



NEW ACTION: Exploring potential for allocation of offshore aquaculture areas and their integration in MSP

Short description

Marine aquaculture is one of the key established sectors of the blue economy. Aquaculture (sea and freshwater) in Bulgaria contributes 13% of the fisheries and aquaculture sector production with a total value contribution of EUR 13 million to GVA. Some 1,100 people are employed in this sub-sector. As of 2024, 25 aquaculture farms are registered (coastal and coastal lakes): 17 farms for black mussels, 1 fish cage farm, 1 oysters & black mussel farm, 1 rainbow trout farm, 1 farm for black mussels & shrimps and 4 farms for marine worms.

The main objective of the new action is to highlight the potential for and limitations to offshore shellfish aquaculture (black mussels), and to proceed to optimal site/high potential areas selection using a variety of data sources to support the national MSP process. A spatial multi-criteria evaluation/analysis of the feasibility and suitability of the offshore areas for marine aquaculture was then carried out through GIS analysis combining technical/administrative, legislation, environmental, and socio-economic factors.

This study was also demonstrated and consulted (validated) with the key competent stakeholders for aquaculture (MSP Competent Authority, (Bulgarian Ministry of Regional Development and Public Works), Black Sea Basin Directorate (Bulgarian Ministry of Environment and Water) and a blue economy private company dealing with infrastructure developments for shellfish production. Online demonstration and validation with key stakeholders were conducted on 16 February 2024.

Finally, a set of recommendations are provided for the effective and streamlined planning of marine space for aquaculture and integration of proposed areas identified for offshore aquaculture into the Bulgarian MSP plan.

Project partner(s) responsible for the preparation of the new action

CCMS

Action typology

(i) Measures + (iv) zoning

Topic(s) addressed

C. Sustainable sea-food production, C.2 Sustainable aquaculture and shellfish production (C.2.1 *Development of marine aquaculture installations and C.2.4 Multi-use of the sea space: combinations including marine aquaculture*)

Geographical scope

Bulgarian territorial sea (12 NM)

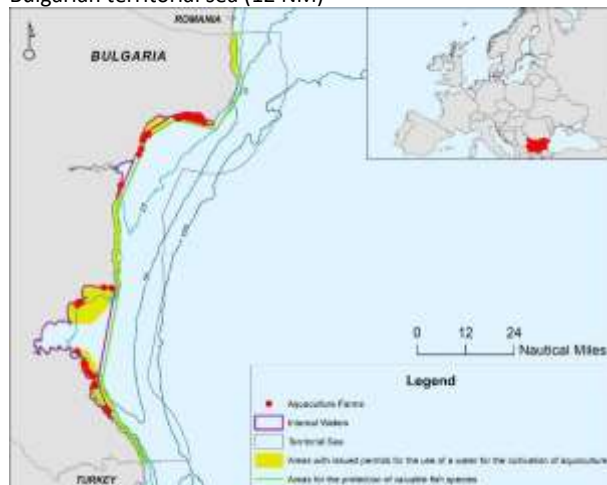


Figure 1. Map of the study area

Sectors/Activity involved

Aquaculture and fisheries, indirectly, shipping, coastal and maritime tourism; maritime defense, nature protection, landscape protection, scientific research, marine industry.

How does the new action support the Green Deal in MSP

The aspect on which this new action mainly supports the EGD is in C. Sustainable sea-food production, C.2 Sustainable aquaculture and shellfish production (C.2.1 Development of marine aquaculture installations and C.2.4 Multi-use of the sea space: combinations including marine aquaculture) by exploring the potential for definition and allocation of new offshore areas for shellfish aquaculture (mostly black mussel) and the way they can be integrated in MSP.

The new study is based on the results from the elaborated valuable practice on aquaculture in Task 3.1. The Bulgarian MSP Plan has Specific objective 2.4. Sustainable development of the Fisheries and Aquaculture sector. It provides general recommendations for sustainable aquaculture development, as the key are:

- ✓ Diversifying fishery and aquaculture production by tapping in economic synergies with tourism, recreational fishing and enhanced environmental services in MPAs;
- ✓ Promoting good aquaculture practices and market expansion;
- ✓ Deepening cooperation among all stakeholders in fisheries and aquaculture sector (FLAGs could play the role of cross-sectoral clusters);
- ✓ Removing abandoned aquaculture facilities against plastic debris.

The MSP Plan integrates the existing zones with aquaculture farms (located in internal waters, 1 NM distance from the coast) and developed general recommendations to reduce their environmental impacts. The MSP plan does not envisage suitable areas allocated for new onshore or offshore farms, as it is a strategic document, also the offshore farming technology is still under development.

The Bulgarian inshore waters are currently overcrowded with many sea activities and uses, and there is a higher risk of conflict interactions with other activities and sectors. Inshore waters are also more vulnerable to eutrophication from agricultural run-off and other land-based pollutants. Offshore areas are more stable in terms of salinity, seawater temperature, or to other extreme climate threats, etc., which is vital for the shellfish aquaculture (European Commission, 2023).

The proposed new action also seeks to promote synergies between different activities & multiple uses of space, such as encouraging aquaculture development in combination with the development of offshore wind farms. When defining areas for marine aquaculture, potential conflicts with other maritime activities can have a strong influence on the process. In the Bulgarian MSP Plan for example, Multi-Functional Zones are defined aimed at reducing conflicts, supporting the efficient use of marine space and better integration of sectoral maritime policies.

For aquaculture, port facilities should be considered, as well as the required storage space for food stock, and therefore access to space is vital, both maritime space but also onshore space (European Commission, 2023). This is related also to Land-Sea Interactions (LSI). Another example of multi-use is between marine aquaculture and nature conservation, which can be combined by developing aquaculture activities in marine protected areas (MPAs). Synergies may exist with coastal tourism and fishing, one of the most recognised. For example, shellfish farms provide habitats and feed



NEW ACTION: Exploring potential for allocation of offshore aquaculture areas and their integration in MSP

for fish. Scuba diving tourists can be attracted by aquaculture farms, as a place for visiting and watching. Small local nearshore restaurants that serve aquaculture products (as black mussels) or fishes caught by small scaling fishery are a good way to promote local economy, coastal tourism and sustainable use of marine resources. Such a good example is the mussel farms in the area of Dalboka, North Bulgarian coast.

Several limitations/uncertainties were identified in the valuable practice (Task 3.1) on sustainable seafood production towards the achievement of the EGD objectives:

- ✓ lack of well protected bays, seawater temperature variations, climate change impacts, land-based pollutants;
- ✓ competition for space with coastal tourism, port activities, maritime transport, non-living resources (offshore oil and gas) and fisheries;
- ✓ MSP plan scenarios for future development of aquaculture are not sufficiently supported with scientific rational and methodology, or for the multi-use opportunities with other sectors. The Plan does not envisage future (reserved) areas for offshore aquaculture that might overlap with the newly designated or extended MPAs.
- ✓ the Plan does not provide cumulative impact assessment to its Environmental Impact Assessment (EIA) report and these aspects could jeopardise the EGD objectives and related policies regarding biodiversity and ecosystem protection and restoration. Currently the existing aquaculture areas overlap with MPAs, as part of the mussel farms fall into Natura 2000;
- ✓ farms could provide biological treatment through the ability of mussels to filter suspended particles in seawater. However, due to production of solid and liquid waste as a result of shellfish production, the two activities are incompatible (this proves once more the need of shifting this activity offshore).
- ✓ development of marine aquaculture is highly dependent on the good quality of the sea water: mussel farms also decrease and mitigate nutrient pollutants, reduce local climate change impacts (e.g. carbon sequestration), support fish stocks, among the others;
- ✓ climate change issues are only generally considered in the MSP Plan and its EIA report, with regards to the potential negative impacts on aquaculture.
- ✓ Ordinance for authorisation/licensing for aquaculture farms is up to date and does not include the permissions for the development of offshore aquaculture. This imposes the need for updates of the regulation and policy modifications.
- ✓ there is still a lack of mussel's growth modelling and climate change predictions on the impact.

In this context, the new action will provide:

- ✓ feasibility study on the preliminary identification of the areas with high potential for offshore aquaculture development and without having conflicts with other maritime activities;
- ✓ a set of recommendations for integration of these areas into MSP;
- ✓ additionally, opportunities for MU options with other uses and environment are also identified/evaluated.

Governance context

There are shared competences in regard to aquaculture sector and farms:

- ✓ The authorisation/licensing for aquaculture farms is regulated by a scheme of the Black Sea Basin Directorate (subnational/regional level) to the Ministry of Environment and

Water of Bulgaria (MOEW) (national level) in accordance with "Instruction for identification of waters in water bodies or parts of them for habitat of fish and the areas with coastal waters for the breeding of shellfish organisms according to the order of Ordinance 4/20.10.2000", as well as with the Fisheries and Aquaculture Act (2001) and other regulations.

- ✓ The Ministry of Agriculture and Food of Bulgaria through its Executive Agency for Fisheries and Aquaculture (EAFA), is the public institution responsible for fisheries and aquaculture sectors and legislation at a national level, also coordinating actions and activities with other ministries, regions and other stakeholders (at national and subnational level). Other public institutions, acting at local (coastal municipalities) and sub-local or regional levels (Dobrich, Varna and Burgas) mainly work as policy-makers and regulators, through their specific departments which are competent in the fishing sector.
- ✓ The good ecological and environmental status of the sea waters is provided by the provisions of the MSFD and the WFD, and the national Marine Strategy and Programme of Measures implemented by the Black Sea Basin Directorate (to the MOEW) and fully integrated in the Bulgarian MSP Plan.
- ✓ In a specific case, a permit or licence can be obtained without having to perform an EIA, for example, in Bulgaria, after initial assessment, if the impact of the activity is considered negligible, an EIA is not required.

Other stakeholders to be involved in the new action

Consultations with administrative (military, maritime administration) and private stakeholders at national and subnational level on the permission of licensing for aquaculture farms. At regional and national level, the implementation and monitoring is provided by the EAFA to the Bulgarian Ministry of Agriculture and Food.

The six coastal FLAGs existing along the Bulgarian coast, which bring together a wide range of local actors (fishermen, marine aquaculture workers, municipalities, scientists, institutions, individuals) can play a role in multi-use development as cross-sectoral clusters acting also as business-support consultancies. Fishermen and aquaculture enterprises, partially organised in cooperatives and associations and operating along the coast, are important commercial business actors in promoting the integration between fisheries and tourism or between aquaculture and tourism.

Description of the new action

As pointed above, the objective of this new action is to assist in the process of identifying new offshore areas, suitable for aquaculture development. The study was conducted through GIS spatial multi criteria analysis, inspired from the methodology suggested by Barillé et al., (2020). As part of the data is not available at this stage, the research focuses in particular on exploring areas in the offshore space of Bulgaria with high potential for the development of aquaculture without conflicts with other sea uses.

Criteria for allocation of the new offshore aquaculture areas

The available data were categorised into three types of *Spatial Suitability Criteria*: Environmental criteria; Socio-economic criteria; and Constraints (Restrictions), (Fig. 2).

NEW ACTION: Exploring potential for allocation of offshore aquaculture areas and their integration in MSP

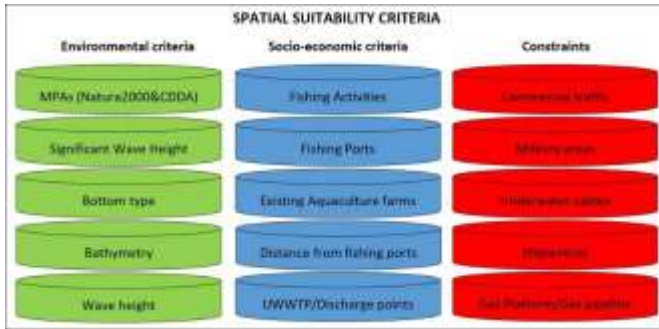


Figure 2. Categories of spatial suitability criteria

- ✓ **Environmental criteria.** These refer to already designated marine areas for nature protection, both under national and European legislation (Natura 2000); bathymetry (bottom depth) is other essential data in the construction of aquaculture facilities; bottom type (seabed substrate) is important for the type in constructions of facilities; wave height is another natural factor that is of great importance to the sustainability and operability of aquaculture installations. In addition, other data can be compiled such as: strength of sea currents, water temperature regime, wind strength, salinity, Eutrophication (Chlorophyll-a), etc.; On the map below, the used environmental data are presented (Fig. 3).

Climate change effects are an important challenge but still not well explored in the Black Sea and because of lack of data, only the climate change perception has been taken into account. The spatial pattern of the Black Sea SST trend reveals a general warming tendency, ranging from 0.053 °C/year to 0.080 °C/year and is rather homogeneous over the whole basin. The impacts of sea surface warming on the physical conditions, sea circulation and fish population stock in the Black Sea remain unclear and should be addressed in the future studies.

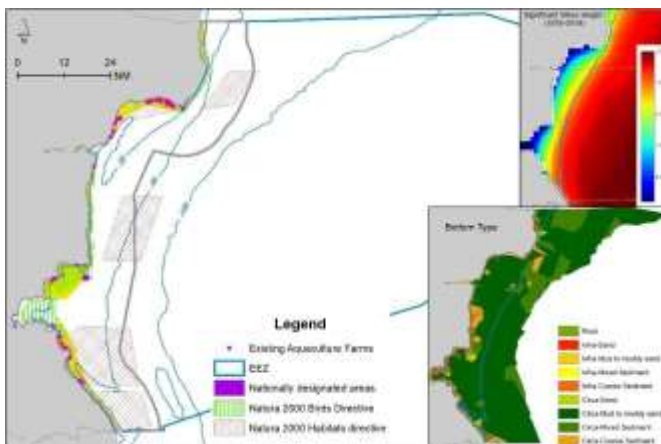


Figure 3. Environmental data included in GIS analysis

- ✓ **Socio-economic criteria** - related to the main economic activities at sea. Areas with intensive commercial fishing are taken into account here; fishing ports (with a view to hosting vessels to serve the aquaculture installations); a buffer of 12 nautical miles' distance from fishing ports has been created, in view of accessibility to aquaculture installations); and layers with already designated and approved aquaculture areas as well as existing aquaculture farms. Another important criterion is the necessary distance of aquaculture sites from pollution sources, and was also taken into account (Urban Waste Water Treatment Plants (UWWTP) and discharge points of water from the sewages, as they are sources of potential threat of water pollution). Despite the fact that in recent years, treatment

plants have been built and modernised along the coast, there are still places without such plants in the northernmost and southernmost parts of the coast, and the untreated waters are directly discharged into the sea. The socio-economic data are shown on the map below (Fig. 4).

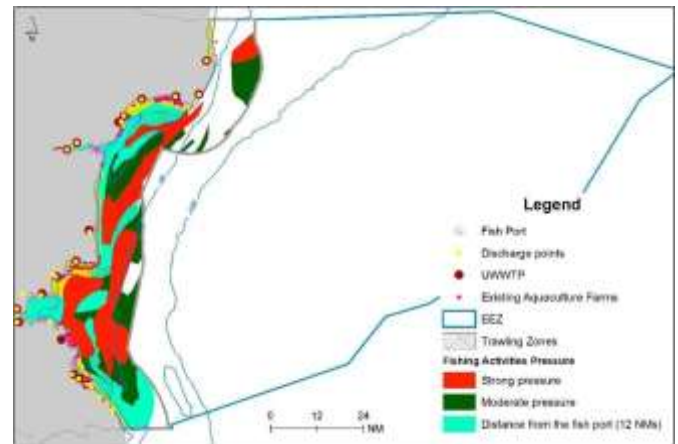


Figure 4. Socio-economic data included in GIS analysis

- ✓ **Constraints (Restrictions)** – related to those criteria that impose a restriction due to incompatibility with other actions, including aquaculture installations (Fig. 5 below). This includes activities such as: i) Maritime traffic (data from the location of the zones for Ship Traffic Separation Scheme, where the construction of any facilities is not allowed); ii) Military zones (areas for military exercises and naval shootings), iii) Underwater infrastructure such as submarine telecommunication cables, gas pipelines, the existing gas platform, etc.; iv) Sunken objects on the bottom (wrecks).

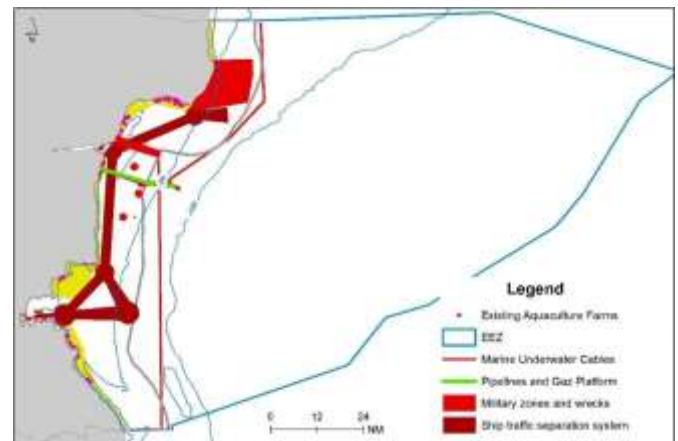


Figure 5. Data for constraints/restrictions included in GIS analysis

Also, a GIS layer can be added with the zones defined in the MSP plan for multifunctional use. Unfortunately, the GIS layers from the Bulgarian MSP plan are not freely accessible, which makes it difficult to perform this task.

The GIS data were acquired from different sources (EMODnet, EEA, Copernicus, as well as from CCMS GIS database). All GIS layers are standardised (transformed into UTM metric coordinate system). To be classified as offshore aquaculture, these installations must meet several criteria (European Commission, 2023):

- ✓ (i) be located greater than 3 km from the shore;
- ✓ (ii) To be located at greater than 50 m water depth;
- ✓ (iii) not normally visible from the shore;
- ✓ (iv) with up to a 5 m wave height;

NEW ACTION: Exploring potential for allocation of offshore aquaculture areas and their integration in MSP

✓ (v) only accessible in 80% of weather conditions.

As of the beginning of 2024, all existing marine aquaculture farms in Bulgaria are located within 3 km distance from the coast. Few are those at a distance larger than 2 km, with the majority at a distance between 0.5 km and 1.5 km. There are also mussel farms located at a distance less than 0.250 km from the coast. As for the depths, the majority of mussel farms are located between 12 and 15 m depth, including all mussel farms in the northern part of the coast. In the south, where the depths are greater, the mussel farms are located between 15 and 35 m depth. None of the mussel farms are located at a depth below 50 m. As for the third condition, visibility from the coast, given the close location to the coast, all operating farms are visible from the coast. Mussel farms are also located in the bays, where the wave heights do not exceed 5 m. This fact also allows most of the time to have access (of weather conditions) to work on the facilities.

The need for development of deep-sea (offshore) marine aquaculture, including synergies between aquaculture with offshore wind farms, is addressed in the MSP of Bulgaria. The area east of the Cape Kaliakra, north Bulgarian coast is indicated as such a highly potential area. The Plan recommends developing multi trophic aquaculture, combining the cultivation of fish with non-fish species (mussels).

Proposed new offshore aquaculture areas

The assumed criteria of identifying the new aquaculture areas predisposed that they should meet as far as possible the definition of offshore aquaculture areas: located at a distance larger than 3 km from the coast and at a depth larger than 50 m, not be visible from the coast, and the wave height is less than 5 m. Also, in the spatial GIS analysis, the areas with restrictions to install aquaculture facilities are taken into account. As mentioned above, such zones are areas for military exercises, maritime transport corridors (traffic separation system), built underwater infrastructure such as cables and pipelines, sunken objects (shipwrecks), etc. Overlapping with nature protection areas (MPAs) was also avoided, although currently almost all sea aquaculture farms are overlapped with MPAs.

The map below shows the proposed new offshore aquaculture areas (in blue), as well as the restricted zones. In yellow, are shown zones for multifunctional uses according to the national MSP Plan (Fig. 6).

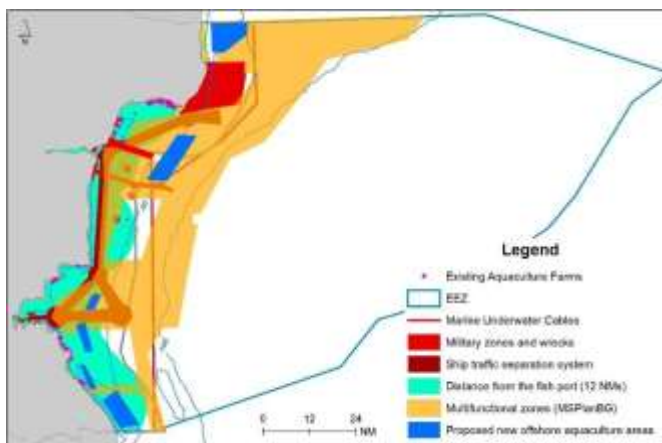


Figure 6. Map of the areas with high potential for offshore aquaculture

A total of 6 new offshore aquaculture areas have been proposed, with different sizes, at different distances from the coast, and at different water depths (Table 1). The only criteria that have been fully met are that the new proposed areas do not overlap with the restricted zones, and that they are in places where the wave height

does not exceed 5 m. The table below shows how well the new proposed areas meet the criteria for offshore aquaculture.

Table 1. Proposed new offshore aquaculture areas

	Area (km ²)	Average Depth (m)	Average Distance from the coast (km)	Significant Wave Height (m)
1	191.8	45	14	2.9
2	213.0	54	13.5	3.0
3	29.1	42	17	2.6
4	56.1	37	7	2.7
5	33.2	49	2	2.8
6	144.5	59	3.1	3.4

The average depth of the new proposed areas is less than 35 m, with two of the areas being at 50 m each. In the other criterion, distance from the coast, only one area is less than 3 km away, 2 of them are between 3 and 7 km away from the coast, and the remaining 3 areas are between 13.5 and 17 km seaward. The larger distance from the coast also implies longer travel times to the installations, as well as higher transport costs. All proposed areas are located in the territorial sea (12 NM).

Overlapping with other users, conflicts/ synergies

Except to 'identify' new areas with potential for offshore aquaculture, in order to meet criteria for offshore aquaculture, the study also considered avoiding overlapping with other sea uses, as well as possible synergies. Given the progressively crowded space with activities, as well as the emergence of new activities (such as offshore wind energy), or the extension of MPAs, it is becoming more and more challenging to "find free" offshore sea areas. In the spatial analysis, an attempt was made to adhere to Multifunctional zones in the Bulgarian MSP Plan, however there might be some deviations due the lack of official MSP data.

After overlaying all available GIS layers, six areas are identified as less "crowded", in terms of less competition for marine space (Fig. 7). Five of the areas are into the preliminary 12 NM distance buffer from the fish ports. None of the new areas overlap with the military areas, areas with underwater infrastructures and shipwrecks, and marine traffic separation zone system. Most of the proposed areas are situated in the southern part of the marine space of Bulgaria. One of the most prospective and large areas is near to the border of Romania. The main constraint here is the fact that there is no one fish port built, only a few small fishing boat places.

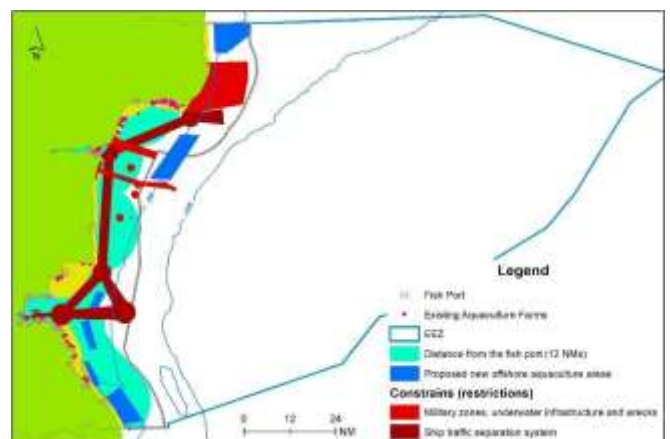


Figure 7. Map of overlapped GIS layers to identify possible conflicts

Recommendations how to integrate proposed future areas



NEW ACTION: Exploring potential for allocation of offshore aquaculture areas and their integration in MSP

suitable for offshore aquaculture in the Bulgarian MSP:

- ✓ Shellfish farming should be preferred in wind energy development areas to achieve a positive combined effect (e.g. northern part of the Bulgarian territorial sea).
- ✓ For multi-use and coexistence with priority maritime activities avoid overlapping with areas that serve national defence, ship traffic (Executive Agency Maritime Administration) and aquaculture areas should be allocated in cooperation with the Executive Agency for Fisheries and Aquaculture and the Ministry of Environment and Water for MPAs overlapping.
- ✓ Strengthening dialogue/coordination between competent MSP and aquaculture authorities is needed.
- ✓ Specific policies and guidelines for aquaculture development should be integrated in MSP, including also cross-sectoral policies and guidance on how aquaculture can: (i) avoid spatial conflicts with other activities and (ii) how synergies and co-location opportunities can be maximised (e.g., involving FLAGS that support both aquaculture and fisheries).
- ✓ Results from stakeholder interviews conducted in Task 2.2 showed recommendation on new requirements regarding the aquaculture areas in the revisions of the Plan, which may result also in adjusting the national normative regulations to reach the EGD objectives.
- ✓ Multi-use concept should be further encouraged in MSP to provide better visibility on spatial synergies between existing/potential maritime activities (example of MARSPLAN-BS II Multi-Use methodology to be integrated and adjusted for aquaculture sector).
- ✓ Integration of LSI needs to be fully considered in MSP. Bulgarian Plan has general description, but not dedicated methodology, the MARSPLAN-BS II LSI methodology to be integrated. Considering that as (i) there is an important need for the sector to have access to port infrastructure for all components of the sector's value chain and (ii) anthropogenic pressures (e.g., land-based pollutants). Space allocation for the sector needs should be coordinated between maritime and municipal planning.
- ✓ Aquaculture licensing data should be preliminary shared by the competent authorities responsible for aquaculture with maritime spatial planners.
- ✓ Allocation of areas offshore should be considered in accordance with investor's interest and the existing or targeted production and markets (local, national or regional scale).

Possible challenges/risks related to the new action

Possible challenges and considerations for aquaculture to be moved offshore:

- ✓ Wave climate, strong currents – all have implications for mooring, stock containment and operations, engineering solutions for these are relatively straightforward.
- ✓ Logistical challenges: longer transit times to / from farm; need for larger boats and support facilities e.g., food storage; human resources, etc.
- ✓ Lack of data and knowledge: modelling of mussel growth and other farm performance is still lacking for a number of different systems and development options; lack of sufficient data on good ecological status offshore.
- ✓ Need of policy regulation updates, not up to date national legislation. There is a risk of policy inconsistency and conflict due to the diversity in the institutional structure for aquaculture and MSP. The licensing and permitting of aquaculture generally remain solely in the field of the fisheries sector management and the Black Sea Basin Directorate to the MOEW, both at national and local levels. The Plan integrates the existing aquaculture areas/farms and makes cross-reference among different agencies and jurisdictions, but the

degree to which this is guided by the national MSP is not sufficiently clear. In reality the aquaculture zoning remains the responsibility of the aquaculture managing and environmental authorities, and it is still not clear what will be coordinated with the MSP process.

- ✓ Time consuming licensing procedures due to multiple actors in decision-making (MSP and sector-specific).
- ✓ Insufficient engagement of the aquaculture sector in the MSP process can result in low levels of consideration of the sector's priorities.
- ✓ Low interests from new investors to develop offshore aquaculture (reluctance of investors as production costs at sea are higher than on land) even if there is government support.
- ✓ Insufficient development of new technologies for offshore aquaculture.
- ✓ Conflicts with other maritime activities and uses which can be exacerbated by MSP process – in particular where exclusive use of space is requested by aquaculture producers, e.g., in nearshore areas and conflicts with other uses such as ship traffic and fishery.
- ✓ Conflicts with land activities (i.e., coastal tourism) onshore due to the need for land and infrastructure for onshore storage and processing.
- ✓ Lack of sharing spatial data on aquaculture activities (e.g., planned, active and inactive) between sectoral managers (e.g., aquaculture, shipping, etc.) and MSP competent authority.

Gaps or elements that the new action does not consider

This is a preliminary study and needs further more detailed exploration and actions with consideration of all needed multiple data, such as climate change modelling, mussel growth modelling and determining the area's 'carrying capacity', i. e. numerical models can be used to simulate the hydrodynamics and ecological conditions of the study area.

Another gap is setting water-quality requirements (in particular for farming of molluscs) due to the lack of data for offshore good ecological status under the MSFD.

Replicability /Elements which can be capitalised

- ✓ The suggested approach/methodology and GIS spatial multi-criteria analysis could be replicated by other countries for the identification of suitable areas with high potential for offshore marine aquaculture development. The approach can be even upgraded, however, it is important to consider that the analysis can only include factors/criteria where needed data is available.
- ✓ Evaluating multi-use options and conflicts in relation to new offshore areas with other maritime activities and nature protection for optimal allocation of offshore aquaculture (including their compatibility with MSP Plan Multifunctional zoning for synergies and co-location of activities) can be also replicated.