring);
- indicator specifying whether the facility is located within an AZA (designation/administrative act).

### 3.4. Proposal for a New Ordinance on AZA/IMTA/RAS

A new ordinance is proposed (based on the expanded Article 25, paragraph 5 of the FAA), regulating:

1. **Designation and modification of AZA** – criteria, procedures, transparency, register/map;



2. **Management of AZA** – rules for installation placement, rotation/relocation, buffer zones (where applicable), coordination with other users;
3. **Minimum monitoring and environmental measures** – basic package + additional requirements by system type;
4. **IMTA** – minimum content of monitoring plans/programmes, control points and indicators, risk-management measures;
5. **RAS** – principles for water use and controlled discharge, minimum requirements for wastewater management plans (aligned with the Water Act and Environmental Protection Act).

#### 4. Enabling Conditions for Funding and Investment Support

The proposed amendments have a direct enabling and stimulating effect because:

**AZA** reduces transaction costs and investor risk by providing clearer locations and conditions.

**IMTA and RAS become formally recognised regulatory categories**, which facilitates:

- directing public support towards systems with positive environmental effects;
- developing priority measures and selection criteria under financial instruments;
- justifying investments in innovation, green transition, monitoring, and digitalisation.

In practical terms, this supports project preparation and absorption of funding from European instruments such as **EMFAF** (and complementary innovation/environment programmes), as the regulatory framework would provide clear definitions, procedures, and requirements for control and accountability.

The aquaculture sector needs clear definitions, predictable rules, and methods for introducing innovations, without overburdening legislation with excessive detail at the level of primary law. The proposed approach — minimal



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amendments to the **Fisheries and Aquaculture Act** and the **Water Act**, combined with a proposal for a **new ordinance on AZA/IMTA/RAS** — enables:

- introduction of key concepts and principles;
- creation of a flexible framework for technical development (criteria/monitoring/procedures) through secondary legislation;
- improved spatial planning and reduced conflicts;
- opportunities to attract funding and stimulate innovative practices.



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