LATVIJAS HIDROEKOLOĢIJAS INSTITŪTS

Interreg Baltic Sea Region

GRASS

EUROPEAN UNION

EUROPEAN REGIONAL DEVELOPMENT FUND

GoA 3.1 Locating the best available macroalgae cultivation and harvesting sites. Summary of methods and results of the conflicts and synergies analysis.

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List of Abbreviations

BSR	Baltic Sea Region
EIA	Environmental Impact Assessment
EU	European Union
MSP	Marine/Maritime Spatial Planning
SEA	Strategic Environmental Assessment
EEZ	Exclusive Economic Zone

Introduction

Marine Spatial Planning (MSP) is a decision-making tool which provides a shared means of achieving much needed effective ocean governance through spatial management of human activities (Directive 2014/89/EU; Friess and Gremaud-Colombier 2019; Foley et al., 2010; Douvere 2008). In the European Union (EU) it has been adopted as an instrument to support to EU coastal nations in achieving aims set in the integrated maritime management strategy. MSP is employed to promote sustainable development meanwhile ensuring 'employment, productivity and societal cohesion' in the European region through the Blue Growth initiative whilst also achieving good marine environmental status (GES) set out by the Marine Strategy Framework Directive (MSFD) (Directive 2014/89/EU; MSP Roadmap 2008; Hassler et al., 2019). The core principles of MSP in the EU are outlined in the MSP Directive (Directive 2014/89/EU) requiring EU states to produce official national marine spatial plans by 2021, which would not only follow an ecosystem based decision making process, but also harmonize the future use of marine and terrestrial space and support cross-border cooperation, and importantly in the case of macroalgae cultivation and harvest, making room for new activities such as offshore renewable energy production, aquaculture and new types of tourism (Directive 2014/89/EU).

The planning process and the outputs are dependent on the domestic and international regulations, institutional setup, and administrative traditions. Due to this, as well as differences in strategic interests, interpretation of other related EU Directives and socio-political contexts, MSPs are all unique and at different stages of development.

Conflicts in marine planning can be grouped into two types – conflicts among users and conflicts between users and the environment (Bonnevie et al., 2019). The former arises in the situation where marine users overlap spatially and temporally and compete for the same pool of resources. Meanwhile the latter is case of the activity resulting in pressures and causing impacts on the environment. Depending on the nature of the cultivation methods and the context in which cultivation is set to take place, experience has shown that aquaculture can be involved in both.

The aim of this study was to find out what are the relations between macroalgae cultivation (or aquaculture) and other maritime sectors as defined in the national maritime spatial plans. The following research questions were asked:

a) Has macroalgae cultivation (or aquaculture more broadly) as a sector been considered in the MPS and has it been designated space for development?
b) Where considered, how is the relationship between macroalgae cultivation activities and other maritime sectors defined?

The results of the cross-sectoral relationship analysis, also known as conflicts and synergies analysis, were presented in conjunction with the results of the environmental suitability assessment to locate the best sites for microalgae cultivation.

Methodology

The steps taken to define the relationships between macroalgae farming and other future and traditional maritime sectors in the case study countries are outlined in Figure 1, presented below.

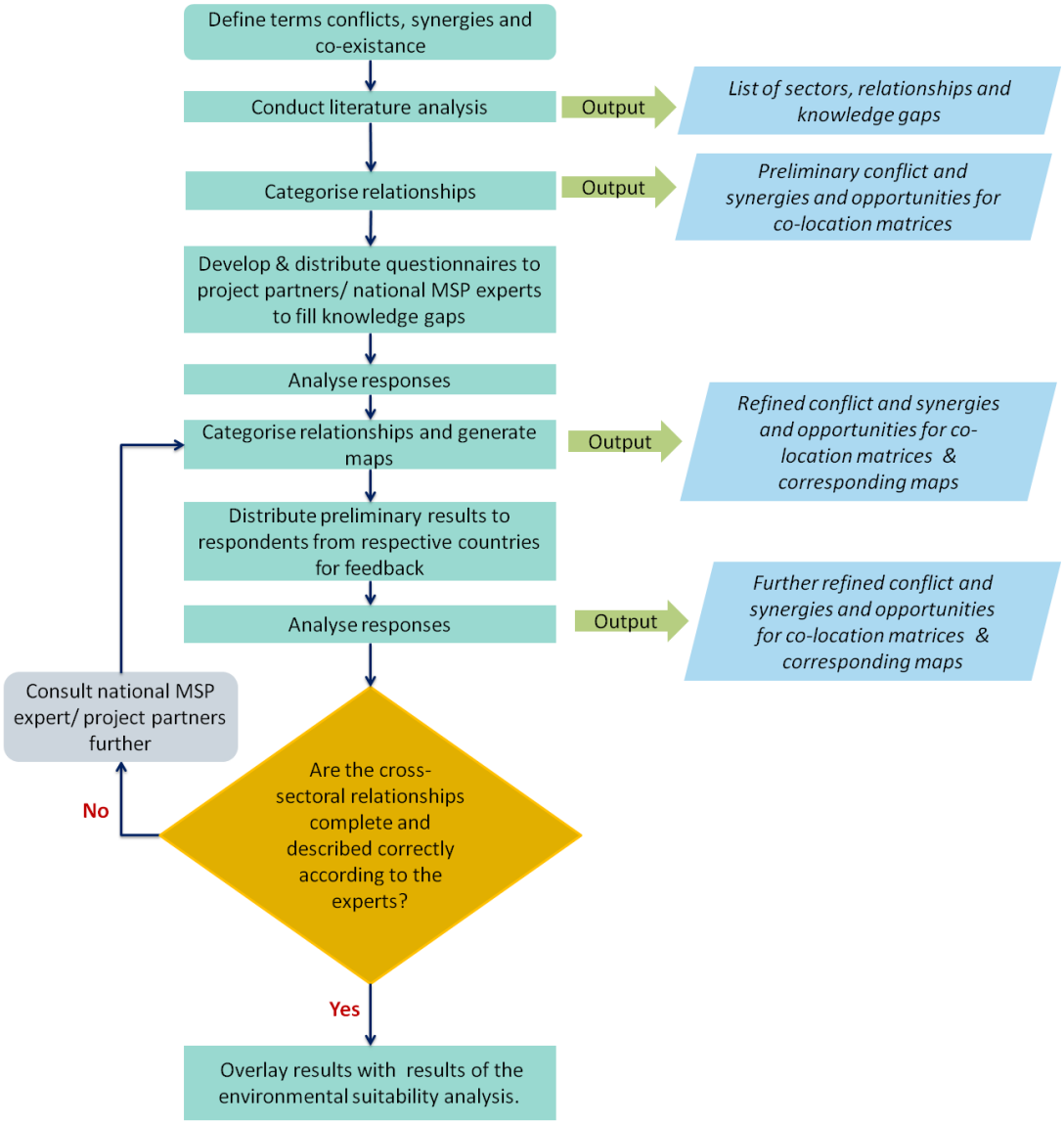


Figure 1 Workflow diagram describing the steps taken to generate matrices and maps defining relationships between macroalgae cultivation and other maritime sectors across MSP in the case study sites.

MSP is fast pace process, which means that information gets outdated very quickly and information availability varies from country to country, particularly as the European coastal nations approach the 2021 deadline (EU Directive 2014/89/EU). To ensure that the data collected was as up to date as possible and reflected all countries within the scope of this study, an iterative, mixed methods approach was employed. The information gathered during the literature review was supplemented with data gathered from surveys and one to one communication with individuals involved in the MSP process.

Conflicts, Synergies and opportunities for co-existence were identified as:

- Conflicts among users – competing user claims over marine space and or resource are seen as conflicts, however they can be resolved thus present an opportunity for co-existence and in some cases synergetic co-location leading to mutual benefits. The basis for synergetic co-location between users is seen as cost-effectiveness and/or effective use of space whilst co-located, depending on the context and the activity it can be harder or easier to achieve. Published as well as draft MSPs, and Questionnaire responses are being analysed to understand which conflicts at present have no clearly identified resolutions and are perceived as relatively difficult to resolve, as well as the cases where resolutions for conflicts have been identified but no steps have yet been taken to put them in place and the sector interrelation where co-existence or synergetic co-location is already expected if macroalgae farming is introduced.
- User- environment – outlined in the Strategic Environmental Assessments (SEAs)

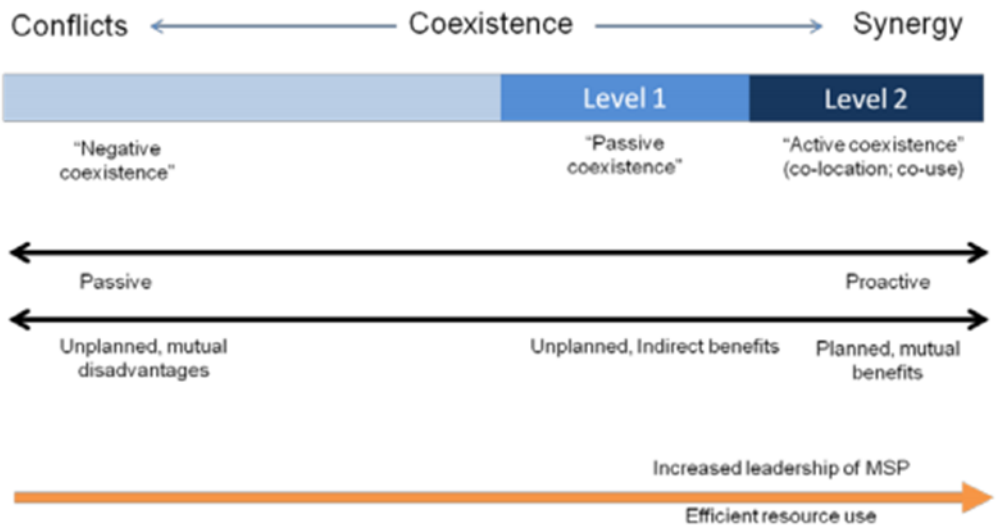


Figure 2 Image source: ICES WGMPCZM Workshop on co-existence and synergies in MSP, 2018

To answer the research questions, a review of national MSPs (draft and final versions), SEAs, supplementary material, official communications released by planning authorities responsible for the planning process, and scientific publications covering the topic of maritime sector relations in the Baltic Sea region, with a particular focus on aquaculture and macroalgae cultivation was conducted.

Knowledge gaps were identified and filled using questionnaires distributed among MSP practitioners or experts using a snowball sampling technique. Once responses were collected and summarised, the respondents were also asked to provide feedback on the results to confirm that the information is up to date and has not been misinterpreted.

1. Literature review

Where available, national marine spatial plans (drafts and final) and supporting material released by the planning authorities were reviewed. In addition to this, results of international projects BalticScope, PanBaltic Scope, BalticLines and BONUS BASMATI as well as academic literature, which covered topics of maritime sector relations in Estonia, Finland, Germany, Poland, Sweden, Latvia and Russia were analysed.

The sector relations were categorised into 'synergetic', 'conflicting' and sectors 'compatible under certain conditions'. Unclear relations were classified as 'unclear suitability level for co-location'.

2. Survey

A questionnaire (see Annex) consisting of open-ended questions was developed and distributed among MSP experts and researchers working in the countries within the scope of this study. All in all, 10 questionnaires were sent out. The respondents were chosen using a snowball sampling technique. To take part respondents had to be involved in the MSP process, represent either the planning authority responsible for MSP or a scientific institution, or consultancy, which has been actively involved in the development of the plan. To limit bias respondents could not be or represent any other stakeholders.

The respondents were asked to describe the extent to which macroalgae cultivation has been considered within the MSP of their respective country, and the nature of the relationships between macroalgae cultivation activities and other maritime sectors from the perspective of the MSP. They were presented with the definitions of terms used to describe the relations ('synergetic', 'conflicting' and 'potential for co-existence') and asked to identify which maritime sectors, according the national MSP, synergise, conflict or could co-exist with macroalgae cultivation activities and why so. In the case of conflicting relations, they were also asked to share ideas on how the conflicts could be resolved.

The respondents were also asked about any institutional/ cross border, process, knowledge and data, and other context related conflicts and synergies to help identify what could the obstacles or drivers of synergetic co-location.

The results of the analysis indicated potential synergies and conflicts between macroalgae cultivation and other offshore activities. The results were presented in a colour coded tables and mapped.

3. Mapping

The geospatial data on the location of different maritime sectors as described in the MSPs was mapped and classified using the results of the study into conflicting, synergetic relations and sectors compatible under certain conditions.

The availability of spatial data varied from country to country. Publicly available data was gathered from the databases hosted by public authorities responsible for national MSP. In the case where data was not publicly available the public authorities were contacted in person.

Results

All countries studied had either draft or final MSPs available online in English, apart from the integrated land-sea German territorial plans and Russia. All in all, 5 questionnaire responses were received. Due to the low number of responses, knowledge was also supplemented via personal communication with research institutions involved in plan development.

The literature review, questionnaire responses and personal communications revealed the nature of the relations between macroalgae cultivation and the following maritime sectors:

- Shipping
- Military defence
- Maritime tourism
- Underwater Cultural heritage
- Marine Protected Areas
- Fisheries
- Exploration and extraction of natural resources
- Port infrastructure and activities
- Submarine cables and pipelines
- Offshore renewable energy production
- Fish Aquaculture
- Other country specific activities

In all countries studied, areas designated for military defence purposes and shipping were restricted to single use only, therefore macroalgae cultivation could take place in those locations under any circumstances in all countries considered in this study.

Estonia

The first draft has been completed and is currently being reviewed by the neighbouring countries – Finland and Latvia (Estonian Draft Maritime Spatial Plan 2020). It incorporates the already adopted pilot plans for the Hiiu Island (2016) and Pärnu Bay (2017).

In Estonia, MSP is based on the 2015 July 1st Planning Act. Since the adoption of the Act, local authorities do not have rights to plan the sea as the marine waters are owned by the state and MSP is conducted at the national level. The full, final draft of the national, legally binding plan is expected by the end of 2020[1].

Macroalgae farming is featured within Estonian MSP as a future use. Macroalgae cultivation is seen as a way of developing the blue economy and introducing new aspects to the Estonian maritime culture. Different economic, socio-cultural, and environmental benefits that macroalgae cultivation bring are described within the plan. The plan states that microalgae cultivation has the potential to improve the state of the local marine environment; increase water quality, promote traditional activities such as construction of boats used for farm

[1] Now possibly postposed due to the COVID-19 outbreak

maintenance, and introduce new business opportunities and enrich the local culture, which would help tourism.

To reap and enhance the benefits macroalgae cultivation can bring, the following are strongly encouraged:

- Multitrophic aquaculture installations, where algae and shellfish cultivation are used to mitigate the environmental impacts of fish aquaculture.
- Co-location with wind farms for synergetic co-existence- wind turbine pillars could be integrated into algae cultivation.
- Involvement of fishermen in installation maintenance work to mitigate seasonality of the fishing sector.

A map of modelled macroalgae growth potential is presented within the plan. It describes the environmentally suitability of the Estonian marine waters for macroalgae cultivation, indicating promising territories for macroalgae aquaculture, which are located mainly west of the islands of Saaremaa and Hiiumaa, in the West Estonian Archipelago Sea, and the western Gulf of Finland. Development is recommended in, but not restricted to, the most environmentally suitable areas.

A precautionary approach is taken when it comes to locating cultivation sites in protected areas. No activities, which pose any environmental threats, are allowed within the *Natura 2000* protected areas. The plan states that the potential environmental impacts of macroalgae farms must be assessed and project Environmental Impact Assessments (EIA) must consider the impact of on fish and their spawning areas.

Further, before development, the site must be examined for historic explosives and other dangerous objects in cooperation with the Ministry of Defence.

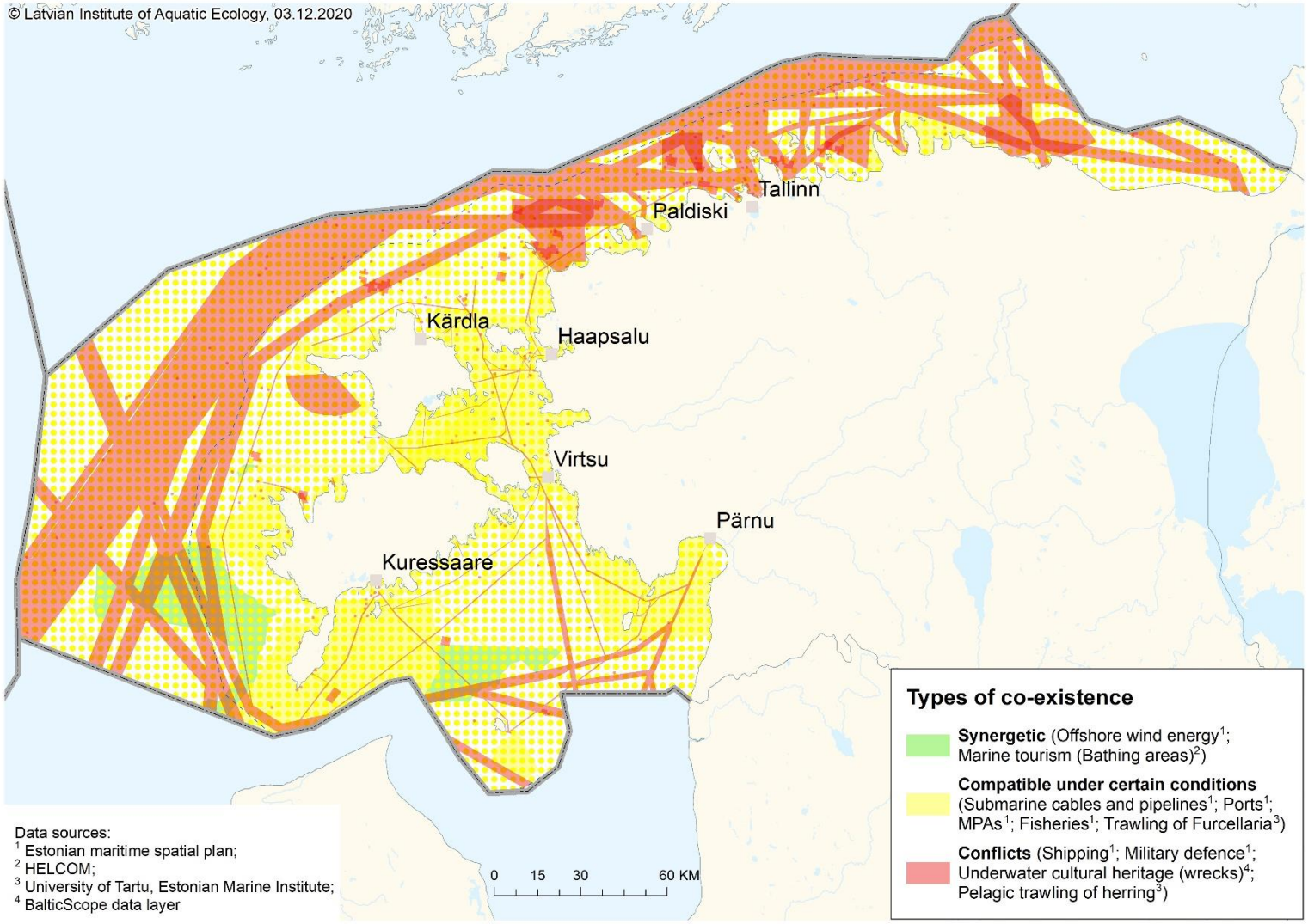
Although it is recommended that macroalgae cultivation avoids sites already occupied by the following sectors, the plan emphasises the need for co-existence between sectors, and co-location may be possible under certain circumstances with:

- Nature protection areas, if authorised by the Environment Agency
- Areas of mineral deposits, if authorised by the Land Board
- Underwater cables if the EIA shows cables will not be affected by the installation
- Buffer zone around cultural monuments, archaeological sites, or shipwrecks, if authorised by National Heritage Board

Aquaculture (macroalgae and shellfish) cannot take place in:

- Ares designated for military defence
- Marine Protected Areas
- Shipping lanes and traffic (Fairways, ship-to-ship areas, anchorage areas, places for ship refuge)
- Underwater cultural heritage sites
- Dumping sites

Shipping
Military Defence
Marine Tourism
Underwater Cultural Heritage (Co-location within the buffer zone will have to be agreed upon with the National Heritage Board)
MPAs (Colocation to be permitted by the Environment Agency)
Fisheries (Pelagic trawling of herring and sprat)
Fisheries (Cultivation may decrease the size of traditional fishing areas and conflict with benthic trawling of *Furcellaria*)
Exploration and extraction of natural resources (Permitting and EIA will be required. Co-location will have to be agreed upon with the Land Board)
Port infrastructure and activities (Marinas & fishing ports can serve as operational ports)
Submarine cables and pipelines (If the EIA shows cables will not be affected)
Offshore wind energy
Fish aquaculture
Other country specific activities (Shellfish aquaculture: promotes multitrophic aquaculture)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Tallinn
Paldiski
Kärdla
Haapsalu
Virtsu
Pärnu
Kuressaare
0 15 30 60 KM
Types of co-existence
Synergetic (Offshore wind energy[1]; Marine tourism (Bathing areas)[2])
Compatible under certain conditions (Submarine cables and pipelines[1]; Ports[1]; MPAs[1]; Fisheries[1]; Trawling of Furcellaria[3])
Conflicts (Shipping[1]; Military defence[1]; Underwater cultural heritage (wrecks)[4]; Pelagic trawling of herring[3])
Data sources:
[1] Estonian maritime spatial plan;
[2] HELCOM;
[3] University of Tartu, Estonian Marine Institute;
[4] BalticScope data layer

Finland

The first draft of the Finnish MSP has been published online and is up for public consultation (Finnish Draft Maritime Spatial Plan 2030). The national plan will be made up of 3 planning areas (the Gulf of Finland, the southern and the northern Bothnian Sea) as well as separate plan for the Åland archipelago. Domestically, the Finishing MSP is regulated by the Land Use and Building Act 132/1999 (482/2016). The Ministry of the Environment is responsible for the development of the plan, and the Regional Council of Southwest Finland coordinate the cooperation between the 8 regional councils responsible for planning at regional scale. The full, national plan is expected to be published by March 2021. The plan will not be legally binding.

Sites best suited for aquaculture have been identified in all 3 areas and the Archipelago Sea however, these are specifically designated for fish farming (Finnish Draft Maritime Spatial Plan 2030 and the Strategic Environmental Assessment). Macroalgal farming is not currently considered as a separate maritime activity within the plan. The environmental effects of fish farms are acknowledged by the Finnish planning authorities and development of fish farms will continue to operate on a permit basis and aquaculture project proposals will have to go through an environmental impact assessment to ensure that the aquaculture sector grows in Finland, but not at the expense of the environment.

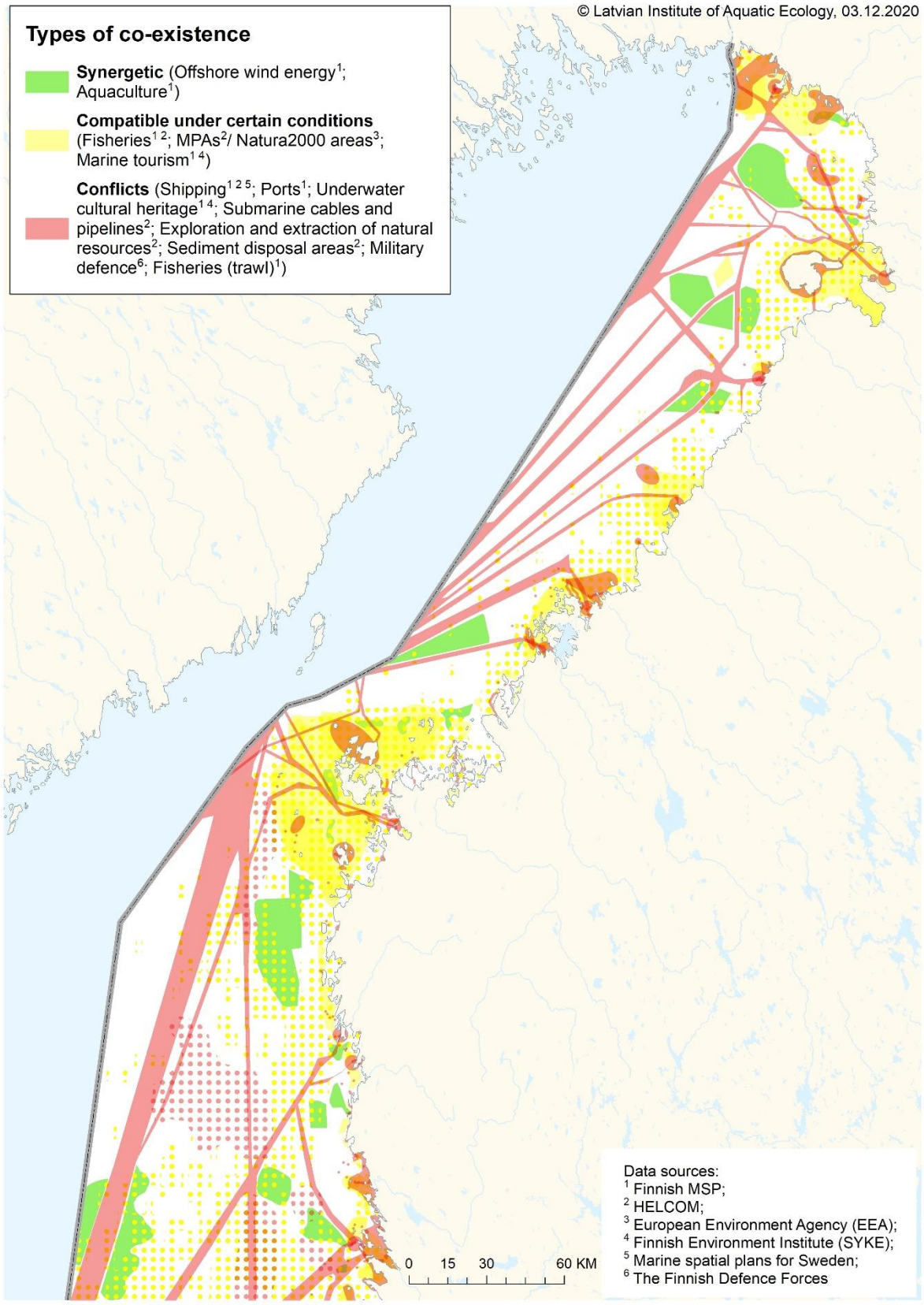
The position towards the aquaculture sector presented within the draft MSP has been shaped the Finnish National Aquaculture strategy 2022. Fish aquaculture is the main type of aquaculture discussed in both instances. According to the respondents, the Finnish Association for Fish Farming representing the business perspective have been actively involved in the negotiations encouraging the expansion of the sector, as have the Central Union of Agricultural Producers and some forest owners who call for reductions of nutrient load to be reduced and have shown some interest in microalgae cultivation. No other types of aquaculture have had representation during the negotiations.

The respondents also note that the Finnish government as some businesses have shown interest in macroalgae cultivation, particularly understanding the ways in which it could help mitigate the impacts of fish farming and resolve the user-environment conflict as well as economically benefit the region.

It has been pointed out by the questionnaire respondents, that within the National Aquaculture strategy 2022 microalgae cultivation has been identified as a way of producing biofuel and feed ingredients in the future, but that a lot of research and development effort will be needed. Further, macroalgae cultivation has been recognised as a possible future sector to synergically co-exist with offshore windfarms in the PlanBothnia pilot plan however, since then no further actions have been taken.

Limited information is currently available on cross-sectoral relationships in English for public access.

Shipping
Military Defence
Marine Tourism (Farming may provide income for archipelago municipalities and enrich cuisine. However, cultivation may have an aesthetic impact and tourists may be interested to see the 'untouched' marine environment)
Underwater Cultural Heritage (Conflicts with archaeological shipwrecks)
MPAs (Depending based on MPA status. Strict protection status - not allowed.)
Fisheries (Pelagic and benthic trawling)
Fisheries (Coastal fisheries Additional income for small scale fisheries, biomass can be used in biogas production)
Exploration and extraction of natural resources (Mostly done in deeper water areas not suitable for algal cultivation)
Port infrastructure and activities (Poor water quality for cultivation)
Submarine cables and pipelines (Cables may need maintenance operations during the growing season)
Offshore wind energy
Fish aquaculture (May mitigate the environmental impact of fish aquaculture)
Other country specific activities (Sediment disposal areas)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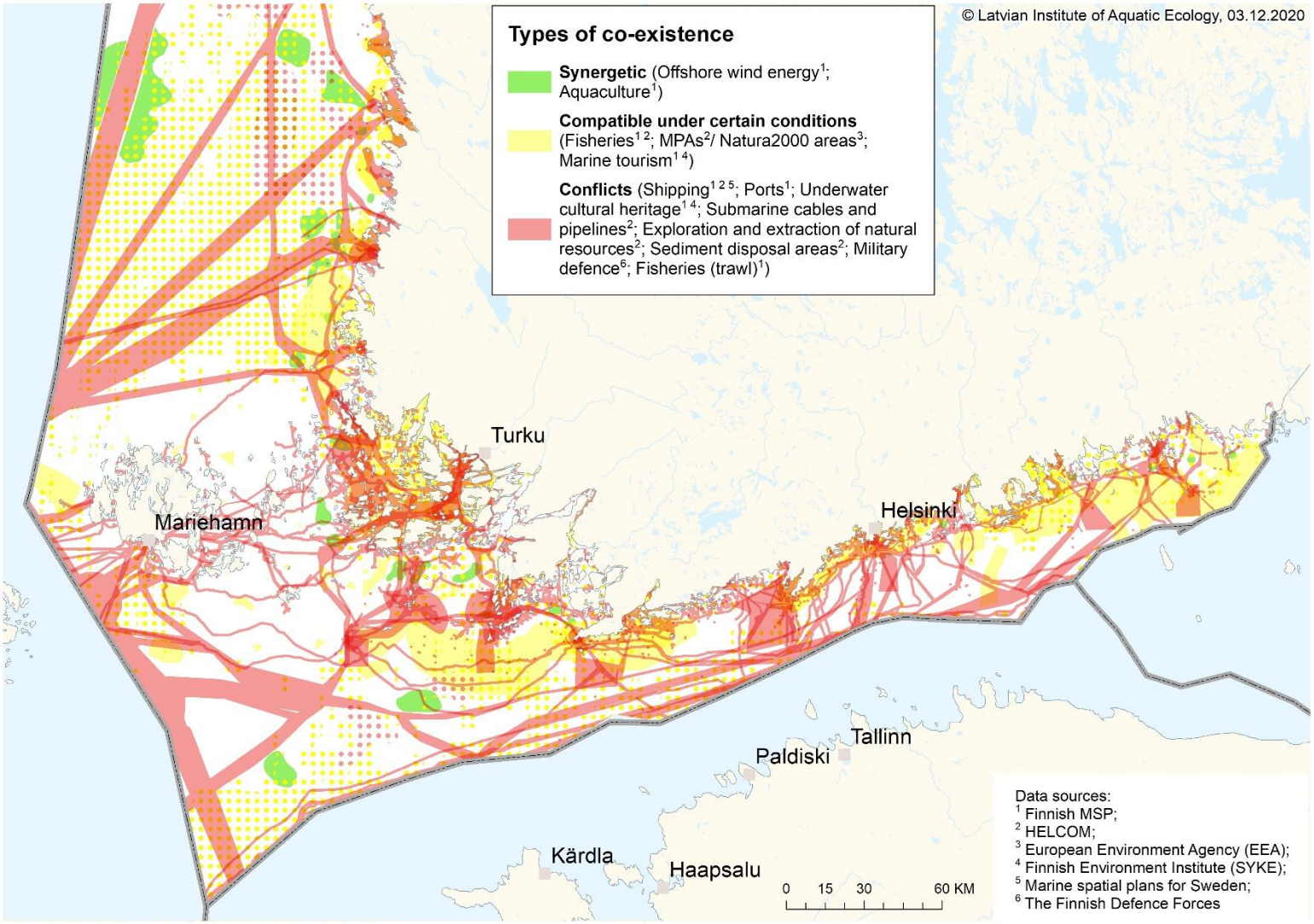
Types of co-existence
Synergetic (Offshore wind energy[1]; Aquaculture[1])
Compatible under certain conditions (Fisheries[1 2]; MPAs[2]/ Natura2000 areas[3]; Marine tourism[1 4])
Conflicts (Shipping[1 2 5]; Ports[1]; Underwater cultural heritage[1 4]; Submarine cables and pipelines[2]; Exploration and extraction of natural resources[2]; Sediment disposal areas[2]; Military defence[6]; Fisheries (trawl)[1])
0 15 30 60 KM
Data sources:
[1] Finnish MSP;
[2] HELCOM;
[3] European Environment Agency (EEA);
[4] Finnish Environment Institute (SYKE);
[5] Marine spatial plans for Sweden;
[6] The Finnish Defence Forces


Types of co-existence
Synergetic (Offshore wind energy[1]; Aquaculture[1])
Compatible under certain conditions (Fisheries[1 2]; MPAs[2]/ Natura2000 areas[3]; Marine tourism[1 4])
Conflicts (Shipping[1 2 5]; Ports[1]; Underwater cultural heritage[1 4]; Submarine cables and pipelines[2]; Exploration and extraction of natural resources[2]; Sediment disposal areas[2]; Military defence[6]; Fisheries (trawl)[1])
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Turku
Mariehamn
Helsinki
Tallinn
Paldiski
Kärdla
Haapsalu
0 15 30 60 KM
Data sources:
[1] Finnish MSP;
[2] HELCOM;
[3] European Environment Agency (EEA);
[4] Finnish Environment Institute (SYKE);
[5] Marine spatial plans for Sweden;
[6] The Finnish Defence Forces

Germany

In German planning there is a clear distinction between the EEZ and the territorial waters. The legal basis for all plans is the Federal Spatial Planning Act 2008 and they are all legally binding.

The German territorial Baltic marine waters are divided into 2 areas - Schleswig-Holstein and Mecklenburg-Vorpommern. The territorial marine space is governed by the coastal state federal governments and is integrated into the terrestrial spatial plans. The Mecklenburg-Vorpommern plan was adopted in 2016, and the Schleswig-Holstein plan has been up for consultation since 2017 and will be finalised in the near future.

The EEZ is governed at the national level. The Federal Maritime and Hydrographic Agency develops and revises the plan on behalf of the responsible Federal Ministry of the Interior, Building and Urban Affairs. 10 years have passed since the adoption of the EEZ plan and it is now being revised, and the updated version will be published in 2021. According to the Federal Maritime and Hydrographic Agency (2020[a]) planning of the EEZ follows domestic laws and the UN Convention on the Law of the Sea, therefore in comparison to the territorial waters, which belong to the federal state, the freedoms of planning are limited. Within the plan for the EEZ the following activities and sectors are considered as a priority: offshore windfarms, cables, platforms, military practice areas, nature conservation (Federal Maritime and Hydrographic Agency, 2020[b]). Aquaculture and mariculture are not mentioned within the plan or designated any space. However, the Concept for revision of spatial plans for the German exclusive economic zone of the North Sea and Baltic Sea (2020) says that aquaculture is an important future activity, which should preferably co-locate with fixed, existing installations such as wind farms, without affecting their operation and maintenance, as this would limit the impact of aquaculture on navigation and shipping, and protected habitats. The wind sector is especially important in Germany and co-location cannot interfere with its functioning.

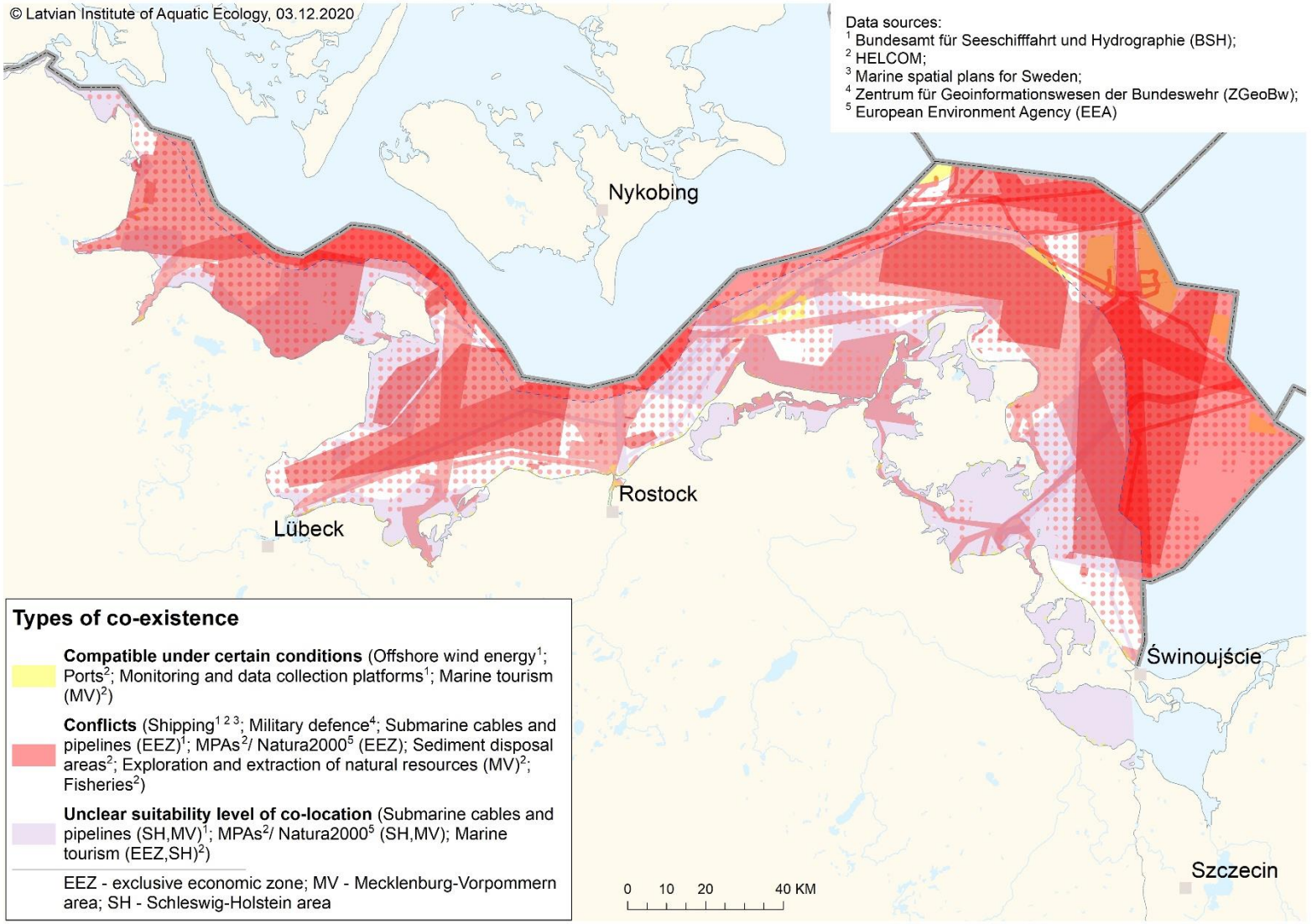
The development of the aquaculture sector is of national interest however, as pointed out by the respondent, the permitting procedures for the approval of an aquaculture farm make the process '*exceptionally long and burdensome'* for the developer.

The Mecklenburg-Vorpommern marine area is very busy and, according to the respondent, *'extremely crowded with obvious conflicts'* and MSP is used as a tool *'to minimize these conflicts and foster opportunities for a more synergetic development between sectors'* in the region. Further, although the planning authorities of Mecklenburg-Vorpommern have designated suitable areas for aquaculture, there are no installations built yet. According to the respondent, it does not seem like aquaculture is a '*strong'* sector in Germany and due to the limited availability of space priority is likely to be given to the offshore energy sector or shipping if the sectors were to compete for space. The marine space has been planned to ensure coastal development, in particular preserve and enhance tourism which relies on seascapes and the natural marine environment. Other priority sectors and activities include protection of the marine environment, sand and gravel extraction, coastal protection, fisheries, tourism, shipping (MSP Platform, 2020).

There are no designated locations for the aquaculture sector in the MSP of the Schleswig-Holstein state of Germany. Shipping, coastal tourism are the key sectors in the area, in fact shipping is allowed to use the whole area without being restricted to lanes.

Aquaculture of any kind had not been allocated space within the EEZ. However, a large part of the German EEZ in the Baltic Sea has been dedicated to wind farm developments, which place restrictions on fishers. To manage conflicts and keep in line with the EU Blue growth strategy, the German EZZ planning authority have shown interest in co-location of aquaculture and windfarms (AquaSpace 2017).

Shipping
Military Defence
Marine Tourism (Regional priority, Mecklenburg-Vorpommern)
Underwater Cultural Heritage
MPAs (Baltic EEZ)
Fisheries
Exploration and extraction of natural resources (Sand and gravel extraction, Mecklenburg-Vorpommern)
Port infrastructure and activities (Mecklenburg-Vorpommern)
Submarine cables and pipelines (Baltic EEZ)
Offshore wind energy
Fish aquaculture (May mitigate the environmental impact of fish aquaculture)
Other country specific activities (Marine scientific research, Baltic EEZ)
Other country specific activities (Sediment disposal areas)
Other country specific activities (Monitoring and data collection, e.g. FINO platforms)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Data sources:
[1] Bundesamt für Seeschifffahrt und Hydrographie (BSH);
[2] HELCOM;
[3] Marine spatial plans for Sweden;
[4] Zentrum für Geoinformationswesen der Bundeswehr (ZGeoBw);
[5] European Environment Agency (EEA)
Nykobing
Rostock
Lübeck
Świnoujście
Szczecin
0 10 20 40 KM
Types of co-existence
Compatible under certain conditions (Offshore wind energy[1]; Ports[2]; Monitoring and data collection platforms[1]; Marine tourism (MV)[2])
Conflicts (Shipping[1 2 3]; Military defence[4]; Submarine cables and pipelines (EEZ)[1]; MPAs[2]/ Natura2000[5] (EEZ); Sediment disposal areas[2]; Exploration and extraction of natural resources (MV)[2]; Fisheries[2])
Unclear suitability level of co-location (Submarine cables and pipelines (SH,MV)[1]; MPAs[2]/ Natura2000[5] (SH,MV); Marine tourism (EEZ,SH)[2])
EEZ - exclusive economic zone; MV - Mecklenburg-Vorpommern area; SH - Schleswig-Holstein area

Latvia

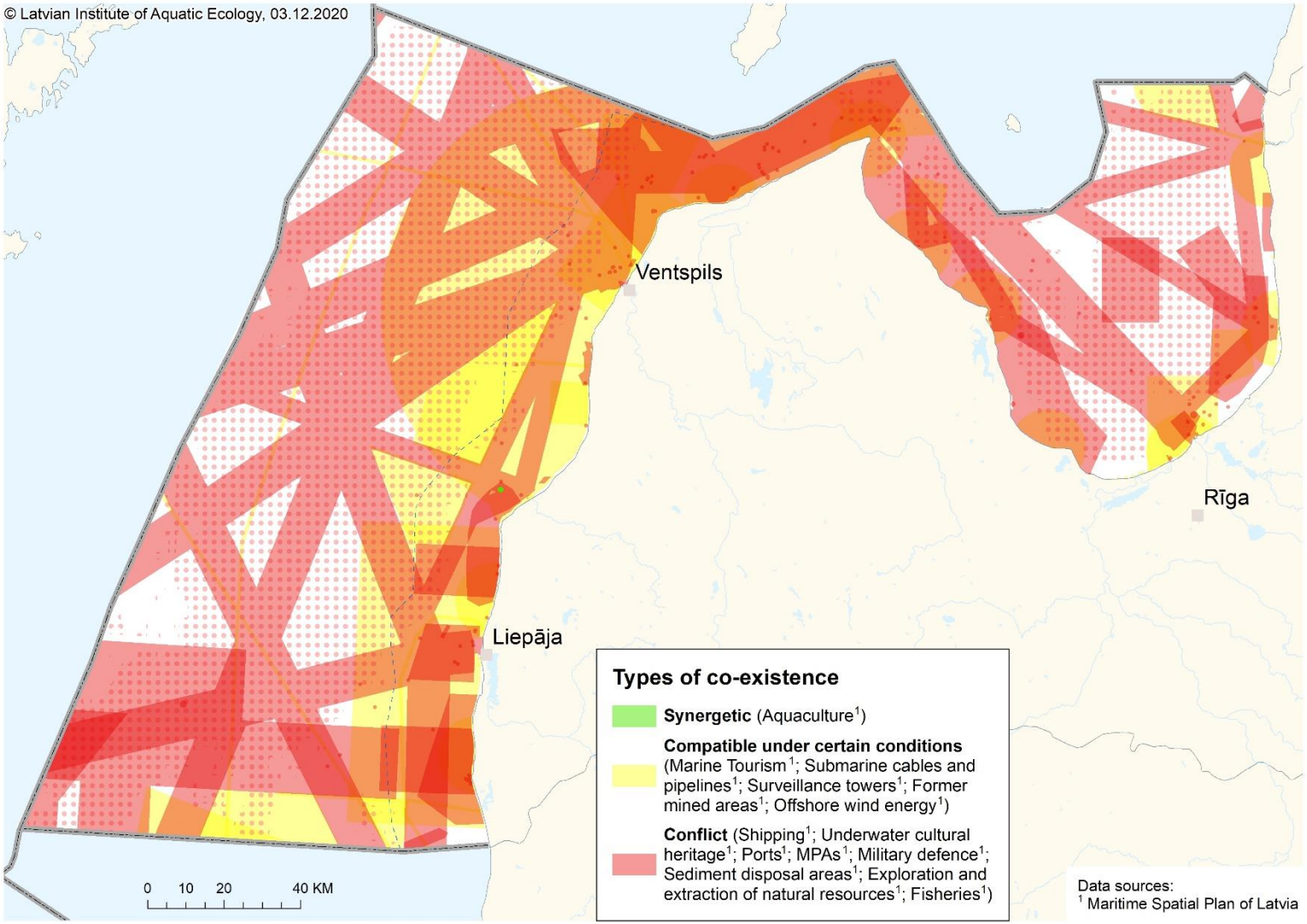
The Latvian Maritime Spatial Plan 2030 was adopted in May 2019. It is legally binding and includes the EEZ as well as the territorial waters. The local municipalities have been given the right to and responsibility for developing detailed, thematic plans for the marine coastal waters (two kilometres in width from the marine coast) adjacent to their administrative territory whilst adhering to the national MSP strategy.

Sites for the development of algae and mussel aquaculture were identified in the first draft but have now been removed. The reasoning behind the decision was as there are currently no fish, algae, or shellfish farms, nor farm proposals. It was decided that all development proposals will be evaluated on a case-by-case basis. Within the project *Baltic Blue Growth* In 2017, Latvian Institute of Aquatic Ecology has started to study the possibilities of shellfish aquaculture farming by establishing a shellfish farming research farm (pilot farm) in the Latvian coast of Open Baltic Sea near Pāvilosta in the marine protected area "Akmensrags".

In preparation of the plan, relations between different maritime sectors and activities, including algae and mussel aquaculture, were identified (Veidemane et al., 2017) using information gathered during stakeholder consultations.

Shipping
Military Defence
Marine Tourism
Underwater Cultural Heritage
MPAs (Bird Protection and Underwater Biotope protection)
Fisheries (Small scale fisheries and pelagic, and benthic trawling)
Exploration and extraction of natural resources
Port infrastructure and activities
Submarine cables and pipelines
Offshore renewable energy production (Wave)
Offshore renewable energy production (Wind)
Fish aquaculture (May mitigate the environmental impact of fish aquaculture)
Other country specific activities (Sediment disposal areas)
Other country specific activities

(Surveillance towers)
Other country specific activities (Former mined areas)
Other country specific activities (Coastline protection/ Landscape)


© Latvian Institute of Aquatic Ecology, 03.12.2020
Ventspils
Rīga
Liepāja
0 10 20 40 KM
Types of co-existence
Synergetic (Aquaculture[1])
Compatible under certain conditions (Marine Tourism[1]; Submarine cables and pipelines[1]; Surveillance towers[1]; Former mined areas[1]; Offshore wind energy[1])
Conflict (Shipping[1]; Underwater cultural heritage[1]; Ports[1]; MPAs[1]; Military defence[1]; Sediment disposal areas[1]; Exploration and extraction of natural resources[1]; Fisheries[1])
Data sources:
[1] Maritime Spatial Plan of Latvia

Poland

Final draft published July 2019. Legally binding, the state owns marine waters. Divides the national marine waters into 95 basins and sub-basins (Executive Summary of the Maritime Spatial Plan of the Polish Internal Sea Waters, Territorial Sea, and Exclusive Economic Zone, 2019) and a more detailed plan for Gulf of Gdansk due to high levels of conflict in the area will be prepared[2].

In Poland, each basin has been allocated their main function and other activities may also occur in some cases as "allowed functions" if they do not disturb the main activity. Options for mariculture activities have been considered in stakeholder consultations and Strategic Environmental Assessment; however, an environmental suitability for mariculture study carried out to inform MSP showed that the activity would be economically viable only in The Gulf of Gdansk. Currently mariculture has been considered in the plan under the umbrella term "space for future uses" or allow function rather than a primary planning basin function.

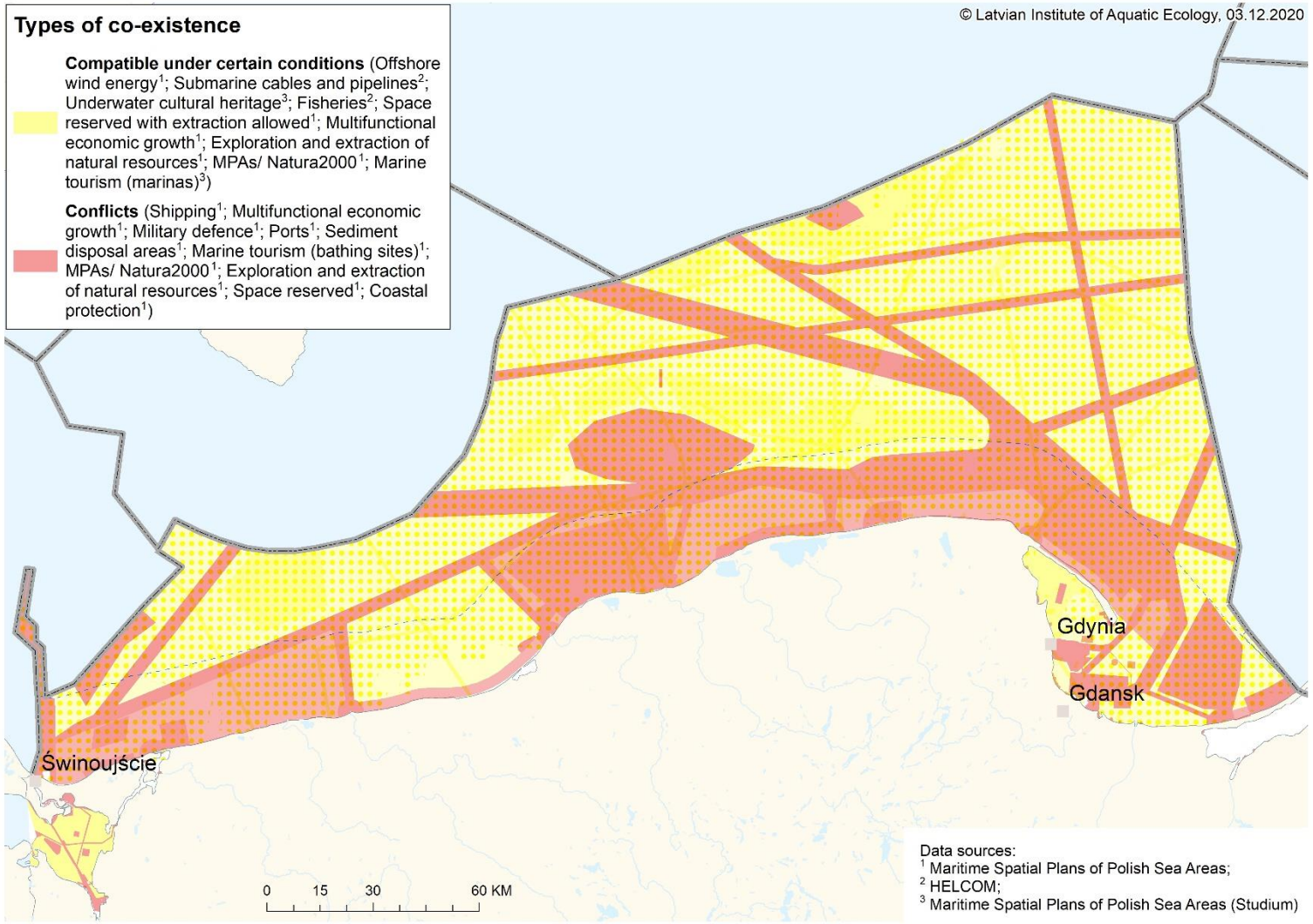
Shipping (Conflict with main function of area, may possibly co-exist when "Shipping" is not main but only allowed function)
Military Defence (Conflict with main function of area, may possibly co-exist when "Military defence" is not main but only allowed function)
Marine Tourism (Not main but allowed function in areas, as such may co-exist with aquaculture)
Underwater Cultural Heritage (Not main but allowed function in areas, as such may co-exist with aquaculture)
MPAs (Not allowed in MPAs Lawica Slupska, Slowinski & Wolinksi National Parks)
MPAs (MPA/NATURA 2000; MPA in Gulf of Gdansk; Oder Lagoon allowed aquaculture for only native marine species and *Dreissena polymorhpa.* In addition, a distance must be kept from fixed fishing gear)
Fisheries (Not main but allowed function in areas as well as aquaculture and as such may co-exist with aquaculture)
Exploration and extraction of natural resources (Possible after agreement with the concessionaire for some areas of main function: Exploration, prospecting and extraction of mineral resource)
Exploration and extraction of natural resources (Conflict for same areas of main function: Exploration, prospecting and extraction of mineral resource)
Port infrastructure and activities (Conflict with main function of area)

[2] Personal communication

Submarine cables and pipelines (Possible if Technical infrastructure is not main but an allowed function)
Offshore wind energy (If in the interest of wind farm developers. After agreement with the concessionaire)
Fish aquaculture (There is no distinction between fish and macroalgae aquaculture (both Aquaculture))
Other country specific activities (Sediment disposal areas)
Other country specific activities (Space reserved for future use)
Other country specific activities (Space reserved for future use with extraction allowed - possible after agreement with the concessionaire)
Other country specific activities (Coastline protection)
Other country specific activities (Multifunctional economic growth: Gulf of Gdansk)
Other country specific activities (Multifunctional economic growth: part of the Gulf of Gdansk reserved for transport, damping sites, bathing sites, military defence or coastal protection)
Other country specific activities (Environmentally conditioned local development - possible with some restrictions)

Based on questionnaire responses, personal communication with MSP responsible authority and the Polish MSP SEA[3]

[3] Environmental Impact Prediction for the Maritime Spatial Plan of the Polish Internal Sea Waters, Territorial Sea, and Exclusive Economic Zone in Scale 1:200 000 – Task 5, Version 3


Types of co-existence
Compatible under certain conditions (Offshore wind energy[1]; Submarine cables and pipelines[2]; Underwater cultural heritage[3]; Fisheries[2]; Space reserved with extraction allowed[1]; Multifunctional economic growth[1]; Exploration and extraction of natural resources[1]; MPAs/ Natura2000[1]; Marine tourism (marinas)[3])
Conflicts (Shipping[1]; Multifunctional economic growth[1]; Military defence[1]; Ports[1]; Sediment disposal areas[1]; Marine tourism (bathing sites)[1]; MPAs/ Natura2000[1]; Exploration and extraction of natural resources[1]; Space reserved[1]; Coastal protection[1])
© Latvian Institute of Aquatic Ecology, 03.12.2020
Gdynia
Gdansk
Świnoujście
0 15 30 60 KM
Data sources:
[1] Maritime Spatial Plans of Polish Sea Areas;
[2] HELCOM;
[3] Maritime Spatial Plans of Polish Sea Areas (Studium)

Sweden

Legislation for MSP has been in place in Sweden since 2014. The Swedish marine space is planned on 3 different levels of authority- municipality, regional and national. The internal and territorial waters are planned by the municipalities and the EEZ on a national level. The marine space is divided into three planning regions plans for which are currently under review to be finalised. Regions included Gulf of Bothnia, The Baltic Sea and the Skagerrak/Kattegat. In addition to the 3 regions, the Swedish marine waters are further divided into privately (up to 300 m from the coastline) and publicly owned.

The EEZ plan will overlap with the territorial plans overruling municipality authority. The marine area is divided into areas of public and national interest; areas of national interest have more weight if competing for space with public interest.

The MSPs currently under review considers ten marine uses: energy extraction, defence, general use, culture, nature, recreation, sand extraction, maritime shipping, investigation area maritime shipping, and commercial fishing as well as areas which are of high nature values, high culture values, or to the interests of Sweden's total defence.

One of the nine goals of Swedish MSP is to prepare for the future establishment of sustainable aquaculture. The current Swedish MSP draft does not specify areas for aquaculture however, it considers macroalgae cultivation as a blue growth opportunity. The plan shows that the aquaculture sector is considered as a future use, but a better understanding of which type of aquaculture, where and how should take place is necessary to ensure sustainability of the sector.

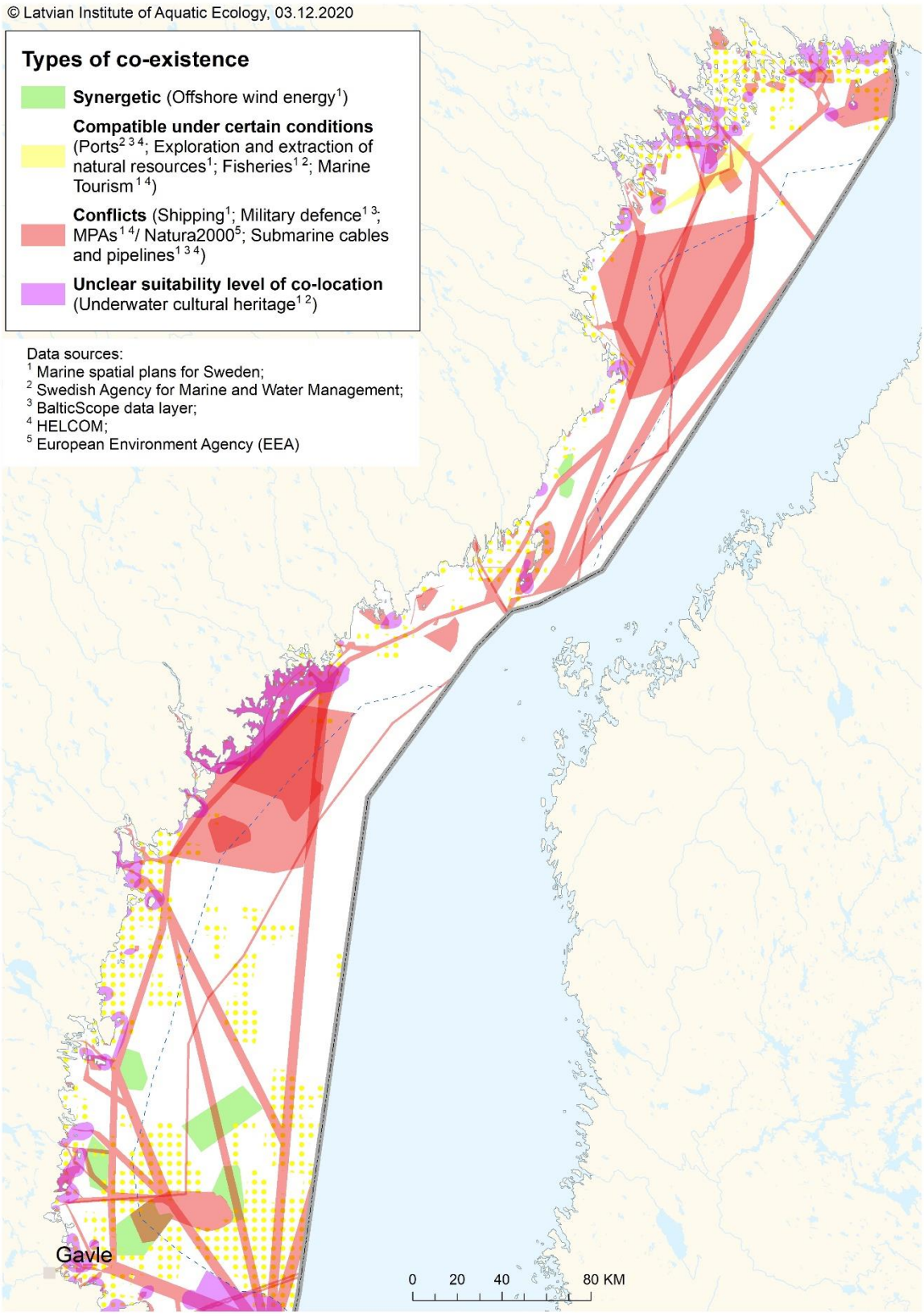
According the MSP proposal under review (2019):

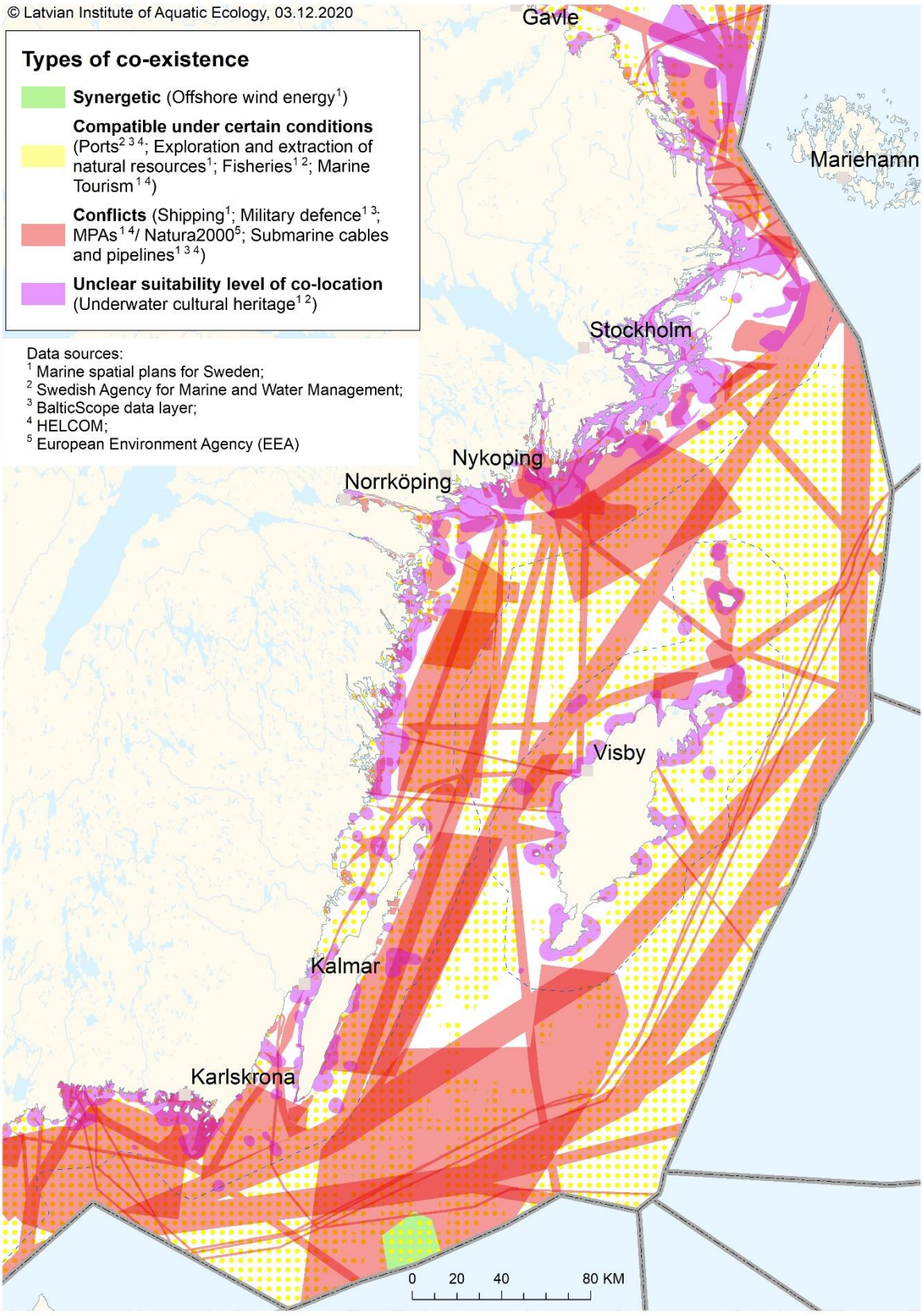
'The national aquaculture strategy (Swedish Board of Agriculture, 2012) aims to have Sweden's municipalities designate suitable locations for aquaculture so that as new cultivation techniques arise MSP can be developed to include aquaculture more explicitly. What's more, water areas of significance for aquaculture must be protected as much as possible from development of other sectors' (Chapter 3, Section 5, first paragraph of the Environmental Code).

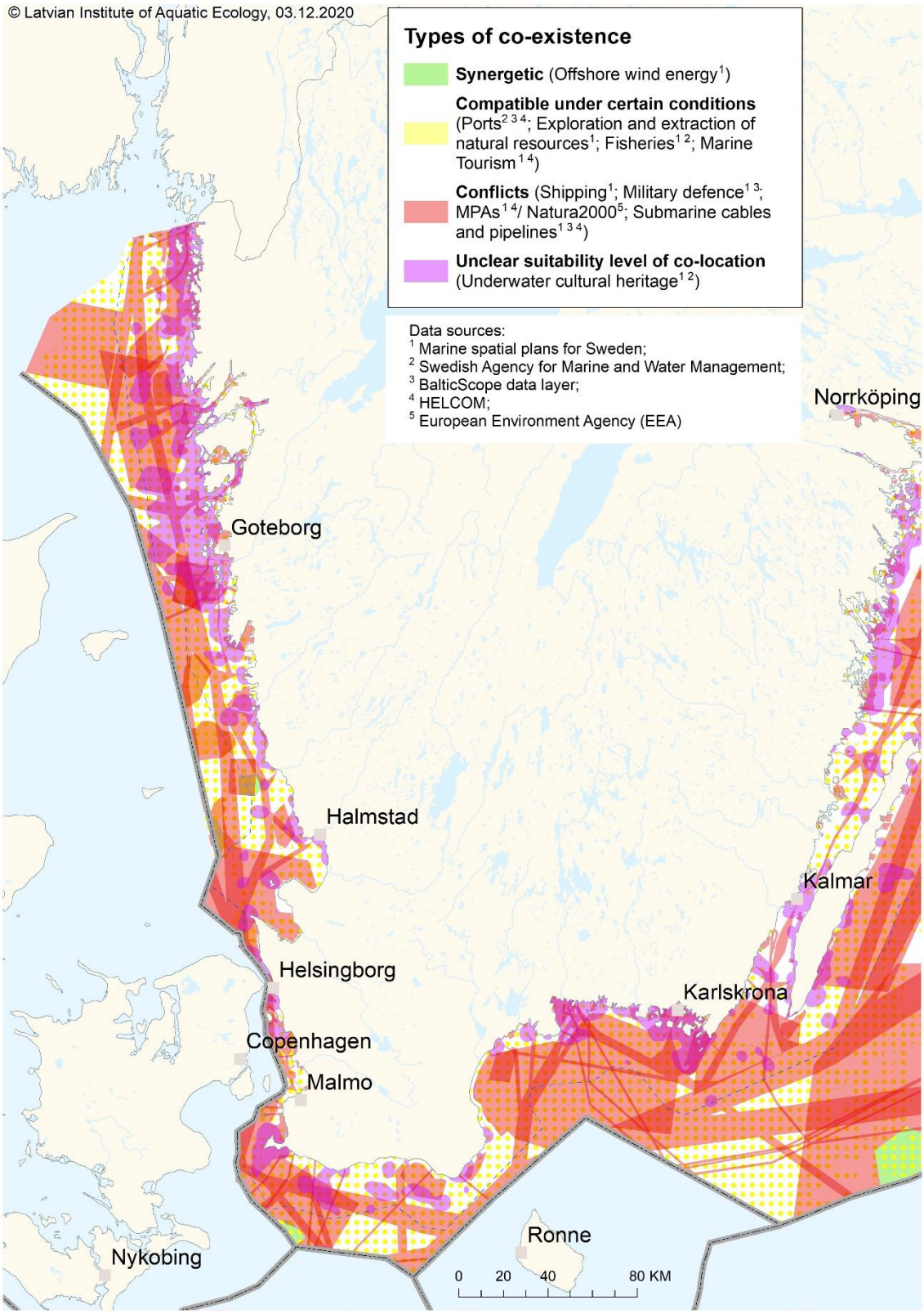
Shipping (International shipping lanes, traffic)
Military defence
Marine Tourism (Marinas may serve as operational ports)
Underwater Cultural Heritage
MPAs
Fisheries (Recommended not to cultivate in areas designated for fishing)

Exploration and extraction of natural resources (Oil discharge: Potentially polluted areas)
Port infrastructure and activities (Fishing ports may serve as operational ports)
Submarine cables and pipelines
Offshore wind energy

Based on questionnaire responses & Marine Spatial Planning – Current Status 2014


© Latvian Institute of Aquatic Ecology, 03.12.2020
Types of co-existence
Synergetic (Offshore wind energy[1])
Compatible under certain conditions (Ports[2 3 4]; Exploration and extraction of natural resources[1]; Fisheries[1 2]; Marine Tourism[1 4])
Conflicts (Shipping[1]; Military defence[1 3]; MPAs[1 4]/ Natura2000[5]; Submarine cables and pipelines[1 3 4])
Unclear suitability level of co-location (Underwater cultural heritage[1 2])
Data sources:
[1] Marine spatial plans for Sweden;
[2] Swedish Agency for Marine and Water Management;
[3] BalticScope data layer;
[4] HELCOM;
[5] European Environment Agency (EEA)
Gavle
0 20 40 80 KM


© Latvian Institute of Aquatic Ecology, 03.12.2020
Types of co-existence
Synergetic (Offshore wind energy[1])
Compatible under certain conditions (Ports[2 3 4]; Exploration and extraction of natural resources[1]; Fisheries[1 2]; Marine Tourism[1 4])
Conflicts (Shipping[1]; Military defence[1 3]; MPAs[1 4]/ Natura2000[5]; Submarine cables and pipelines[1 3 4])
Unclear suitability level of co-location (Underwater cultural heritage[1 2])
Data sources:
[1] Marine spatial plans for Sweden;
[2] Swedish Agency for Marine and Water Management;
[3] BalticScope data layer;
[4] HELCOM;
[5] European Environment Agency (EEA)
Gavle
Mariehamn
Stockholm
Nykoping
Norrköping
Visby
Kalmar
Karlskrona
0 20 40 80 KM

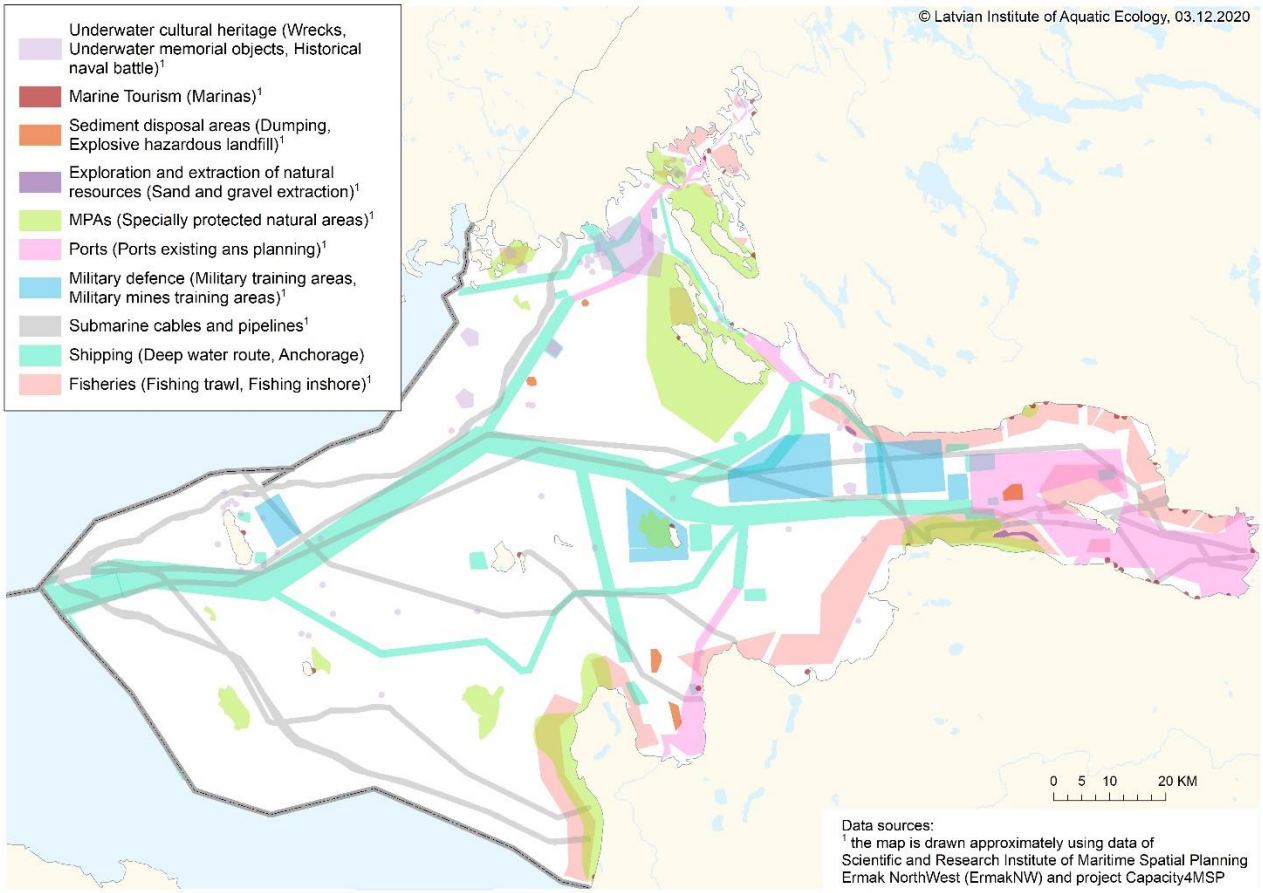

© Latvian Institute of Aquatic Ecology, 03.12.2020
Types of co-existence
Synergetic (Offshore wind energy[1])
Compatible under certain conditions (Ports[2 3 4]; Exploration and extraction of natural resources[1]; Fisheries[1 2]; Marine Tourism[1 4])
Conflicts (Shipping[1]; Military defence[1 3]; MPAs[1 4]/ Natura2000[5]; Submarine cables and pipelines[1 3 4])
Unclear suitability level of co-location (Underwater cultural heritage[1 2])
Data sources:
[1] Marine spatial plans for Sweden;
[2] Swedish Agency for Marine and Water Management;
[3] BalticScope data layer;
[4] HELCOM;
[5] European Environment Agency (EEA)
Norrköping
Goteborg
Halmstad
Kalmar
Helsingborg
Karlskrona
Copenhagen
Malmo
Ronne
Nykobing
0 20 40 80 KM

Russia

Russia is surrounded by 14 different seas, all of which are state owned and managed by the federal government. However, there is currently no single responsible authority for the management of maritime activities and resources and no legal framework for MSP. A number of federal agencies, mostly on a sectoral basis manage resources and activities. Pilot MSPs in the Baltic and Barents Seas have been developed and interest in MSP has been shown via the introduction of the Maritime Doctrine of the Russian Federation in the national maritime policy.[4]

The development of the aquaculture sector is considered in the socio- economic strategic documents of the coastal regions of Russia and is active development of the sector is expected within the next 5 years. There are currently no aquaculture farms in the Russian part of the Gulf of Finland and as it stands no areas have been designated for it.[5]

Following personal communication with Larisa Dnilova and Andrei Lappo of the Scientific and Research Institute of Maritime Spatial Planning Ermak NorthWest (ErmakNW) the following draft plan of the current and future sea use for the Gulf of Finland.

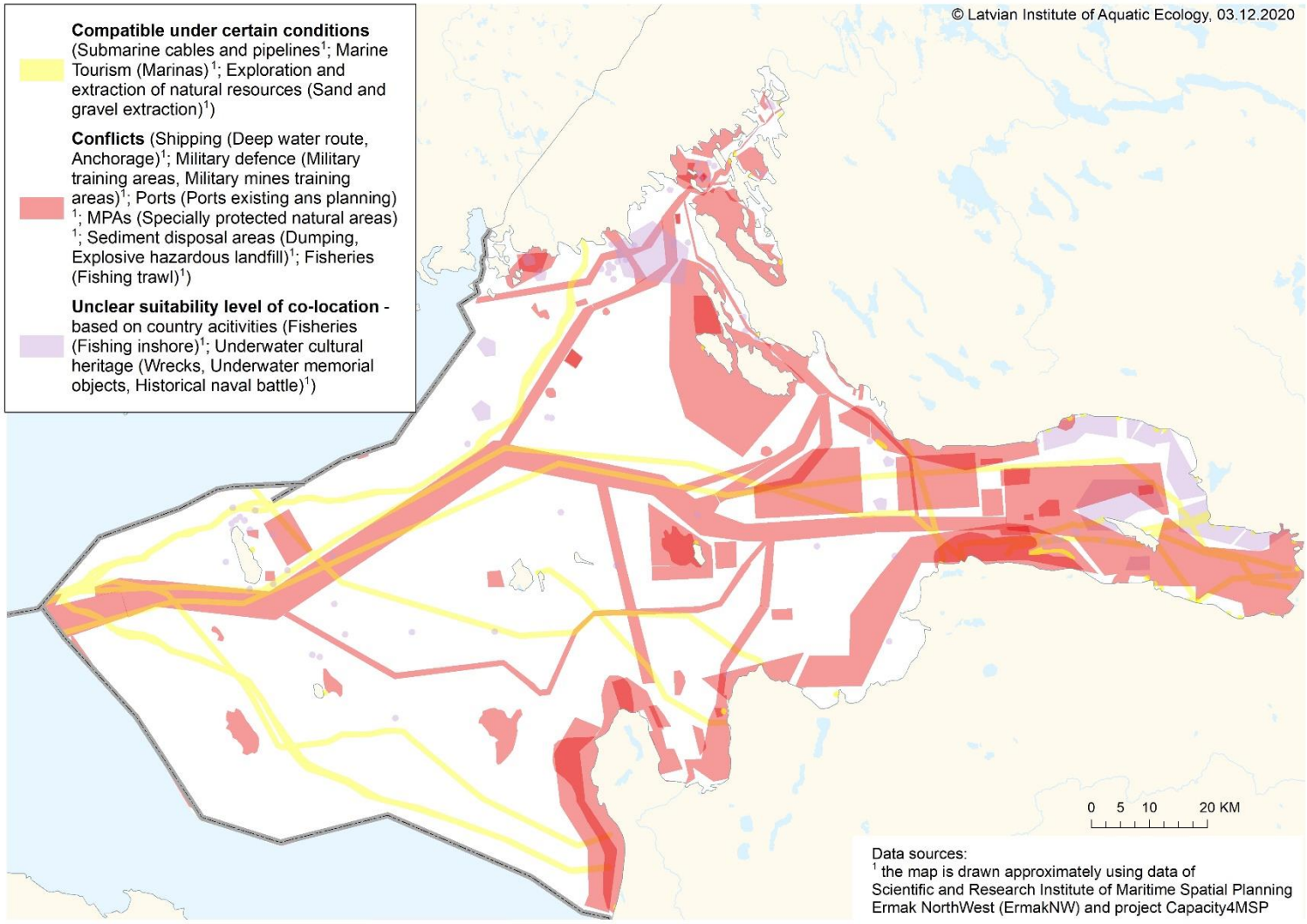


[4] Lappo &Danilova 2015

[5] personal communication with Larisa Danilova and Andrei Lappo, Scientific and Research Institute of Maritime Spatial Planning Ermak NorthWest (ErmakNW)

Potential sectoral relations based observations made during the study.

Shipping (Deep water route, anchorage)
Military defence (Military training/military mines training areas)
Marine Tourism (Marinas)
Underwater Cultural Heritage (Wracks, memorial objects, historical naval battle)
MPAs (Special protected natural areas)
Fisheries (Fishing trawl)
Fisheries (Fishing inshore)
Exploration and extraction of natural resources (Sand and gravel extraction)
Port infrastructure and activities (Existing and planning)
Submarine cables and pipelines
Other country specific activities (Sediment disposal areas - Explosive, hazardous landfill)


Compatible under certain conditions (Submarine cables and pipelines[1]; Marine Tourism (Marinas)[1]; Exploration and extraction of natural resources (Sand and gravel extraction)[1])
Conflicts (Shipping (Deep water route, Anchorage)[1]; Military defence (Military training areas, Military mines training areas)[1]; Ports (Ports existing ans planning)[1]; MPAs (Specially protected natural areas)[1]; Sediment disposal areas (Dumping, Explosive hazardous landfill)[1]; Fisheries (Fishing trawl)[1])
Unclear suitability level of co-location - based on country acitivities (Fisheries (Fishing inshore)[1]; Underwater cultural heritage (Wrecks, Underwater memorial objects, Historical naval battle)[1])
© Latvian Institute of Aquatic Ecology, 03.12.2020
0 5 10 20 KM
Data sources:
[1] the map is drawn approximately using data of Scientific and Research Institute of Maritime Spatial Planning Ermak NorthWest (ErmakNW) and project Capacity4MSP

Summary points

- Aquaculture (including macroalgae cultivation) is considered to some extent in all studied MSP, however, is not seen as a priority activity by most making co-location for cultivation facilities a primary concern.
- Co-location with wind farms is considered widely (all plans/ Q. responses). In some cases, as an opportunity for synergy co-existence (Germany, Sweden and Estonia), in others – possible depending on the location and outcomes of the EIA, and if in the interest of wind farm operators (Latvia and Poland).
- Synergetic co-existence of macroalgae farming and fish aquaculture was found in Estonia, Finland and Poland. The plans and questionnaire responses suggest microalgae cultivation could be used as an instrument to mitigate environmental impacts of fish farms through integrated multi-trophic aquaculture. Further, it is recognised in some plans that cultivation of macroalgae would over all improve the over-all state of the marine environment by decreasing nutrient levels (Poland, Estonia).
- In Estonia, it is seen that macroalgae farming activities may improve the livelihoods of small-scale fishers provided they are able to initiate the farming projects or take part in the construction and maintenance of the infrastructure and that the location of the farm does not limit access to fishing spots. Similarly, potential synergy can be found between local tourism, cultural heritage and mariculture, as the introduction of the new activity could increase local economic prosperity by providing more jobs, increasing coastal area attractiveness to tourists as well as enriching the local cuisine.
- Aquaculture installations in all analysed plans and questionnaire responses were seen not compatible under any circumstances with shipping and national military interests. The two sectors are of strategic importance thus spatial overlap is non-negotiable as the areas for military exercise and shipping lanes are set in stone. Operating mariculture farms in the proximity of either is a question of safety.
- Potentially co-existence with port infrastructure and activities were seen in Estonia and Sweden, indicating that fishing ports may serve as operational ports during maintenance of macroalgae cultivation and harvesting.
- The conflict between bird and underwater biotope protection and aquaculture (such as introduction of cultivated species to the protected ecosystem, changes to the structure of the seafloor and introduction of pressures arising from farm maintenance and cultivation) is in essence a conflict between users and the environment, rather than users.
- According to one of the questionnaire responses, institutional and knowledge related conflicts may be observed as regulatory authorities take the precautionary approach and due to a lack of evidence and experience face difficulties issuing permits or imposing restrictions for macro-algae projects.
- According to another respondent, institutional synergies could be achieved once macroalgae farming is recognised as an instrument helping tackle eutrophication

issues and developing the national bioeconomy or it is then positively greeted by the governing authorities as it supports Blue Growth.

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Annex

Characterisation of the current state of MSP

Marine Spatial Planning (MSP) is a decision-making tool which provides a shared means of achieving much needed effective ocean governance through spatial management of human activities (Directive 2014/89/EU, Friess & Gremaud-Colombier 2019, Foley et al 2010, Douvere 2008). In the EU it has been adopted as an instrument to support to EU nations to achieve aims set in the integrated maritime management strategy to achieve sustainable development meanwhile ensuring 'employment, productivity and societal cohesion' in the European region through the Blue Growth initiative whilst also achieving good marine environmental status (GES) set out by the Marine Strategy Framework Directive (MSFD) (Directive 2014/89/EU, MSP Roadmap 2008, Hassler et al 2019). The core principles of MSP in the EU are outlined in the MSP Directive (Directive 2014/89/EU) requiring EU states to produce official national marine spatial plans by 2021 which would not only follow an ecosystem based decision making process but also harmonize the future use of marine and terrestrial space and support cross-border cooperation, and importantly in the case of microalgae cultivation and harvest, making room for new activities such a offshore renewable energy production, aquaculture and sustainable tourism (Directive 2014/89/EU). In the development of the MSP the MSP directive requires member states to at least:

1. Involve stakeholders.
2. Develop cross-border cooperation.
3. Apply an ecosystem-based approach.
4. Use the best available data and share information.
5. Take into account land-sea interaction.
6. Promote the co-existence of activities.
7. Review the plans at least every 10 years (Friess et. Al in press 2019).

Whilst coastal EU members states are obliged to adopt the principles set out in the document, the MSP Directive is considered as part of the 'new generation' of EU directives, purposely developed to provide certain freedoms during its adoption, in turn allowing member states to integrate the new instrument into their domestic agenda and existing planning policy (Hassler et al 2019). Shaped by both national, EU level policy and administrative traditions as well as International regulatory bodies such as IMO the process of MSP and the end results in the EU are diverse. Differences can already be observed in range of authorities responsible for MSP, planning scale and extent, degree of stakeholder involvement, the number and type of sectors and activities considered and the legal status of the plans.

Aquaculture in MSP

(Focus on macroalgae cultivation, harvesting, and collection, including that of free flowing macroalgae and beach casting)

Mariculture involves the cultivation of plants and animals in the sea for food and other economical purposes and for reproduction of other, rare or endangered, sea organisms [Sadowski, 2009]. Marine organisms, especially macroalgae, molluscs, microalgae and fish are farmed for food and in order to obtain substances valuable for many sectors of economy (mainly for pharmaceutical, cosmetics and food industry). Maricultures can be used for restitution of protected or endangered species and also for improving the state/quality of environment. Especially in case of large scale marine farms, selection of an appropriate location is important. When choosing the location, the following should be taken into account:

- insolation,
- temperature,
- weather anomalies,
- strength and time of ice cover,
- availability of nutrients,
- availability of space,
- availability of qualified staff,
- labour and services' costs,
- transport infrastructure,
- market for the most important products,
- social and economic stability,
- legal issues.

The Baltic Sea is characterized by relatively low salinity and transparency of water, therefore it is not rich in macroalgae. In spite of that, at Swedish, Finnish, Danish and Estonian coasts, mainly near sewage collectors and diffusers, macroalgae cultures are maintained mainly in order to eliminate excessive quantities of nutrients, and also with the objective of obtaining material for the pharmaceutical, cosmetic and fuel industries (Study of Conditions of Spatial Development of Polish Sea Areas, 2016)

a) Background information.

In appr. 300 words please describe the current state of MSP, focusing on the key requirements of the MSP Directive outlined above and the prominent activities and sectors the MSP of the country you represent discusses. Please see the MSP Platform Website (https://www.msp-platform.eu/msp-practice/countries) for a list of relevant sectors which may be useful.

b) Characterisation in relation to conflicts and synergies which are related to microalgae cultivation, harvesting and collection, including free floating macroalgae (e.g. Estonia case) and beach casting.

Please try to describe MSP according to the following 4 different dimensions in relation to **conflicts and synergies:**

1) Marine use related conflicts and synergies. Conflicts in marine planning can be grouped into two types- user-user conflicts or conflicts between users and the environment. The former arises in the situation where marine users overlap spatially and temporally and compete for the same pool of resources (Bonnevie et al 2019). Meanwhile the later is case of

the activity resulting in pressures and causing impacts on the environment. Depending on the nature of the cultivation and harvest methods, mariculture can be involved in both.

To identify conflicts between marine space users and macro algae cultivation and harvesting please consider the sectors (traditional and emerging) featured in the MSP you are writing about. You may also want to refer to the national Strategic Environmental assessment conducted for the MSP.

2) Institutional cross-border and process-related conflicts and synergies. It is also important to remember that conflicts or synergies are multi-dimensional and cannot be understood at face value as only rinsing from the use of space/resource etc., in conflict management known as the content of the conflict (Giacometti et al 2019). All conflicts and synergies also have a human interaction side which may be driving the synergy or exacerbating the conflict, which are embodied in the stakeholder's attitudes and behaviours (Giacometti et al 2019).

Please reflect on the way in which the processes of MSP and decision making (the role of planners, legal status of plan) and institutional set up within which the decisions are being made (levels of governance, hierarchical positioning of sector in planning (new vs traditional sectors, political interest, domestic vs EU regulations) may conflict or synergize with the introduction of macro algae cultivation, harvest and collection.

3) Knowledge/data related synergies, conflicts. Conflicts and synergies may arise due to lack of reliable scientific data suitable for decision making. Knowledge and data may exist but not be standardized or it may have gaps.

4) Other types that are context related. Any other conflicts & synergies that come to mind not covered in the above, such as societal values which may synergise or conflict with the prospect of mariculture.

Type of Conflict and Synergies	MSP	Further Comments
Marine use related conflicts and synergies		
Institutional cross-border and process-related conflicts and synergies		
Knowledge/data related synergies and conflicts		
Context Related issues		

c) Please point in the map (approximately) the territories of Synergies and Conflicts based on the text written in the paragraph *b*.

Some institutional and process conflicts may not be appropriate for mapping, feel free to skip those.

Example: Latvia

a) Background information

The Latvian Maritime Spatial Plan 2030 was adopted on May the 14th, 2019. It has been the result of a 5 year planning process and superseded the first draft published in May 2016. The authority responsible for implementing MSP in Latvia is the Ministry of Environmental Protection and Regional Development. Participation of the MEPRD in EU projects BalticLines and BalticScope ensured international cooperation and a number of extensive, well attended stakeholder consultations held throughout the planning process. The plan extends across the Inland Marine Waters of the Republic of Latvia, the Territorial Sea and the Exclusive Economic Zone and features the following as the current users of marine space in Latvia:

- Shipping
- Ports
- Nature conservation
- Fisheries
- Tourism
- Military
- Scientific research
- Submarine cables and pipelines (MSP Platform 2018)

In the future it is expected that hydrocarbon exploration and extraction as well as offshore wind energy production be also take place in the Latvian waters (MSP Platform 2018). Interestingly, the previous draft of the plan also accommodated of aquaculture sites, however the more recent draft states that aquaculture installation suitability will be evaluated on a case by case basis as developments are proposed (Ministry of environmental protection and regional development, Republic of Latvia 2018). The reason for this, being that there are currently no proposals for development of aquaculture installations.

Currently the collection of beach cast macroalgae could be considered as activity in the certain areas, however such sector has not been considered in the existing MSP.

b) Characterisation in relation to conflicts and synergies which are related to macoralgae cultivation, harvesting and collection, including free floating macroalgae (e.g. Estonia case) and beach casting.

According to a conflict and synergy matrix developed in the process of Latvian MSP Algae and mussel aquaculture Conflict with:

- Shipping
- Port areas
- Sediment deposition areas
- Military polygon
- Coastal fisheries
- Pelagic trawling in the open sea
- Benthic trawling in the open sea
- Exploration of hydrocarbons
- Extraction of hydrocarbons
- Extraction of mineral resources
- Wave energy production
- Diving
- Underwater biotope protection

- Protection of Birds
- Cultural monuments

Algae and mussel aquaculture is Compatible under certain conditions with:

- Surveillance towers
- Former mined areas
- Wind energy production
- Underwater cables
- Marine water sports
- Marine tourism and leisure
- Fish spawning and nursery

Algae and mussel aquaculture is Compatible with:

- Fish aquaculture
- Protection of coastal landscapes

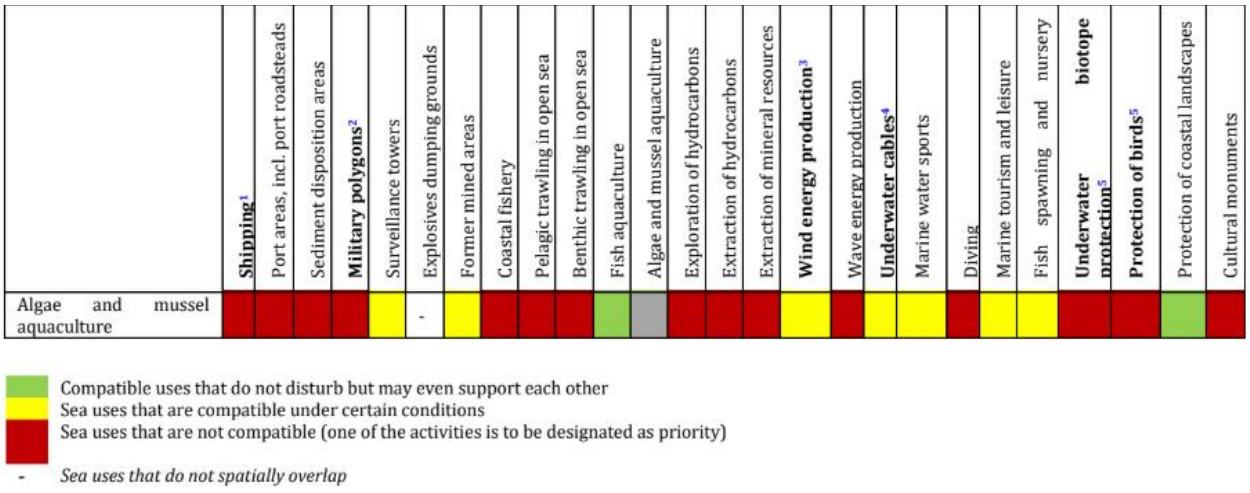

Figure 3 Sea User conflicts and synergies matrix, Ministry of Environmental Protection and regional development, Republic of Latvia (2018)

Type of Conflict and Synergies	MSP	Further Comments Ideas for conflict resolution
Marine use related conflicts and synergies	• Shipping and port activities (closest ports, introducing pollution, currents) • co-location of algae and fish farms (reduce impact of fish farm pollution) • Conservation of habitats • Fishermen- would site designation be limiting their access to area where macro algae grow	
Institutional cross-border and Process-	• Difference in interest on border sites (lack of	

related conflicts and synergies	communication between institutions) • First draft already published with no specific aquaculture sites, site designation may take a while	
Knowledge/data related synergies and conflicts	• Lack of sufficient data to enable decision making	
Context Related issues	Synergies • Historically accepted activity can be traced back to many decades regarding beach cast algae. Coastal communities used algae as crop fertilizer.	