



# Roadmap Status Report

Towards a blue-green economy  
in the Baltic Sea Region

Spring 2016





## SUBMARINER Roadmap Status Report





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# Introduction: Why a status report?



## 1.1 The SUBMARINER Roadmap: promoting a blue-green economy in the Baltic Sea Region

By 2030, biobased innovations and integrated uses of blue-green solutions should have secured the maintenance of the Baltic Sea Region’s natural capital, made marine resources an important part of the region’s smart energy and biomass production, and improved human well-being. Such was the vision set out by the SUBMARINER partners in their 2013 publication SUBMARINER Roadmap, which is the most important reference point for the broad range of actions that the SUBMARINER Network and its members engage in.<sup>1</sup> This status report presents an update on each of the Roadmap’s key issues. All of

these issues – organised into eleven strategic action fields that combine thematic and transversal elements – require a joint effort across the Baltic Sea Region in the years to come in order to realise the vision for 2030.

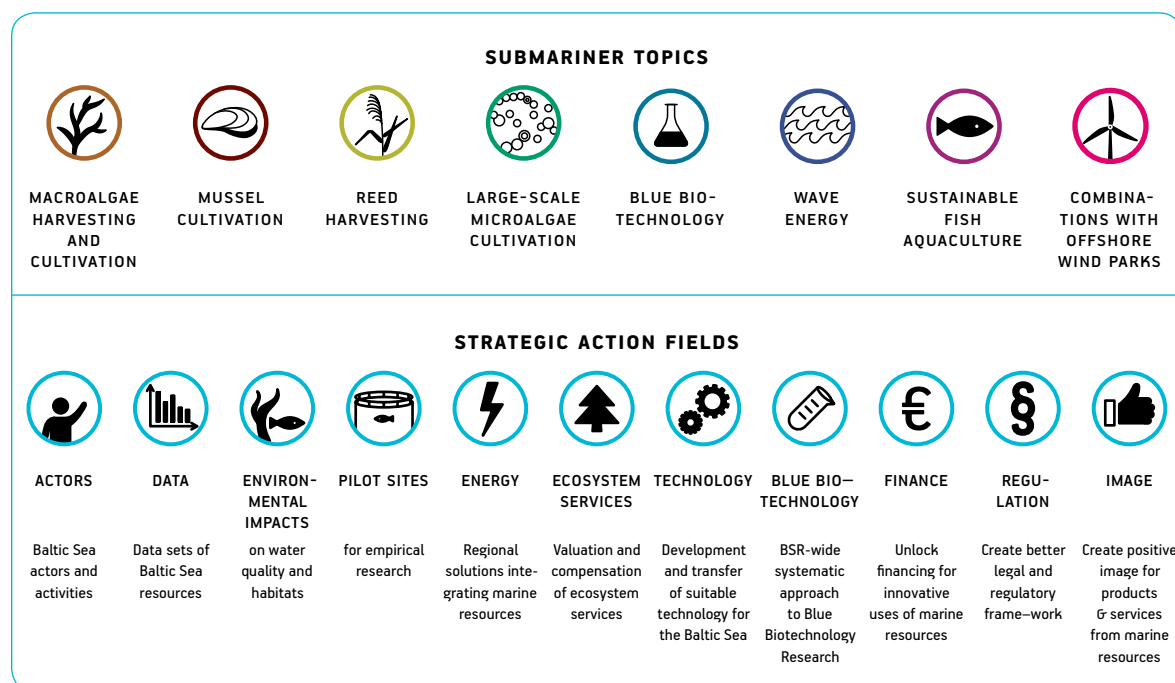
The SUBMARINER Roadmap is in turn based on the findings of the SUBMARINER Compendium<sup>2</sup>, a comprehensive assessment of the potential for innovative and sustainable uses of marine resources for the Baltic Sea Region. The actions proposed in the SUBMARINER Roadmap can be grouped thematically into the SUBMARINER topics and strategic action fields shown below in Figure 1.

For a complete overview of the actions suggested in the SUBMARINER Roadmap, please download the document from [www.submariner-network.eu](http://www.submariner-network.eu).

1 Przedzrymirska, J.; Zaucha, J. & Schultz-Zehden, A. (eds.) 2015: SUBMARINER Roadmap. Towards a blue-green economy in the Baltic Sea Region. Gdańsk. 2nd edition. [www.submariner-network.eu](http://www.submariner-network.eu).

2 Schultz-Zehden, A. & Matczak, M. (eds.) 2012: SUBMARINER Compendium. An Assessment of Innovative and Sustainable Uses of Baltic Marine Resources. Gdańsk. [www.submariner-network.eu](http://www.submariner-network.eu).

Figure 1: SUBMARINER topics and strategic action fields



## 1.2 Developments since the formulation of the SUBMARINER Roadmap

The two and a half years since the publication of the SUBMARINER Roadmap have seen an ever-increasing interest in SUBMARINER topics.

This interest was encapsulated by the institutionalisation of the SUBMARINER Network in 2014: seven institutions representing research, public administrations, consulting, NGOs and business parks from around the Baltic Sea took the joint initiative to register the SUBMARINER Network as a European Economic Interest Grouping (EEIG) with the aim of creating a free-standing cooperation and communication platform for promoting innovative approaches to the sustainable use of marine resources. Eight associate members have since joined the network (see information on SUBMARINER Network members on the last page of this report).

Sustainable blue growth issues have gained further political tailwind through a number of initiatives at different levels. In May 2014, the European Commission published its “Sustainable Blue Growth Agenda for the Baltic Sea Region”<sup>3</sup>, followed by a series of maritime stakeholder conferences that will form a basis for the formulation of “Master Plans” for selected blue growth areas in the Baltic Sea Region. In its 2014 agenda, the Commission mentioned the SUBMARINER Network as an example that demonstrates “the potential for developing forward-looking blue growth initiatives” within the EU Strategy for the Baltic Sea Region (EUSBSR). The blue bioeconomy is also a priority area in Nordic cooperation. In 2016, the Finnish Presidency of the Nordic Council of Ministers will launch the priority programme “Nordic Road Map for Blue Bioeconomy” as a three-year (2016–2018) programme aiming to pool the R&D work of Nordic experts to achieve sustainable growth and added value in the use of

living aquatic resources.<sup>4</sup> National and regional maritime strategies that have also been adopted in the Baltic Sea Region countries during recent years place an emphasis on SUBMARINER topics, too. To give an example, the Swedish maritime strategy<sup>5</sup> includes a focus area called “the sea as a natural resource” e.g. for food, energy and bioresources. Moreover, blue growth topics in general and issues related to the sustainable use of marine resources in particular have been included into several funding programmes developed since the publication of the SUBMARINER Roadmap, such as the BONUS Programme’s Strategic Research Agenda, the cooperation programmes of both cross-border and transnational Interreg programmes or the Horizon 2020 work programme for food security, sustainable agriculture and forestry, marine, maritime and inland water research and the bioeconomy.

These developments have created a favourable framework for the launch of many new initiatives in the field of sustainable uses of marine resources throughout the Baltic Sea Region. The SUBMARINER Network and its members as well as a variety of other actors have been active in this respect during recent years. The purpose of this report is therefore to provide an overview of recent actions, projects and initiatives and to answer the question as to how far they contribute to implementing the actions suggested in the SUBMARINER Roadmap. Advances made in the last years as well as remaining gaps and resulting focus areas for future actions are identified.

This status report is the first update on the implementation of the SUBMARINER Roadmap. Follow-up reports are planned at regular intervals in the coming years.

3 SWD(2014) 167 final.

4 Cf. Programme of the Finnish Presidency of the Nordic Council of Ministers. <http://norden2016.fi/en/program/>

5 Regeringskansliet: En svensk maritim strategi – för människor, jobb och miljö. <http://www.regeringen.se/contentassets/86a578f7a521469e9b6b8c62ac5aa128/maritim-strategi.pdf>

### 1.3 Methodology and structure of the report

This report is a joint exercise undertaken by the action field coordinators of the SUBMARINER Roadmap. Using a combination of independent desk research and an open online survey, the team constructed an overview of relevant initiatives and projects contributing to the implementation of the SUBMARINER Roadmap. The evaluation process was completed in December 2015, which is the status reflected in this report.

During desk research, projects were identified using project databases such as the CORDIS, Keep and EurOcean databases or the European Marine Innovation Database. Invitations to provide information on relevant initiatives and projects through the online survey were distributed to approx. 2,500 stakeholders through newsletters and 344 personalised invitations to selected key experts were additionally issued.

The aim was to collect information on all kinds of activities promoting innovative approaches to the sustainable use of marine resources – from small-scale, bottom-up initiatives at local or regional level to larger cross-border, transnational or EU-wide innovation and research projects. For each of the recorded initiatives and projects, information was collected regarding topical focus, links to SUBMARINER topics and SUBMARINER Network action fields, geographical scale, types of actors involved as well as budget and funding sources. The geographical focus was on the Baltic Sea Region as defined in the SUBMARINER Compendium, i.e. the countries surrounding the Baltic Sea, the Belt Sea, the Sound and Kattegat. EU-wide and international initiatives were reflected if at least partly being implemented in these countries.

In this way, a set of 139 initiatives and actions was compiled as the basis for this update report. A list of these initiatives and projects can be found in its annex. Though this is an impressive figure, we are aware of the fact that it still cannot provide a comprehensive and/or representative picture. In particular, the data might be biased, as information on national and regional initiatives was not always as easily accessible as information on EU-financed projects, which must fulfil special visibility and publicity rules. As is usually the case, the response rate to the online survey was rather low.

Nevertheless, the data sets provide a detailed enough picture to draw at least some preliminary conclusions on which of the actions proposed in the SUBMARINER Roadmap are already being tackled – as well as the remaining gaps.

Section 2 provides some general key messages and main trends revealed by the data on an overall level. Section 3 takes a closer look at the identified initiatives and projects by summarising the main trends per strategic action field of the SUBMARINER Roadmap and by highlighting selected initiatives in case boxes. Finally, section 4 derives some overall conclusions and recommendations for the following years from these summaries.

It should be noted that many of the initiatives and actions included in our data set are still running or are about to begin. Therefore the analysis undertaken for this report mainly considered the topics and questions that these initiatives address, while their results and outcomes in very many cases do not yet exist. They will be taken into consideration in one of the following status reports on the implementation of the SUBMARINER Roadmap.



# Key messages and main trends on an overall level

In total, 139 initiatives and projects were entered in our online survey as contributing to the implementation of the SUBMARINER Roadmap. This chapter provides some general key messages and main trends revealed on an overall level.

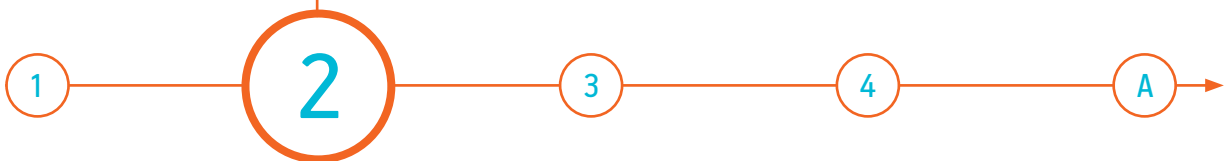
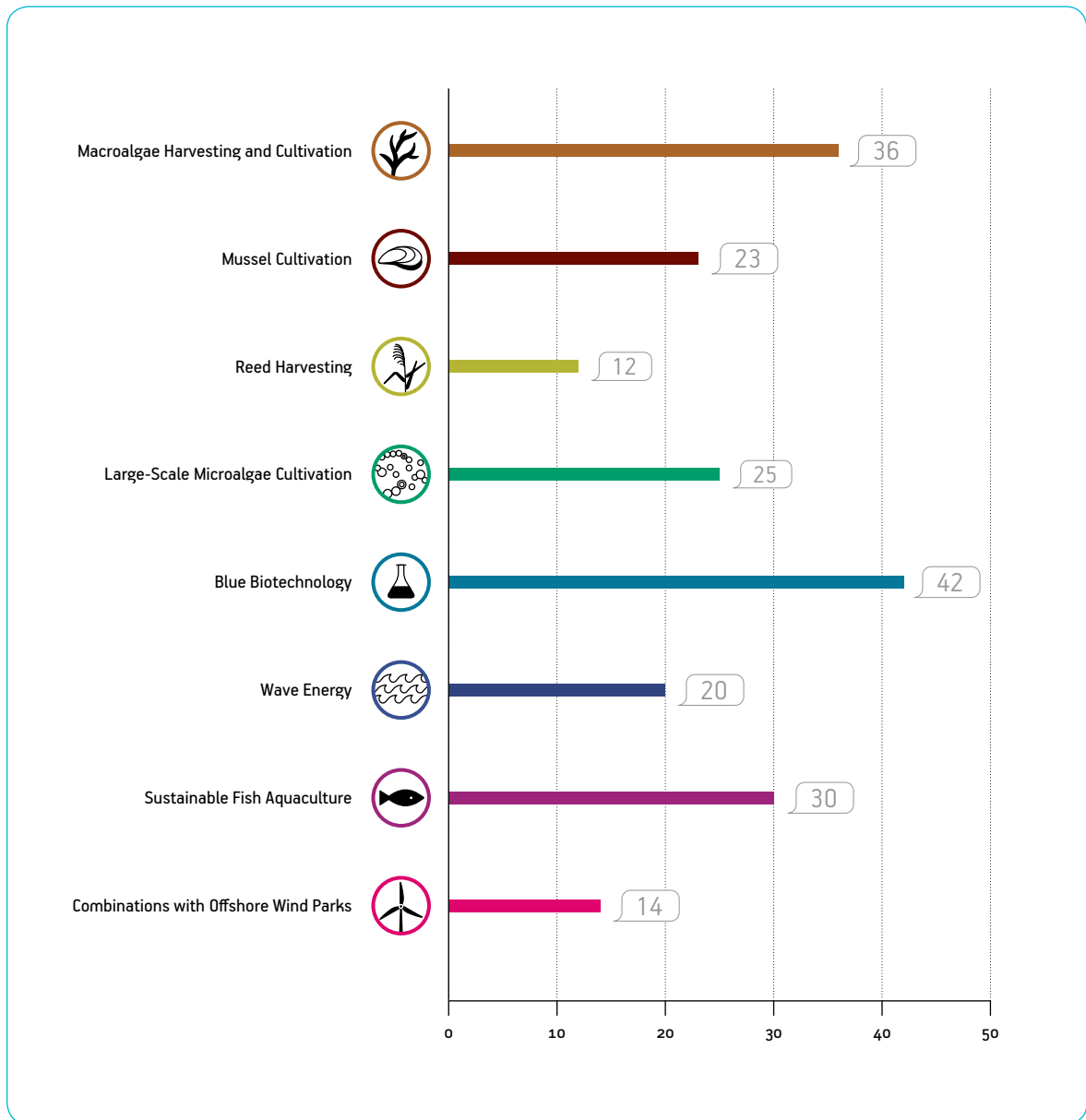


Figure 2: SUBMARINER topics (multiple choices allowed)

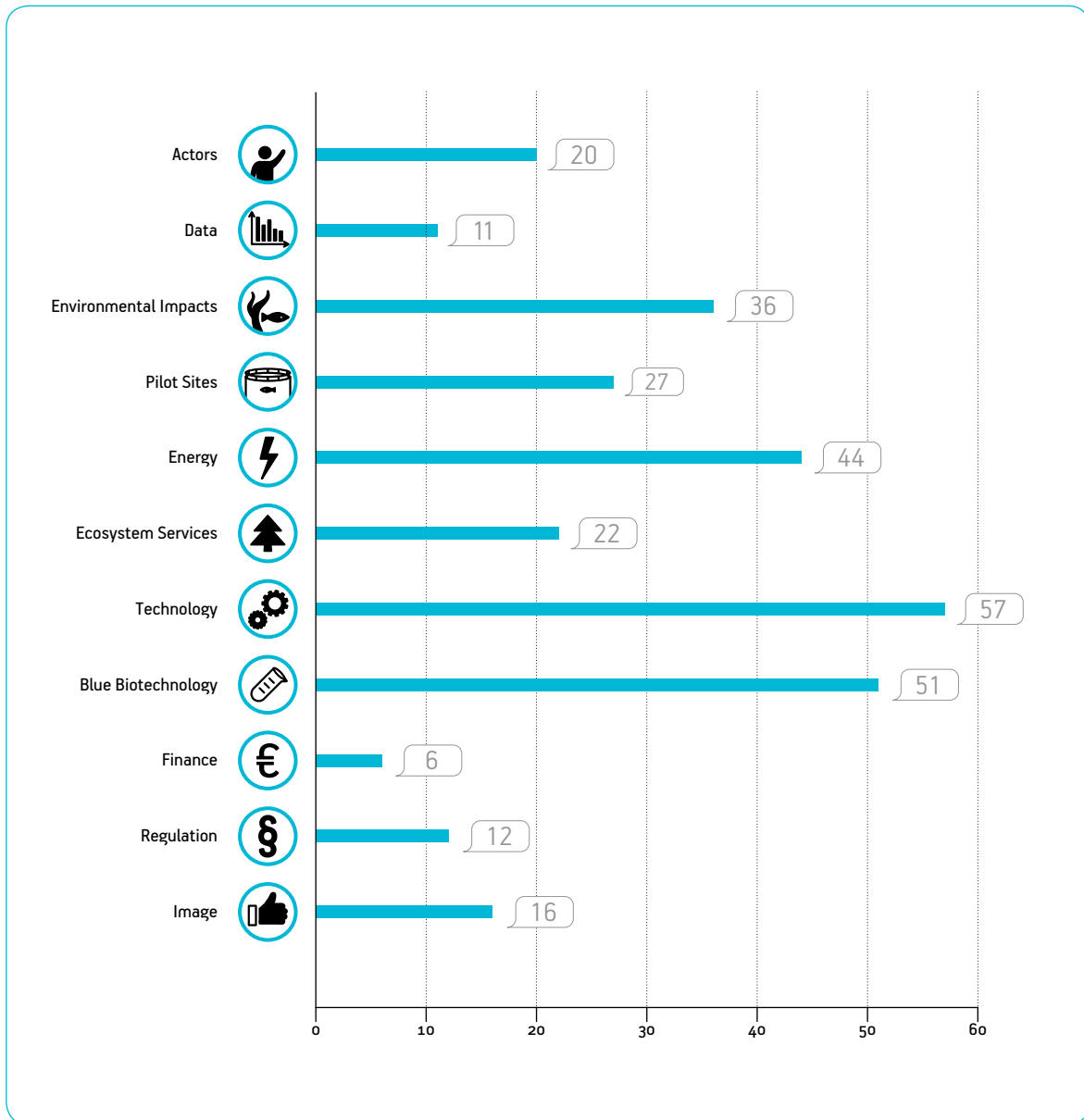


## 2.1 SUBMARINER topics and strategic action fields

Survey respondents were asked to choose which of the SUBMARINER topic(s) their initiative or project addresses and to which of the Roadmap action fields it contributes. Multiple choices were allowed in these questions.

Blue biotechnology (42 initiatives), macroalgae harvesting and cultivation (36) and sustainable fish aquaculture (30) are the SUBMARINER topics addressed by the highest number of initiatives and projects. Reed harvesting (12) and combinations with offshore wind parks (14) were selected least frequently.

Figure 3: Strategic action fields (multiple choices allowed)



Survey respondents also had the opportunity to enter other innovative uses of marine resources if the SUBMARINER topics did not closely match the focus of the respective initiative or project. Among the responses for such “other” uses are current or tidal energy applications, the use of fish waste in aquaculture, the use of ascidians (sea squirts)

biomass as well as the restoration of spawning grounds (so-called “pike factories”).

When it comes to the strategic action fields, technology (57 initiatives), blue biotechnology (51) and energy (44) were the action fields chosen most frequently by the survey respondents, while finance (6), data (11) and regulation (12) were the least frequently selected action fields.

Figure 4: Number of initiatives addressing specific combinations of topics and strategic action fields

	 Actors	 Data	 Environmental Impacts	 Pilot Sites
 Macroalgae Harvesting and Cultivation	6	5	10	9
 Mussel Cultivation	4	4	10	7
 Reed Harvesting	4	2	6	5
 Large-Scale Microalgae Cultivation	2	2	3	4
 Blue Biotechnology	7	4	5	5
 Wave Energy	1	1	0	1
 Sustainable Fish Aquaculture	2	3	13	7
 Combinations with Offshore Wind Parks	1	3	1	0

Figure 4 shows how many of the 139 survey initiatives are addressed by specific combinations of SUBMARINER topics and strategic action fields. While obvious combinations rank relatively high (e.g. blue biotechnology – blue biotechnology, wave

energy – energy), the figure also reveals the remaining gaps. 11 combinations of topics and strategic action fields are not addressed by a single initiative or project, while 13 combinations are addressed by only one initiative or project each.



 Energy	 Ecosystem Services	 Technology	 Blue Biotechnology	 Finance	 Regulation	 Image
12	7	14	10	1	3	5
2	10	9	3	2	7	6
4	5	2	1	0	1	1
6	6	11	11	0	1	4
6	5	15	33	4	2	5
16	0	7	0	0	1	0
2	5	13	6	1	5	2
10	0	6	0	0	2	1

## 2.2 Actors involved in the initiatives and projects

Survey respondents were also asked to provide information on the type and origin of the actors involved in the respective initiatives and projects.

Higher education and research institutions (83% of all survey initiatives) as well as private companies (63%) are involved in the highest number of

initiatives and projects, while the participation of international organisations (6%), intermediaries (11%) and interest groupings (13%) is not equally widespread. This corresponds with the high number of projects funded by EU research and innovation programmes (see Figure 8). These projects are usually driven by research institutions, but very often involve at least one SME in the partnership.

Figure 5: Actors. Number of initiatives with the involvement of... (multiple choices allowed)

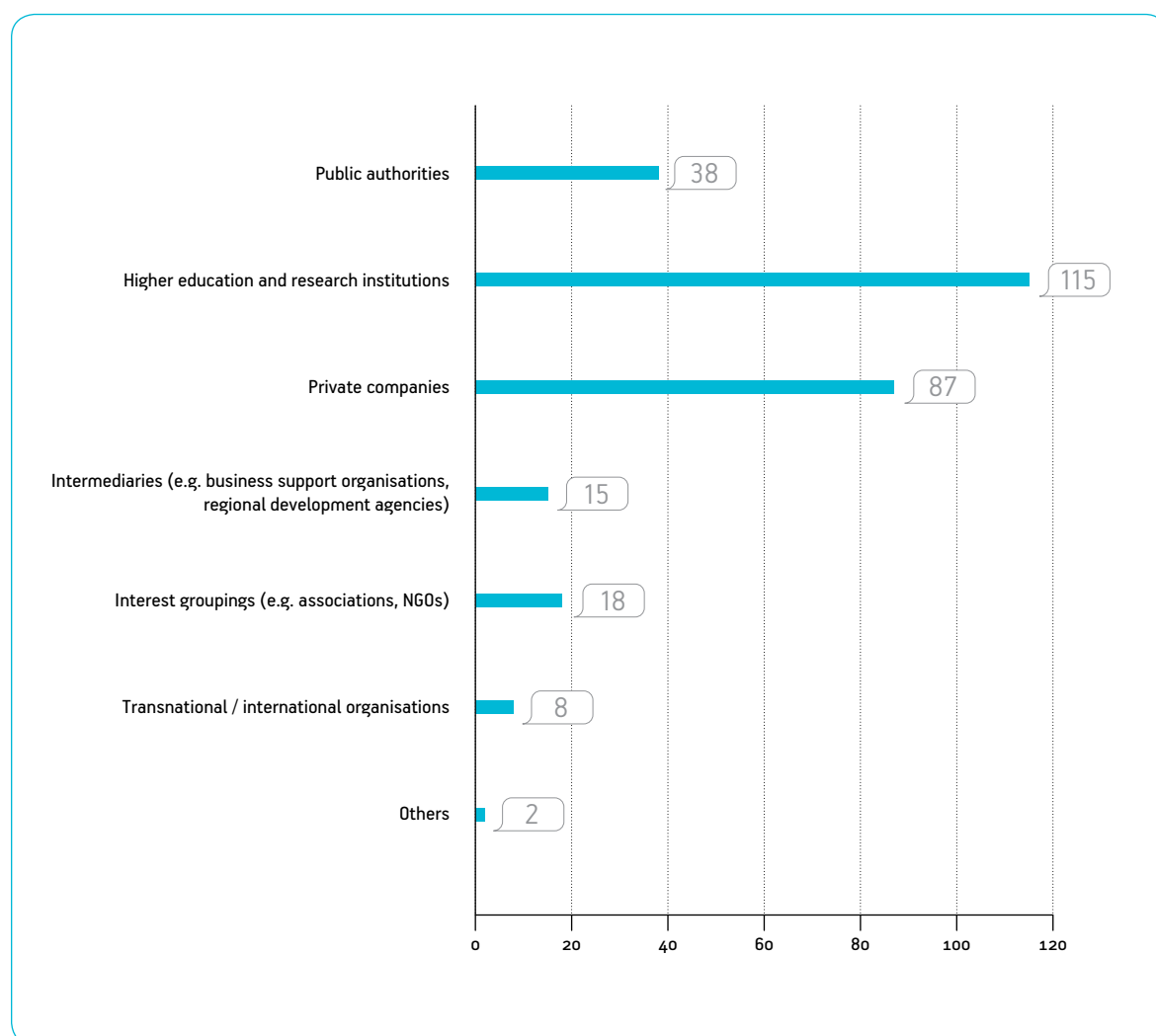


Figure 6: Number of initiatives with the involvement of actors from different Baltic Sea Region countries



Figure 6 shows a relatively clear divide between old and new member states when it comes to the participation of Baltic Sea Region countries in the 139 screened survey initiatives. While Sweden (47.5% of all survey initiatives), Denmark (40%), Germany

(36%) and Finland (20%) are involved in the highest share of projects, the institutions from Poland (15%), Estonia (10%), Lithuania (6.5%), Latvia (5%) and Russia (1.4%) are involved to a substantially smaller degree.

## 2.3 Budget and funding

Survey respondents were also asked to provide information on the budget range as well as the main funding sources.

More than half of the survey initiatives have a budget of more than € 1 million. 42 initiatives (30%) even have a budget of more than € 3 million.

133 initiatives were indicated as financed mainly through public funds, five through mainly private funds (for 1 initiative, this information was not submitted). Of the 133 initiatives with mainly public funding, projects funded by European (50 initiatives) as well as national research and innovation programmes (44) clearly dominate. National or regional rural development programmes (16) as well as European territorial cooperation (Interreg) programmes (13) are the other larger groups of public funding programmes financing the survey initiatives.

Figure 7: Number of initiatives with budget ranges...

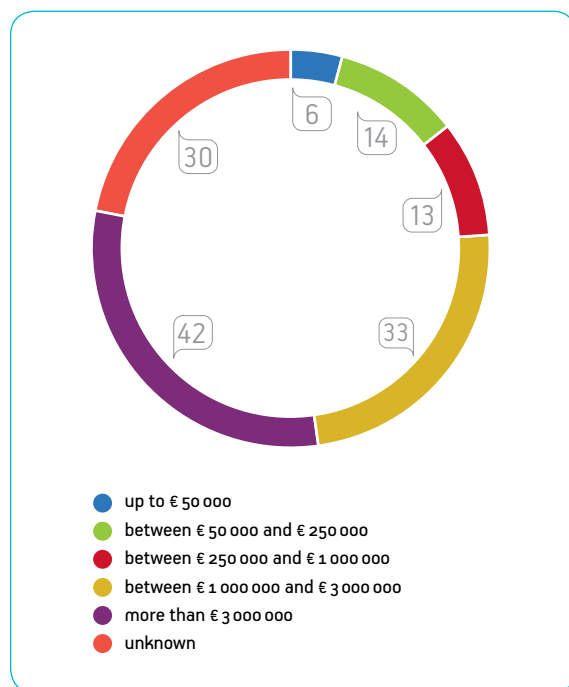


Figure 8: Public funding programmes. Number of initiatives with public funding from...





The strategic  
action fields:  
Where are we at?



### 3.1 Actors: Baltic Sea actors and activities

#### 20 survey initiatives

- 40% of projects are funded by either Interreg or FP7
- 30% of projects have lead partners from Sweden
- focus so far mainly on bringing together project consortia rather than project-independent strategic initiatives
- mapping of education programmes and actors remains a gap
- private companies and actors to be mapped by some new projects – but not for all SUBMARINER topics

#### SUBMARINER ROADMAP ACTIONS IN ACTION FIELD “ACTORS”

Collect information, establish and maintain a BSR-wide database on relevant actors, initiatives and projects, equipment and education

Identify potential linkages between natural and socioeconomic research and introduce research results of both disciplines to each other

Support actions for information and contact exchange among new marine use stakeholders

Integrate marine sectors into BSR-wide research and technology development projects, which integrate knowledge for whole the catchment area of Baltic Sea, e.g. energy sector, waste treatment, CO<sub>2</sub> capture and storage, socio-economic aspects

#### LEVEL OF IMPLEMENTATION:

- Action addressed by survey initiatives to large extent
- Action addressed by survey initiatives to some extent
- Action poorly or not at all addressed by survey initiatives
- Unknown / lack of information



THE MAIN OBJECTIVE OF THE ACTION FIELD “ACTORS” is to raise awareness among public and private actors about their respective activities and thus to achieve better and faster results whilst using fewer resources (as duplications of actions are avoided). This is to be achieved through the creation and maintenance of databases, but also through accompanying support actions for information and contact exchange.

## Contribution to action field objective

As will be evident throughout this report, this task is among the core activities of the SUBMARINER Network itself. Over the course of the last two years, it has succeeded in gathering information on actors and their activities throughout the Baltic Sea Region and in bringing them together across different disciplines and levels as well as combining research, administration and business concerns. The network has done so mainly through pro-active project development. Using regularly surveyed “hot” topics among its core members as a starting point and matching these with the relevant funding opportunities, the SUBMARINER Network has systematically brought together actors within specific topic areas. Moreover, the SUBMARINER Network was invited to and participated in numerous activities pursued by external partners. Most recently, it joined Euro-Ocean, a network of 11 marine research institutions throughout Europe working together to systematically gather information and knowledge outputs from marine research and innovation projects.

## Type of actors

Apart from the SUBMARINER Network, other actors including networks, foundations or associations are active in bringing “blue actors” around the Baltic Sea Region together, mainly through workshops, seminars, etc. Chief among these are the Baltic Development Forum (BDF), the Conference of Peripheral Maritime Regions of Europe (CPMR) and the Zennström Foundation. The European Commission organised two conferences to gather

blue economy actors. This was done in cooperation with the Ministry of Economic Affairs, Employment, Transport and Technology Schleswig-Holstein in Kiel and the BDF in Copenhagen. Research funding institutions have also joined forces to coordinate “blue research”. The BONUS programme, for instance, has organised a series of events to foster cross-cutting communication among its various “blue” research projects within the Baltic Sea Region. Sweden, Germany and Denmark are part of the European wide ERA-NET on Marine Biotechnology, which (similarly to BONUS) seeks to coordinate the respective national research funds.

The Nordic Council of Ministers is also active in this field, mainly (but not exclusively) through its function as Policy Area Coordinator for Bioeconomy in the EUSBSR. The CPMR has a maritime working group, which brings together mainly Finish and Swedish regions. In many cases, these networks (e.g. PA Bioeconomy mapping / CPMR) are currently cooperating with the SUBMARINER Network to represent the “blue” dimension.

Whereas the SUBMARINER Network itself focuses on transnational and pan-Baltic initiatives, recent years have also seen a steady increase in more sub-regional and local initiatives bringing together blue actors. These initiatives tend to promote coordinating work around smaller water bodies or on specific topics (such as blue biotechnology or maritime clusters). In many cases, the SUBMARINER Network cooperates with these locally based initiatives by connecting them across the Baltic Sea Region.

## Actions addressed

Initiatives carried out so far have focused on assembling an optimal group of actors for specific projects. However, in almost all instances the resulting projects include the aim of creating a systematic database of blue actors for a given topic.

## Remaining gaps

Whereas there is much that looks promising, one action has been identified as missing almost altogether: the mapping of available education at various levels. DG MARE has launched a study to identify skills required for blue growth. The survey responses indicate that none of the screened initiatives pursue a blue growth education agenda in a structured way. AgroTech and EUC-C-D support some initiatives targeting educational material for schools or the general public, but this is far from undertaking the mapping of all education available. The focus has so far been at a much higher level: coordinating research funding or bringing together

senior researchers. The basic educational levels, such as schools and apprenticeships, have so far been neglected.

Furthermore, a systematic mapping and survey of private companies engaged in SUBMARINER topics and action fields is still missing – even though all facilitators try to engage private actors and recent project initiatives such as the Blue Biotechnology Alliance, Baltic Blue Growth and Smart Blue Regions clearly aim to integrate private companies.

## Main trends

Despite the many initiatives, there is still a long way to go for the SUBMARINER Network itself to serve as

### IN PRACTICE

#### THE SUBMARINER NETWORK AS A HUB FOR BALTIC SEA ACTORS AND ACTIVITIES

Over the course of the last two years the SUBMARINER Network has systematically gathered information on relevant actors and gathered them around specific project development events covering the following topics:

- Smart specialisation for blue growth in the Baltic Sea Region,
- Creation of a pan-Baltic Blue Biotechnology Alliance,
- Technology transfer for innovative integrated aquaculture systems,
- Maritime monitoring technology development and transfer,
- Large-scale mussel cultivation,
- Promotion of macroalgae cultivation in the Baltic Sea Region,
- Underwater cultural heritage in Maritime Spatial Planning,
- Turning environmental challenges into blue growth opportunities in the Baltic Sea Region lagoons and bays.

As a result the SUBMARINER Network has already reached out to more than 50 different institutions and higher number of experts working in these institutions. In most cases the resulting projects, which will start to be implemented over the course of 2016, include activities which take a much more systematic approach towards creating databases of relevant actors (including their respective capabilities, focus areas, available facilities and resources) as well as fostering strategic ways of collaboration.

[www.submariner-network.eu](http://www.submariner-network.eu)



the hub for all Baltic Sea actors and activities. This is an on-going exercise. However, the network is well placed to do so. With more of its projects now entering the full implementation phase, there will be more opportunities for it to act as a permanent information point for all types of actors within the “blue sphere” – be it regions, research organisations, public administrations or private and public companies.

Whereas the focus has so far been on cross-border and transnational project development, the projects themselves will include more action. They directly target value chain and product development creation and thus also work more closely with private companies. More emphasis is also placed

on the availability of technical equipment as well as the integration of socio-economic aspects into projects and the general integration of knowledge. The projects will also facilitate the realisation of more sophisticated surveys and – most importantly – continuously maintained databases, with the SUBMARINER Network being at the hub and serving as the information point. Furthermore, the projects will increasingly facilitate the creation of and/or support for network initiatives at the regional level (e.g. Smart Blue Regions). These initiatives are as necessary as networking at the pan-Baltic and European levels, as they serve to connect the levels with one another.

**Figure 9:** Regular exchanges at SUBMARINER Network conferences contribute to a closer BSR community (picture: Maritime Institute in Gdańsk).



## 3.2 Data: Data sets of Baltic Sea resources

### 11 survey initiatives contribute to the action field Data

- Finland leads 36% of projects in this action field
- Over 1 in 3 projects is funded by Interreg programmes
- many initiatives linked to identifying mariculture sites
- no BSR-wide approach to resource monitoring and mapping visible

#### SUBMARINER ROADMAP ACTIONS IN ACTION FIELD "DATA"

Establish and implement BSR-wide best practices for monitoring and systematic mapping of biomass, nutrient and CO<sub>2</sub> resources



Identify and recommend institutional structures for permanent monitoring as well as structures for data-sharing and visualisation (GIS)



Link the data sets with surveys and mapping of other local (terrestrial) resources and demand for biogas or any other biomass refinery process



Develop a system to support the use of existing monitoring data to identify best sites for mussel cultivation, fish aquaculture sites and macroalgae cultivation



#### LEVEL OF IMPLEMENTATION:

- Action addressed by survey initiatives to large extent
- Action addressed by survey initiatives to some extent
- Action poorly or not at all addressed by survey initiatives
- Unknown / lack of information



THE MAIN OBJECTIVE OF THE “DATA” ACTION FIELD is filling the identified gaps in data availability on Baltic Sea resources.

Figure 10: Data-gathering technology such as remotely operated vehicles is helping to fill the gaps on available BSR resources (picture: GEOMAR ROV team).

## Contribution to action field objective

The new initiatives and projects proposed within the action field of “Data” contribute to fill the identified data gaps through the implementation of new technologies. They combine environmental, social and economic factors and include innovations in bioeconomy, the fish farming industry, new usages of macroalgae, improvements in ecosystem-based regional planning of marine areas, development of sustainable aquaculture, the combination of activities (e.g. wind power and fish farming) in the same areas, and the promotion of sustainable blue growth.



### IN PRACTICE

#### SEAGIS – COOPERATION FOR ECOSYSTEM-BASED PLANNING OF THE MARINE ENVIRONMENT USING GIS

- **Duration:** 2011–2014
- **Budget:** between € 1,043,858
- **Main source of funding:** Interreg Botnia-Atlantica
- **Baltic Sea countries:** Finland, Sweden
- **Lead Partner:** Centre for Economic Development, Transport and the Environment, Ostrobothnia, Finland

The main aim of SeagIS was to produce an increased knowledge base and make it more accessible in order to increase the possibilities of a coordination of ecosystem-based regional planning of marine areas and create a common platform for knowledge storing, planning and future decision-making in the Kvarken region. In terms of the contribution to the action field of Data, SeagIS identified and recommended institutional structures for permanent monitoring as well as structures for data-sharing and visualisation (GIS).

A follow-up project called “SeagIS 2.0” is about to start its implementation in June 2016.

[www.seagis.org](http://www.seagis.org)

## Types of actors

The main actors involved in the action field Data are higher education and research institutions, interest groupings (NGOs, associations etc.), public authorities and private companies. Intermediaries such as business support organisations or regional development agencies are also involved in a small number of initiatives.

## Actions addressed

Proposed new initiatives and projects mainly target the Roadmap action of developing a system to support the use of existing monitoring data to identify the best sites for mussel cultivation, fish aquaculture sites and macroalgae cultivation.

One project identifies and recommends institutional structures for permanent monitoring as well as structures for data sharing and visualisation. It proposes to increase the possibilities for coordination of ecosystem-based regional planning in marine areas and to create a common platform for knowledge storing, planning and future decision-making in the Kvarken region (see box on p. 25).

A further two projects link the data sets with surveys and mapping of other local (terrestrial)

resources to the demand for biogas or other biomass refinery processes. These projects propose a new usage for macroalgae and promote the sustainable use of marine resources through the implementation of new methodologies for sustainable blue growth.

## Remaining gaps

The establishment and implementation of BSR-wide best practices for monitoring and systematic mapping of biomass resources, nutrient resources and CO<sub>2</sub> sources for microalgae cultivation has so far been insufficiently covered in proposed initiatives and projects. Future initiatives are welcomed in this area.

## Main trends

Advances made in the action field Data are mainly on the institutional and structural levels. Together with improved monitoring technology and data processing and storage systems, these are positive developments. However, the necessity for a truly systematic, BSR-wide approach to monitoring and mapping remains a priority.

### 3.3 Environmental Impacts: Environmental impacts on water quality and habitats

#### 36 survey initiatives contribute to the action field Environmental Impacts

- 15 of these making substantial, targeted contributions
- 42% of initiatives have a lead partner from Denmark
- Danish national R&I funding supports 28% of projects
- environmental impacts mostly studied not for their own sakes but as by-products of mariculture technology projects

#### SUBMARINER ROADMAP ACTIONS IN ACTION FIELD "ENVIRONMENTAL IMPACTS"

Promote and conduct systematic research on the role of reed beds and harvesting, macroalgae harvesting and cultivation as well as mussel cultivations on local biodiversity and water quality

Assess the consequences for nutrient regeneration and biogeochemical cycling and benthic habitat deterioration arising from increased sedimentation and sediment oxygen uptake by mussel cultivations

Assess the relationship between offshore, attached, living macroalgae stocks and beach cast macroalgae in terms of biomass, density and annual production rates of stocks of attached, living macroalgae to support the derivation of sustainable quantities of beach cast and free-floating algal mats that can be removed

Investigate the cumulative ecological impact of biomanipulation of bivalve populations

Investigate the danger of releasing bioengineered or invasive compounds, bacteria and microalgae into the marine environment on marine habitats and species

Investigate effects on water quality and animal health through analyses and cultivation of microorganisms in bioponds and filters

Investigate the impact of wave installations on the marine environment

Further investigate feed supply and efficiency of open net cages

#### LEVEL OF IMPLEMENTATION:

- Action addressed by survey initiatives to large extent
- Action addressed by survey initiatives to some extent
- Action poorly or not at all addressed by survey initiatives
- Unknown / lack of information



THE OBJECTIVE OF THE ACTION FIELD “ENVIRONMENTAL IMPACTS” is to close knowledge gaps on environmental impacts of innovative sea uses.

## Contribution to action field objective

Some 36 of the initiatives and projects screened in our survey have been identified as contributing to the action field of environmental impacts, however only one of the projects exclusively addresses this action field (see “in practice” box). In the other 35 initiatives the connection to the general objective of the action field or even its overall aim, i.e. reducing the anthropogenic impact on marine ecosystem, is only a side product of the project/initiative. Only 15 of the 36 projects<sup>1</sup> can be said to make substantial

contributions and to address directly the actions defined in the SUBMARINER Roadmap.

## Types of actors

Higher education and research institutions are the dominant type of actor involved in nearly all of these projects, followed by private companies and public authorities. Intermediaries, interest groupings and international organisations are considerably less involved.

## Actions addressed

Most of the initiatives and projects cover research on the role of aquatic resources for local biodiversity and water quality, with research on the environmental effects of mussel cultivation and reed harvesting being most prevalent. Some initiatives also assess the biochemical effects of mussel cultivation. Two more projects and initiatives investigate the danger of releasing compounds, bacteria or microalgae. An investigation of the effects of microorganisms in bioponds and -filters on water quality and animal health as well as an investigation of the feed supply and efficiency of open net cages are undertaken by one initiative respectively.

<sup>1</sup> Seafarm – macroalgae for a bio-based society; HABFISH – Harmful algae and fish kills; MUMIHUS – production of mussels; ProAqua – reducing antibiotics, using probiotics; EnviGuard – biosensor monitoring for environmental monitoring and disease prevention in aquaculture; BalticEcoMussel; BBG – Baltic Blue Growth; Marine BioGas; Production of macroalgae in the Baltic Sea – a pilot project; BaltCOAST – A Systems Approach Framework for Coastal Research and Management in the Baltic; COMBI – rearing; Nutrients of reed growth to fields; Water on Gotland; Mynälahti general planning project; MINOTAUR – metabolic interaction in oceanic photosymbiosis

## Remaining gaps

The following three actions defined in the action field “Environmental impacts” are not targeted at all:

- Investigations supporting the derivation of sustainable quantities of beach cast and free-floating algae mats that can be removed,
- Investigations on the cumulative ecological impact of biomanipulation of bivalve populations,
- Investigations of wave installations’ impact on the marine environment.

The issues of environmental capacity does not yet seem to receive broad-scale attention, as the majority of the topics addressed have a direct and clear link to future (industrial) production.

## Main trends

Tendencies observed point to a high share of academic and research institutions involved in the investigation and development of mariculture technologies and perspectives (blue mussels, fish) and the use of plant biomass. Environmental aspects as such are considered throughout the sample of projects/initiatives while more complicated impacts (both in investigating and per se) are not widely considered.

### IN PRACTICE

#### HABFISH - HARMFUL ALGAE AND FISH KILLS

- **Duration:** 2012–2016
- **Budget:** € 3,640,690
- **Main source of funding:** Danish Council for Strategic Research
- **Baltic Sea countries:** Denmark, Germany
- **Lead Partner:** University of Copenhagen

Blooms of ichthyotoxic algae are a major problem for fish production in Danish waters. In the context of exploring the environmental impact of marine aquaculture on the farmed species, HABFISH seeks to identify the causative toxins and develop new chemical assays. Within the project, molecular probes for reliable identification of the algae are being developed and the mechanisms involved in the acclimation of fish to the toxic algae are being studied, as is the possible accumulation of the toxins in fish. Currently, ichthyotoxic algae have detrimental consequences for the fish farmers affected, recreational and commercial fishing. As fish farming has the potential to become an economically important industry in Denmark, the work done in HABFISH towards developing modern means to cope with harmful algal blooms (HABS) is essential. The project will result in a significantly improved monitoring programme of ichthyotoxic algae and their toxins and enable a much better risk assessment during algal blooms in Danish waters.

[www.habfish.dk](http://www.habfish.dk)

### 3.4 Pilot Sites: Pilot sites for empirical research

**27** survey initiatives contribute to the action field Pilot Sites

- 1 in 3 of these has a lead partner from Sweden
- over 40% are supported by national R&I funding programmes
- relatively high level of private sector involvement
- many initiatives aim to create mariculture pilot sites

#### SUBMARINER ROADMAP ACTIONS UNDER ACTION FIELD "PILOT SITES" LEVEL OF IMPLEMENTATION

Promote investments into concrete pilot sites for new uses of marine resources

Creation of concrete pilot sites:

IMTA solutions

RAS technologies

agar production

macroalgae and mussel cultivation

reed harvesting

Research for BSR large-scale microalgae cultivation

marine biorefinery pilot sites

wave energy production

Identify most suitable sites within wind parks in relation to cultivation technologies.



**LEVEL OF IMPLEMENTATION:**

- Action addressed by survey initiatives to large extent
- Action addressed by survey initiatives to some extent
- Action poorly or not at all addressed by survey initiatives
- Unknown / lack of information



THE OBJECTIVE OF THE ACTION FIELD “PILOT SITES” is to create pilot sites for empirical research around the Baltic Sea Region.

## Contribution to action field G actions addressed

In the survey, 27 initiatives and projects were marked as contributing to the implementation of the action field “Pilot Sites”, including the devel-

opment of full-scale pilot sites as an important project element.

The dominant topics are:

- the creation of mariculture pilot sites within the Baltic Sea Region, be it for the stand-alone cultivation of blue mussels (e.g. in the Baltic Blue Growth projects and predecessor initiatives) or seaweed (e.g. in the Seafarm project, see “in practice” box in section 3.5 Energy) or for integrated multi-trophic aquaculture solutions (e.g. in the KOMBI-opdræt project, see next page),

IN PRACTICE

### BALTIC BLUE GROWTH – INITIATION OF FULL-SCALE MUSSEL FARMING IN THE BALTIC SEA

- **Duration:** 2016–2019
- **Budget:** approx. € 4.6 million
- **Main source of funding:** Interreg Baltic Sea Region Programme
- **Baltic Sea countries:** Sweden, Denmark, Estonia, Finland, Germany, Latvia, Poland
- **Lead Partner:** Region Östergötland (Sweden)

Pilot sites in Sweden, Denmark, Estonia, Latvia and Germany have been selected for the implementation of this large-scale project. At these pilot sites (or “focus farms”), the project partners will initiate large-scale, business-based feed mussel farming to harvest nutrients from the Baltic Sea. The aim is then to proceed from pilot stage to real cases and build an awareness of and capacity for blue growth and mussel farming among the private and public sector. It will also include evaluating Baltic production potential and environmental impacts of mussel farms under current and future environmental conditions. Post-harvest processing of farmed mussel will take place in the Eastern and Western Baltic. Finally, policy issues for the establishment of mussel farming and environmental services will be reviewed.

[www.balticbluegrowth.eu](http://www.balticbluegrowth.eu)

## KOMBI-OPDRÆT (COMBI-REARING)

- **Duration:** 2011–2015
- **Budget:** € 1,946,308
- **Main source of funding:** GUDP – Green Development and Demonstration Programme (Grønt Udviklings- og DemonstrationsProgram)
- **Baltic Sea countries:** Denmark
- **Bodies involved:** Hjarnø Havbrug

The project “KOMBI-opdræt” (COMBI-rearing) investigated the possibility of expanding the mariculture production of fish (rainbow trout) without increasing the nutrient load in the marine environment. This is done by combining fish production with large-scale production and harvest of mussels and seaweed for nutrient removal in an Integrated Multitrophic Aquaculture (IMTA) system. Further objectives included developing a business case based on the production of mussels and seaweed for human consumption and animal feed. The project studied the operating conditions, production capacity, nutrient contents in mussels and seaweed including high value substances, and the environmental effects from the establishment and operation of four mussel production sites and one seaweed site.

[www.kombiopdraet.dk](http://www.kombiopdraet.dk)

- wave and current energy pilot sites (e.g. a full-scale wave energy park in Sotenäs on the Swedish west coast),
- the piloting of local-level solutions to reducing the eutrophication of coastal waters, e.g. through reed harvesting, algae collection or the restoration of fishing spawning grounds (so-called “pike factories”).

## Types of actors

In comparison to the other Roadmap action fields, a relatively high level of private sector involvement can be observed in the initiatives contributing to pilot site development.

## Remaining gaps

Remaining gaps have been identified regarding the further development of recirculating aquaculture systems (RAS) technologies, pilot sites for agar-agar production, pilot sites for full-scale biorefinery based on marine substrates as well as the co-location of marine uses within offshore wind parks.

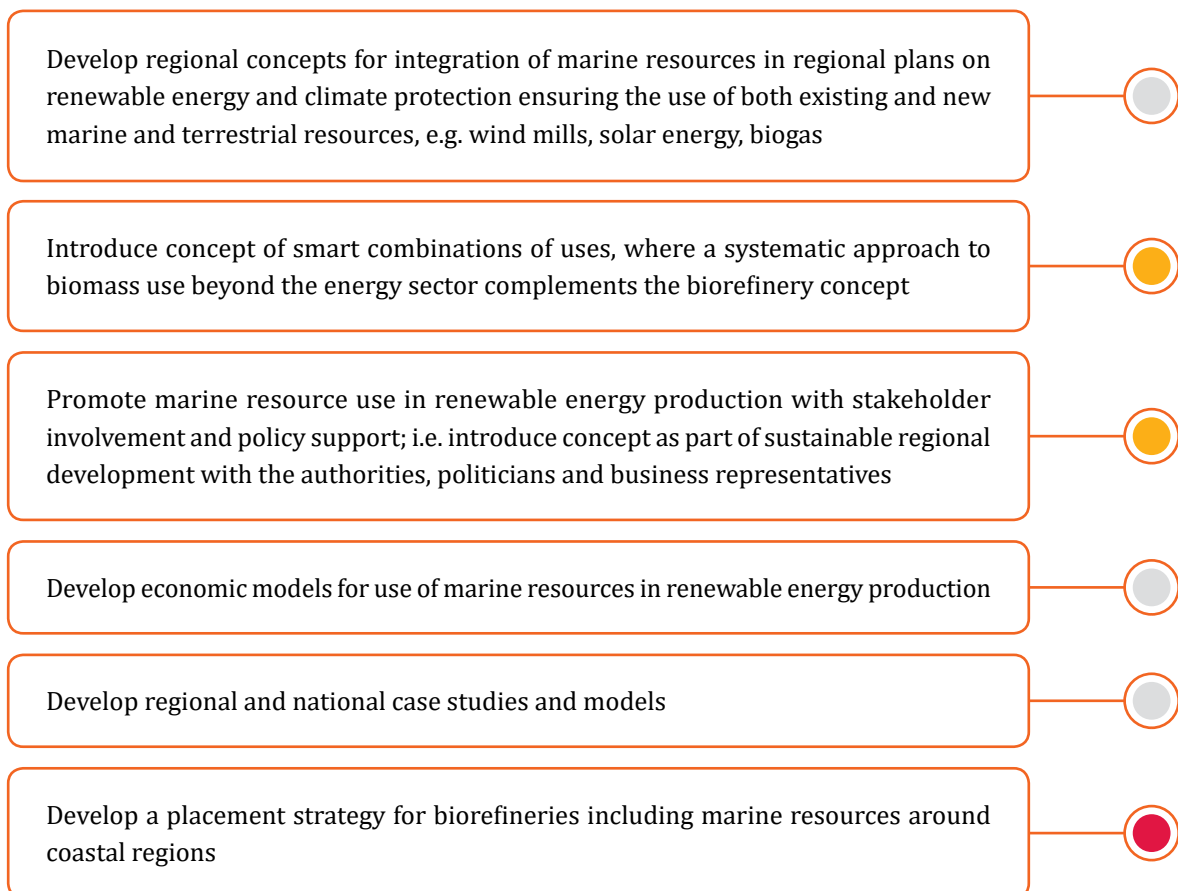
It should also be noted that pilot sites identified are almost exclusively open for research actors from the given country or region, but are not accessible to other Baltic Sea actors.

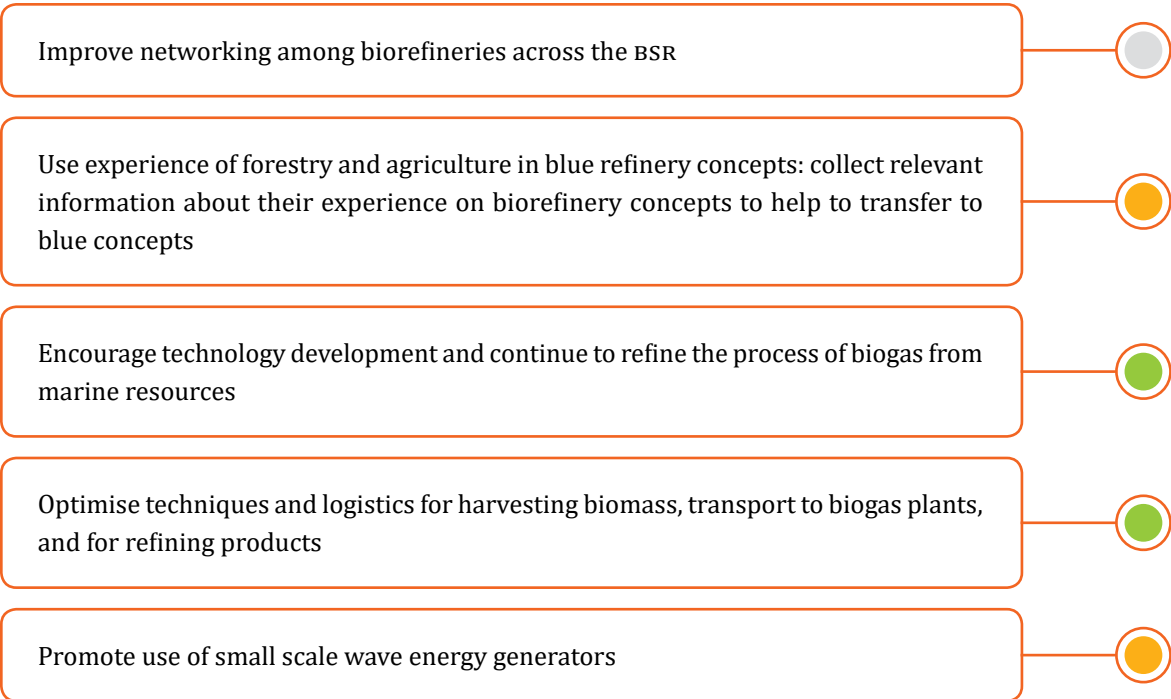
### 3.5 Energy: Regional energy solutions integrating marine resources

#### 44 survey initiatives contribute to the action field Energy

- Sweden accounts for **43%** of lead partners
- **20%** of initiatives are funded by FP7
- increasing acceptance of marine bioenergy sources can be observed
- blue biorefinery developments urgently needed

#### SUBMARINER ROADMAP ACTIONS IN ACTION FIELD "ENERGY"





**LEVEL OF IMPLEMENTATION:**

- Action addressed by survey initiatives to large extent
- Action addressed by survey initiatives to some extent
- Action poorly or not at all addressed by survey initiatives
- Unknown / lack of information



**THE OBJECTIVE OF THE ACTION FIELD “ENERGY”** is to encourage appropriate consideration of marine resources in energy planning in order to create markets for climate friendly energy production.

**Contribution to action field objective**

The survey does not clarify whether the various energy initiatives are involved in overall “energy planning” at an infrastructural level. At present however, there is increasing focus on the bio-economy in the EU and BSR in general and this is or will presumably be reflected at decision-making levels in the near future. The bio-economy discussions have resulted in wider acceptance of marine resources as an appropriate, new and innovative source of high-value components and bio-energy. According

to the survey, these actions are prevalent in the BSR countries Sweden, Denmark and Germany. They are less apparent in Poland, Lithuania, Estonia, Latvia and Finland. In EU projects not lead by BSR countries, there is a strong presence from Ireland, the UK, Belgium, Holland and Italy.

**Types of actors**

Many different actors are involved in the initiatives and projects pertaining to bio-energy development in the BSR. The various BSR countries have different collaborative tendencies. In Finland, triple helix collaborations seem to be popular. In Sweden, most initiatives come from the public sector (research, regional and municipal levels) as well as a few private company cluster initiatives. Denmark shows quite a few public-private partnerships and Germany

IN PRACTICE

**H2OCEAN – DEVELOPMENT OF A WIND-WAVE POWER OPEN-SEA PLATFORM EQUIPPED FOR HYDROGEN GENERATION WITH SUPPORT FOR MULTIPLE USERS OF ENERGY**

- **Duration:** 2012–2014
- **Budget:** € 6,047,000
- **Main source of funding:** FP7
- **Baltic Sea countries:** Denmark, Germany
- **Bodies involved:** The H2OCEAN Consortium is composed of 17 partners from 5 European countries (Spain, United Kingdom, Denmark, Germany and Italy). The lead partner is Meteosim Truewind S.l. (Spain).

The rational exploitation of oceans’ space and resources is seen as crucial to enhance European competitiveness in key areas such as renewable energy and aquaculture. In particular, offshore platforms that can combine many functions within the same infrastructure could offer significant benefits in terms of economics, optimising spatial planning and minimising the impact on the environment. The H2OCEAN consortium has developed an innovative design for an economically and environmentally sustainable multi-use, open-sea platform. Focusing on marine energy production, the H2OCEAN platform harvests wind and wave power. Part of the energy is then used on-site for multiple applications including a multi-trophic aquaculture farm. Excess energy is converted on-site into hydrogen that can be stored and shipped to shore as green energy carrier.

[www.h2ocean-project.eu](http://www.h2ocean-project.eu)

has collaborations between research and regional authorities. The eastern Baltic Sea countries have a good representation of collaboration between research institutions and private companies.

**Actions addressed**

The initiatives and projects target a very wide range of energy actions in the BSR. Among these are wave, wind, hydrogen, energy efficiency, conductivity and energy insulation, ocean current, biogas, bio-fuels, combined solar/algae biomass, seabed mining, reed and marine bio-waste.

**Figure 11:** Offshore wind energy is a key component of climate friendly energy production (picture: Enbw/Matthias Ibeler).



## SEAFARM – MAKROALGER FÖR ETT BIOBASERAT SAMHÄLLE (SEAFARM – MACROALGAE FOR A BIO-BASED SOCIETY)

- **Duration:** 2013–2017
- **Budget:** € 2,640,000
- **Main source of funding:** Formas – The Swedish Research Council (Forskningsrådet Formas)
- **Baltic Sea countries:** Sweden
- **Lead Partner:** KTH Royal Institute of Technology

Seaweed has the potential to contribute significantly to energy solutions of the future. The overarching goal of Seafarm is to develop a sustainable system for the use of seaweeds as a renewable resource to power a (future) biobased Swedish society. The transdisciplinary research approaches used in this project include cultivation techniques for seaweeds to be used as raw material in a biorefinery for the production of food, feed, biobased materials and bioenergy. Seafarm will also evaluate methods for suitable preservation and storage, as well as fractioning the seaweed in an integrated biorefinery, delivering products such as biochemicals, biogas and biofertilisers. An environmentally friendly renewable source of energy, seaweed farming circumvents the need for fertilisers and irrigation, does not compete for arable land and counteracts coastal eutrophication.

[www.seafarm.se](http://www.seafarm.se)

### Remaining gaps

Most topics are covered somewhere in the Baltic Sea Region. At the national levels, however, there are various gaps, as not all energy actions are adopted. Moreover most initiatives are at research scale and do not relate to large-scale, commercial applications. Bio-refineries are still very few and “blue” resources still require promotion. Hydrogen technology initiatives are also very rare.

### Main trends

The BSR energy production involving the marine environment can be divided into two groups: organic and non-organic. The non-organic group involves energy production from sea-based platforms, such as offshore wind, wave power, solar power and offshore combinations of these. In the

non-organic group, various technological initiatives have been targeted to improve the efficiency of these energy sources; energy efficiency, energy flow simulations, optimising transmission, generators and storage solutions of energy produced offshore (wind, wave, solar) is therefore present in many of the energy-related actions that have been implemented in the BSR.

The organic energy group includes biofuels produced from marine biomass, chloroplast, bio-methane, aquaculture bio-waste, bio-remediation and booster materials for biogas production. However, when regarding marine biomass for bio-energy, there is a general awareness of the requirement for an added-value approach in order to be economically viable. The well-known cascade methodology is generally accepted by most of the actors and therefore the need for bio-refineries is increasing rapidly. The

cascade approach allows for high-value components to be extracted from a given biomass (e.g. marine biomass, reed, algae biomass from wastewater) before the rest fraction or bulk is used either as renewable fertiliser or to produce bio-energy (i.e. biogas).

There are a few initiatives ambitious enough to combine different technologies in an offshore multi-scale test platform where non-organic and organic technologies are combined (such as H2OCEAN).

The societal aspect of energy production and consumption has also been approached in Poland within the project Living Lab PL.

**Figure 12:** Cultivating algae can not only provide a sustainable renewable energy resource, but also raw material for the production of biobased materials (picture: Toa55 / shutterstock.com).



### 3.6 Ecosystem Services: Valuation and compensation of ecosystem services

#### 22 survey initiatives contribute to the action field Ecosystem Services

- 27% of these have lead partners from Denmark
- over 1 in 3 initiatives is supported by national RGI funding
- many of these initiatives linked to ecosystem service valuation
- Possible compensation measures developed by only a few initiatives

#### SUBMARINER ROADMAP ACTIONS IN ACTION FIELD "ECOSYSTEM SERVICES"

Assess the applicability of new marine uses on ecosystem services for different sub-regions of the BSR

Proactively liaise and inform EU, HELCOM and relevant BSR Priority Areas of SUBMARINER initiatives related to valuation and compensation of ecosystem services

Develop a practical BSR-wide methodology for valuation of ecosystem services, as the basis for ecosystem services compensation schemes

Develop recommendations and proposals for establishment of ecosystem service compensation schemes

Generate life cycle assessments and techno-economic models pertinent to local conditions in the BSR to critically examine the costs and benefits of new uses and technologies compared with existing solutions (e.g. waste water treatment plants)



Assess the role of blue biotechnology products which are applied to the protection and management of marine ecosystems with respect to benefits to ecosystem services

**LEVEL OF IMPLEMENTATION:**

- Action addressed by survey initiatives to large extent
- Action addressed by survey initiatives to some extent
- Action poorly or not at all addressed by survey initiatives
- Unknown / lack of information



THE OBJECTIVE OF THE ACTION FIELD “ECOSYSTEM SERVICES” is to develop an accepted approach to valuation of ecosystem services and propose compensation mechanisms for the provision of ecosystem services by new marine uses in the BSR.

### Contribution to action field objective

Some of the surveyed initiatives propose compensation mechanisms for the provision of ecosystem services through new marine uses in the BSR. However, most of the initiatives in this action field focus on particular (detailed) aspects constituting the basis

IN PRACTICE

#### NUTRITRADE – PILOTING A NUTRIENT TRADING SCHEME IN THE CENTRAL BALTIC

- **Duration:** 2015–2018
- **Budget:** € 2.2 million
- **Main source of funding:** Interreg Central Baltic Programme
- **Baltic Sea countries:** Finland, Sweden
- **Lead Partner:** John Nurminen Foundation

Eutrophication of the Baltic Sea can only be stopped by greatly reducing the phosphorus and nitrogen load entering the sea. The objective of the NutriTrade project is to enable nutrient reductions in the Baltic Sea area with fast, effective and economically efficient measures. Mussel cultivation will be one of the measures to be taken into account. Instead of financing single cost-effective nutrient reduction methods, NutriTrade aims to create a functioning Baltic Sea-wide policy mechanism to support such activities in the future. Emissions trading has been an important policy instrument in European climate policy. However, nutrient offsets or trading have not been used previously in European or Baltic Sea region water policy. Due to its high regional policy relevance, NutriTrade has been nominated as a flagship project of the EU Baltic Sea Region Strategy.

[nutritradebaltic.eu](http://nutritradebaltic.eu)

for ecosystem service valuation. Only a few projects aim to develop compensation schemes based on selected marine resources (e.g. coastal tourism, fishery, high-value products). Many of those that cover both valuation and compensation are limited to a national perspective and scope (e.g. in Estonia, Denmark, Germany).

## Types of actors

Most of the actors involved in the identified initiatives are public authorities and research institutes. Private companies are also involved in many initiatives, though it is difficult to determine their actual role.

## Actions addressed

All listed projects proactively liaise and inform relevant EU, HELCOM and EUSBSR bodies about SUBMARINER initiatives related to the valuation and compensation of ecosystem services.

Four initiatives have developed a practical BSR-wide methodology for valuation of ecosystem services as the basis for ecosystem services compensation schemes. The first of these is the identification of pertinent HELCOM/MFSD-based environmental indicators of Good Environmental Status (GES), which will serve as a basis for ecosystem service accounting and valuation. The same purpose is pursued by the assessment of different valuation methods for various sub-regions of the BSR, including a comparison of integrated valuation methods. Valuation analysis examples using SUBMARINER case study remediation instances (addressing, amongst others, nutrient recycling, waste treatment and CO<sub>2</sub> capture) contribute in this field. Lastly, a cross-sectoral dialogue and approach to integrated remediation measures has been initiated. The same purpose is pursued by the assessment of the relevance of different valuation methods.

BONUS projects MIRACLE, BALTCOAST and BALTS-SPACE are initiatives that all contribute to developing a method for the assessment and mapping of ecosystem services of marine and inland waters.

Recommendations and proposals for the establishment of ecosystem service compensation schemes will be developed in the course of several initiatives. Among the most promising are a regional analysis of existing and proposed compensation mechanisms; the assessment of the role of the private sector and NGOs and their capacity for ecosystem service system development; and the investigation and development of relevant case studies.

## Remaining gaps

There has so far been a lack of initiatives assessing the applicability of new marine uses for ecosystem services in the various sub-regions of the BSR. Very little has also been done to generate life cycle assessments and techno-economic models pertinent to local conditions in the BSR in order to critically examine the costs and benefits of new uses and technologies compared to existing solutions (e.g. waste water treatment plants). However, following up on the spin-off effects of “sustainable protein production” (NCM) and COMBI rearing (Danish national) initiatives may yield some progress in this area.

Figure 13: Compensation mechanisms such as nutrient recycling are explored in the action field ecosystem services (picture: Fredrik Broman, Image Bank Sweden).



## MIRACLE – MEDIATING INTEGRATED ACTIONS FOR SUSTAINABLE ECOSYSTEM SERVICES IN A CHANGING CLIMATE

- **Duration:** 2015–2018
- **Budget:** € 1,900,000
- **Main source of funding:** BONUS Programme
- **Baltic Sea countries:** Sweden, Denmark, Germany, Latvia, Poland
- **Lead Partner:** Linköping University (Sweden)

MIRACLE will approach ecosystem services with policy instruments that acknowledge links between eutrophication, flood management, biodiversity, coastal water quality & human health. The objective is to identify, measure and recommend cost-efficient solutions in the Baltic Sea region, through modelling, visualisation, stakeholder dialogues and social learning. Cost-benefit analyses of priority measures will be linked to interactive modelling of sources and the magnitude of eutrophication and floods in a changing climate. Impact scenarios of measures suggested by stakeholders to reduce floods and eutrophication will be modelled, and the impact on e.g. biodiversity, human health and biosecurity assessed. Recommendations for innovative governance structures and instruments will be formulated, including payment for ecosystem services, in order to improve incentives for provision of sustainable ecosystem services.

[www.bonusportal.org/projects/research\\_projects/miracle](http://www.bonusportal.org/projects/research_projects/miracle)

The assessment of the role of blue biotechnology products that are applied to the protection and management of marine ecosystems with respect to benefits to ecosystem services has not been directly addressed. Progress is likely to be made by the new SUBMARINER Network initiative Baltic Blue Biotechnology ALLIANCE, which starts in 2016.

### Main trends

Issues related to the action field Ecosystem Services are gaining more and more attention on the BSR and EU scale. While increasing research is devoted to gaining both basic and in-depth knowledge (validation of the ecosystem services), only few initiatives focus on proposing the development of reliable and efficient compensation schemes based on already evaluated ecosystem services. In this context, the related future action of looking into compensation

schemes for nutrient uptake generated by mussel cultivations (within the Baltic Blue Growth and NutriTrade projects) is noteworthy. The overall lack of initiatives in this regard may well be related to shortcomings in the action field Regulation.

Considering the growing pressures on blue and green economies, it is of high importance for the SUBMARINER Network to follow up on all initiatives listed above and their outcomes. Initiatives that are currently “under construction” will be strongly supported by the SUBMARINER Network (e.g. application to the BONUS Programme on sustainable and socially accepted aquaculture, applications to the cross-border programmes like InnoAquaTech and Save Your Bay).

### 3.7 Technology: Technology development and transfer

#### 57 survey initiatives contribute to the action field Technology

- Denmark provides lead partners for **26%** of these
- **1 in 5** initiatives in this field draws funding from FP7
- high share of aquaculture technology initiatives
- implementation in the BSR remains one of the largest gaps

#### SUBMARINER ROADMAP ACTIONS IN ACTION FIELD "TECHNOLOGY"

Foster communication, collaboration and technology transfer in and between BSR countries

Scout for pilot installations and technology providers; enhance information exchange between technology providers and users, foster technology developments for:

- underwater macroalgae and mussel farming technologies
- reed and beach cast algae harvesting technologies
- IMTA production methods
- solutions for offshore combinations with wind parks
- new RAS systems
- water treatment technologies using blue biotechnology or algae cultivation
- microalgae cultivation technology
- sustainable up-scaling processes for getting blue biotechnology basis materials
- biosensors
- combinations of wave energy converters with existing installations

**LEVEL OF IMPLEMENTATION:**

- Action addressed by survey initiatives to large extent
- Action addressed by survey initiatives to some extent
- Action poorly or not at all addressed by survey initiatives
- Unknown / lack of information



THE OVERALL OBJECTIVE OF THE ACTION FIELD “TECHNOLOGY” is to develop environmentally friendly and cost-efficient technologies suitable for Baltic Sea conditions, taking into account knowledge and technologies from terrestrial resources.

**Contribution to action field objective, type of actors and actions addressed**

“Technology” is the Roadmap action field most frequently addressed by the initiatives and projects screened for this report. These initiatives are also among those with the highest budget ranges. Where “Technology” initiatives cover SUBMARINER topics, there is a tendency towards the aquaculture sector, with focus on fish aquaculture, but also other forms of mariculture and related technology areas.

IN PRACTICE

**RESOURCE EFFICIENT MARITIME CAPACITY (REMCAPI)**

- **Duration:** 2013–2015
- **Budget:** € 2 M
- **Main source of funding:** FP7
- **Baltic Sea countries:** Sweden, Lithuania
- **Bodies involved:** Total of six European Regional Research Driven Clusters: Solent Maritime Cluster (UK), Western Sweden Maritime Cluster (SE), Pole Mer Mediterranee (FR), OCEANO XXI (PT), Irish Maritime and Energy Research Cluster (IE), Klaipeda Maritime Cluster (LT)

The Resource Efficient Maritime Capacity (REMCAPI) project aims to capitalise on the opportunities that arise from increasing commercial demand across marine industries. The project focuses on expanding the capacity for innovation and growth across the key markets of offshore wind; ocean energy; fishing; aquaculture; blue biotech; aggregates and dredging and sea bed mining. An inclusive value-chain perspective is applied. The main objective of REMCAPI is to develop its six clusters’ ability to promote innovation and enable sustainable growth within – and beyond – the project’s cluster areas. REMCAPI builds on an earlier Regions of Knowledge project, EMSAC (European Marine Science Applications Consortium), which made significant progress in understanding how RRDCs can stimulate maritime resource capacity to supply growing marine markets.

[www.remcap.eu](http://www.remcap.eu)

Figure 14: Constant technological development is required to increase the sustainability of aquaculture (picture: Pan Xunbin / shutterstock.com).



However, the majority of projects in this action field are not directly BSR-oriented.

A very high percentage of the surveyed projects are European research projects funded through FP7 or Horizon 2020. The majority of these are coordinated and led by institutions from outside the Baltic Sea Region, which means that these projects are – if at all – only partly focused on Baltic Sea conditions. Institutions from the Baltic Sea Region involved in this field come mainly from the western Baltic Sea Region countries – which is in line with the overall innovation gap still perceived between the old and new EU Member States.

In all cases, the focus is on the development of new technology, rather than technology transfer and information exchange between technology providers and users. Projects that do encompass this kind of activity have often been initiated by or with the involvement of the SUBMARINER Network

members (e.g. Baltic Blue Growth, Monitoring Technology Transfer, InnoAquaTech, Baltic Blue Biotechnology Alliance, Smart Blue Regions).

Further impulses for this action field are expected to come from the support measures fostering the creation of “investment roadmaps”. These will be launched by the European Commission’s Directorate-General for Maritime Affairs and Fisheries (DG MARE) in 2016 and will accompany the development of a “Masterplan for Maritime Technologies for the Baltic Sea Region” by DG MARE. Also the most recent call for proposals under the BONUS programme opened in late 2015. It allocates substantial research and development funds to the development of technologies adapted to Baltic Sea conditions and encourages the involvement of private actors.

### INNOAQUATECH – CROSS-BORDER DEVELOPMENT AND TRANSFER OF INNOVATIVE AND SUSTAINABLE AQUACULTURE TECHNOLOGIES IN THE SOUTH BALTIC AREA

- **Duration:** 2016–2019
- **Budget:** € 1.7 M
- **Main source of funding:** Interreg South Baltic Programme
- **Baltic Sea countries:** Denmark, Germany, Lithuania, Poland
- **Lead Partner:** BioCon Valley (Germany)

InnoAquaTech is an application submitted to the first call of the Interreg South Baltic Programme 2014–2020. The project aims at strengthening the South Baltic area's aquaculture sector through cross-border development and transfer of state-of-the-art aquaculture technologies. Departing from the results of AQUAFIMA and SUBMARINER, special emphasis will be given to recirculating aquaculture systems (RAS) and innovative combinations of RAS systems with e.g. plant production (aquaponic systems) and/or renewable energy production. InnoAquaTech comprises investigations of the agro-economic and environmental impacts of integrated aquaculture systems, an SME service package as well as four regional aquaculture pilot cases to gain hands-on experience on the actual regional potential of different innovative and sustainable aquaculture systems.

[www.submariner-network.eu](http://www.submariner-network.eu)

## Remaining gaps

With the active involvement of the SUBMARINER Network member CORPI, the EU-wide FP7 REMCAP project has identified the following four priority areas as in need of further technological innovations:

- seabed anchoring,
- aquaculture,
- autonomous systems,
- novel fuels.

The first three are directly linked to SUBMARINER topics. The field “seabed anchoring” is central to the development of deep-water wind farms and offshore aquaculture, where cost reduction and operability in challenging environmental conditions are key issues.

Within the field of aquaculture, fish feed technologies are in need of innovations that make use of new knowledge gained in fish nutritional and

feeding requirements, integrated multi-trophic aquaculture (IMTA) and recirculating aquaculture systems (RAS) technologies, biological lifecycle and genomic information.

Autonomous systems provide the opportunity to monitor offshore wind and ocean energy device farms from a distance, making parks more self-dependent and giving operators more control. They are also relevant for the monitoring and surveillance of fishing. Whilst significant (public and private) investment has been made in autonomous underwater vehicles over recent years, much work remains to be done to create a complete system that meets the requirements for fisheries resource management.

The development of novel fuels might also be of interest on an experimental level (biogas, methanol, glycerol, synthetic fuels, hydrogen and other).

### 3.8 Blue Biotechnology: BSR-wide systematic approach to blue biotechnology research

#### 51 survey initiatives contribute to the action field Blue Biotechnology

- Lead partners come from **6** different BSR countries
- EU R&I programmes fund **55%** of initiatives in this action field
- only very few initiatives with a focused Baltic Sea perspective

#### SUBMARINER ROADMAP ACTIONS IN ACTION FIELD "BLUE BIOTECHNOLOGY"

On the basis of the systematic mapping of research capacities, research fields and laboratory equipment across the BSR and analysis of BSR and national priorities / needs for blue biotechnology applications contribute to development of national (blue) biotechnology strategies

Develop pan-Baltic research agenda and create respective pan-Baltic research and development groups on topics related to the use of biomarine materials in various biotechnological applications

Identify and test Baltic Sea organisms for various applications

Establish a BSR centre for bioprospecting of Baltic Sea (micro-) organisms

- Action addressed by survey initiatives to large extent
- Action addressed by survey initiatives to some extent
- Action poorly or not at all addressed by survey initiatives
- Unknown / lack of information





BLUE BIOTECHNOLOGY IN THE BSR has been characterised by its huge potential and the availability of infrastructure and resources, but also by a lack of realisation due to the individual institutions remaining quite unconnected. Hence, the overall objective of the action field “Blue Biotechnology” is to make efficient and effective use of blue biotechnology research capacities across the BSR.

### Contribution to action field objective, type of actors & actions addressed

As can be seen from the overall statistics of initiatives screened, the action field of Blue Biotechnology is currently covered by the substantial number of 51 initiatives dominated by Baltic Sea research institutions, who take part in a high number of the projects funded via the European research programmes (FP7 and Horizon 2020) in the area of blue biotechnology. Almost half of these initiatives fall under this category (23 = FP7 and 4 = Horizon 2020). These projects are to a great extent led by research institutions from outside the Baltic Sea

Region (from the UK, the Netherlands, Ireland and Portugal). Only very few are led mainly by German research institutions (GEOMAR, Fraunhofer, Universities of Göttingen and Mainz), not all of which are – from a geographic point of view – part of the Baltic Sea Region. Overall, German, Danish and some Swedish institutions are predominant in this action field. The SUBMARINER Network member Tallinn University of Technology (Estonia) is also part of one EU-funded blue biotechnology initiative.

The action field is not driven exclusively by the EU research programmes. National and other transnational institutions are also actively promoting blue biotechnology. Some of the most substantial funding for Baltic Sea Region institutions is currently provided via the respective national programmes. In Sweden, the most important project – especially Seafarm led by the SUBMARINER member KTH – is funded through the national research programme Formas. Initiatives in Denmark and Poland are also funded by national programmes. These Polish institutions are, however, not yet part of any EU-wide initiative. This indicates that even though researchers in the eastern Baltic Sea Region have

#### IN PRACTICE

##### BALTIC BLUE BIOTECHNOLOGY ALLIANCE

- **Duration:** 2016–2018
- **Budget:** approx. € 3,3 M
- **Main source of funding:** Interreg Baltic Sea Region Programme
- **Baltic Sea countries:** Denmark, Estonia, Finland, Germany, Latvia, Lithuania, Poland, Sweden
- **Lead Partner:** GEOMAR

The Baltic Blue Biotechnology ALLIANCE will bring together blue biotechnology actors from across the BSR. Together they will develop innovative marine bio-based products and services and also promote the concept of blue biotechnology to related stakeholders. By systematically pooling national capabilities, the participating research institutes, SME and business clusters will be empowered to reach the critical mass required for action and global competitiveness.

[www.balticbluebioalliance.eu](http://www.balticbluebioalliance.eu)

strong capacities in blue biotechnology, individually they find it difficult to gain access to the highly competitive consortia of EU-wide calls. This indicates important cooperation opportunities on both sides. Activities of companies are very rarely listed.

Initiatives such as the “SeaWeed symposium” led by Ocean Rainforest are closely related to the SUBMARINER action plan, but do not stretch to the eastern Baltic countries. The same holds true for the ERA-Net Marine Biotechnology, of which only Germany, Denmark and Sweden are part. A start has been made in terms of better coordination among national funding programmes for blue biotechnology and the creation of a joint research agenda, but this omits important resources from eastern Baltic Sea countries.

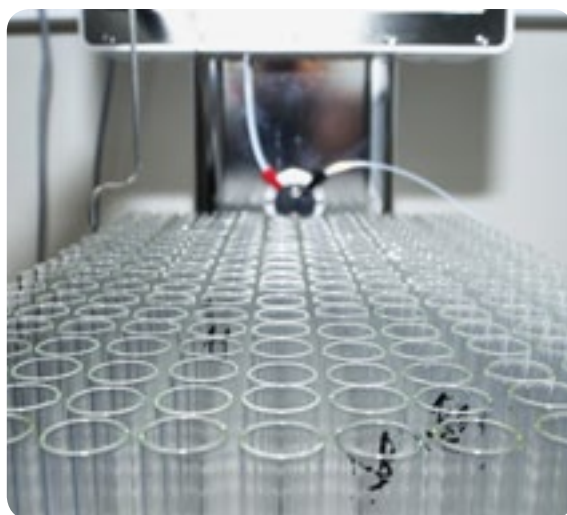
The field of blue biotechnology comprises an extremely wide portfolio of both biological resources and application fields, implying a huge potential for a variety of research, development and business models and ideas. This potential is not reflected by the current topics: most of the initiatives/ projects focus on microalgae as a source, followed by the use of waste materials. The main application areas are feed and food, followed by energy. Especially the latter offers future potential, as the energetic use of marine resources is as yet quite limited. Bio-refinery approaches can improve the eco-balance/ ecosystem services of bio-resources (e.g. invertebrates used for nutrient removal, fertiliser and energy production, as shown by the Marine Biogas project). Health, as one of the target areas with pronounced economic potential, and other application fields (e.g. cosmetics, environment, enzymes) are still underrepresented.

In terms of activities covered, the 51 surveyed initiatives show a certain degree of variability, ranging from highly specialised research topics to projects that centre more on networking, technology development or “end of line” development (i.e. being closely related to actual product development). Given the predominant “European” nature of projects, only a few focus on “Baltic Sea” specific species or conditions.

To summarise, in the current status gaps remain especially in the setup of functioning value chains, in use of the broad portfolio sense and in pan-Baltic approaches to tackle bottlenecks and realise economic potential.

In designing the Baltic Blue Biotechnology ALLIANCE project (see box on p. 47) over the course of the last year, the SUBMARINER Network has created an important opportunity to actively pursue the action field activities as proposed in the Roadmap. The project will promote a systematic pan-Baltic approach to bundling the resources available throughout the Baltic Sea Region for an effective pursuit of blue biotechnology research and its active integration into product/industry development. The project will make use of the networks created at sub-regional level such as the northern German “Nordverbund Marine Biotechnology” and the Swedish “Seafarm” collaboration of five universities. The ALLIANCE integrates most of the Baltic Sea Region institutions/ partners identified in the current set of 51 initiatives, which are already part of European projects. From a technical, activity-oriented point of view, it is therefore expected that the ALLIANCE will cover an important identified gap.

Figure 15: Blue biotechnology in the BSR has great potential, not least due to the high availability of specialists (picture: Siegfried Nörling, GEOMAR).



### 3.9 Finance: Unlock financing for innovative uses of marine resources

#### 6 survey initiatives contribute to the action field Finance

- half of these have lead partners from Germany
- the funding is an equal mix of EU, national, regional and private
- implementation of this action field in early stage
- despite improved framework conditions for private sector involvement

#### SUBMARINER ROADMAP ACTIONS IN ACTION FIELD "FINANCE"



#### LEVEL OF IMPLEMENTATION:

- Action addressed by survey initiatives to large extent
- Action addressed by survey initiatives to some extent
- Action poorly or not at all addressed by survey initiatives
- Unknown / lack of information

## MARINE BIOTECHNOLOGY ERA-NET

- **Duration:** 2013–2017
- **Budget:** € 2,278,857
- **Main source of funding:** FP7
- **Baltic Sea countries:** Denmark, Germany, Sweden
- **Coordinating Partner:** The Research Council of Norway
- **Bodies involved:** National funding institutions from Norway, Belgium, the Netherlands, Denmark, France, Germany, Iceland, Ireland, Italy, Portugal, Romania, Slovenia, Spain and Sweden

The Marine Biotechnology ERA-NET (ERA-MBT) was founded to unlock financing for innovative uses of marine resources. ERA-MBT is a consortium of 19 national funding agencies seeking complementarities between national activities by pooling resources to undertake joint funding of transnational projects in the area of marine biotechnology. ERA-MBT activities include the development of a Strategic Roadmap for marine biotechnology that will support the European bioeconomy. The vision of the ERA-MBT project is to support Europe's marine biotechnology community to participate in a lasting enterprise-driven network that adds value to marine biological resources in ways that nurture and sustain the lives of European citizens.

[www.marinebiotech.eu](http://www.marinebiotech.eu)



THE OVERALL OBJECTIVE OF THE ACTION FIELD “FINANCE” is to improve access to finance for private as well as public stakeholders for collaborative projects.

### Contribution to action field objective, type of actors & actions addressed

A look at the action fields most frequently addressed by the 139 initiatives screened for this report shows that the action field “Finance” is clearly under-represented: respondents identified only 6 of the 139 initiatives as contributing to this action field.

Of those initiatives addressing the action field “Finance”, not many have the explicit goal of improving the relationship between public research and private companies. This is despite the fact that

- private entities have become eligible partners in the new programming period of many EU-funded

programmes (such as Horizon 2020, BONUS or Interreg),

- the involvement of private companies is in many cases even a pre-condition for projects to be eligible for submission,
- SMEs are the specific target groups of some of these financing facilities.

These trends are not yet visible on the project level.

### Main trends

Overall, some of the more recent projects (i.e. those developed during the last two years, but having not yet reached the full implementation stage) include activities such as cost-benefit analyses, the development of nutrient compensation schemes and/or concrete business developments. These include the Baltic Blue Biotechnology ALLIANCE, the Baltic Blue Growth project (both with the involvement of

the SUBMARINER Network and its members) or the Baltic Mussel Feed project.

At “non-project level”, some of the Baltic Sea networks, foundations and NGOs such as the Baltic Development Forum (BDF), the Baltic Sea Action Group (BSAG), the Zennström Foundation or the John Nurminen Foundation are seeking active collaboration with private companies in order to raise awareness on business opportunities that can be generated from the improvement of the environmental status of the Baltic Sea, including sustainable and innovation solutions towards using marine resources as one of the possible solutions. Especially the BSAG is working on persuading companies to commit to becoming active in counter-acting eutrophication in the Baltic Sea.

A recently announced initiative of the European Commission’s Directorate-General for Maritime Affairs and Fisheries (DG MARE) to promote the creation of investment roadmaps for maritime technology fields may create new opportunities to foster actions. However, with a financial frame of € 2.5 million for the whole of Europe, the extent of its impact will be limited. The same holds true for the SME Instrument under Horizon 2020 dedicated to

the “development, deployment and market replication of innovative solutions for blue growth”. The terms are generous for the “winning” individual SME (with an EU contribution of € 50,000), but the first calls were highly oversubscribed (approx. 200 applications leading to 7 approvals in the first call in 2014 for the whole EU) or to formulate it differently – the facility has such a low overall budget, that the risk of non-success to get an application approved means a high burden for individual SMEs.

## Remaining gaps

A lot of work remains to be done in order to implement the action field “Finance”, especially in relation to the structured collaboration with investment funds, venture capital organisations and the development of “bankable” projects.

What is required is a more systematic approach towards investment projects to be supported by public administrations and implemented with private engagement. Moreover such an approach should foster access not only to “classic” public funded financing opportunities but also include the exploration of new, innovative forms of financing such as crowd funding etc.

### 3.10 Regulation: Create better legal and regulatory framework

#### 12 survey initiatives contribute to the action field Regulation

- over **1 in 3** lead partners are from Germany
- EU funding (both territorial cooperation and RGI) supports **72%** of projects
- MSP and mariculture are the dominant topics
- there is a lack of holistic approaches

#### SUBMARINER ROADMAP ACTIONS IN ACTION FIELD "REGULATION"

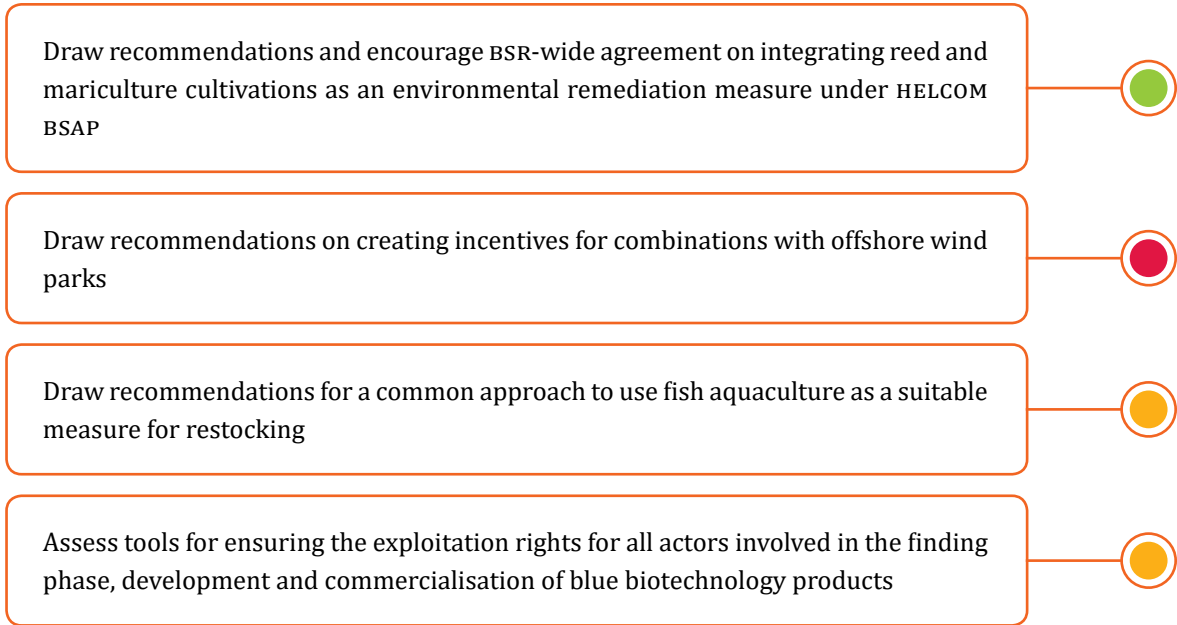
Assess the existing integration of innovative uses of marine resources in relevant EU Directives

Establish a dialogue with relevant national authorities and respective EU COM Directorates

Foster a joint interpretation on how to reach targets set by the relevant EU Directives (e.g. Natura 2000, WFD, MSFD) with regard to "harvesting" marine resources (e.g. macroalgae, reed)

Consider how new uses of marine resources shall be taken into account in Maritime Spatial Planning and Integrated Coastal Zone Management Plans (i.e. develop pilot plans in various regions, develop criteria for "suitable sites")

Draw recommendations for EU policy development on Baltic Sea resources uses



**LEVEL OF IMPLEMENTATION:**

- Action addressed by survey initiatives to large extent
- Action addressed by survey initiatives to some extent
- Action poorly or not at all addressed by survey initiatives
- Unknown / lack of information

**§** THE OBJECTIVE OF THE ACTION FIELD “REGULATION” is to reduce vagueness in current legislation and regulations in view of innovative uses of marine resources.

**Contribution to action field objectives**

In the online survey, 12 initiatives were indicated as a contribution to the action field Regulation, 3 of which were also indicated in the action field Finance (2 in aquaculture, 1 in blue biotechnology). Different aspects concerning legal and regulatory conditions are touched upon by all these initiatives to a certain degree. However, each initiative listed in this action field focuses either on one particular marine use (e.g. mussel cultivation, fish aquaculture, biotechnology) or is limited to national or even regional scope (e.g. Schleswig-Holstein initiatives on mariculture).

**Types of actors**

Most of the actors involved in the identified initiatives are public authorities and research institutes. In many projects, the involvement of private companies is indicated, though it is difficult to determine their actual role and level of engagement.

**Actions addressed**

The initiatives identified in the survey target several Roadmap actions under this Action Field.

BALTSPACE (BONUS), AquaSpace (H2020, only Germany); Smart Coast (EUSBSR seed money / Interreg Central Baltic), BALTCOAST (BONUS) and Baltic SCOPE (DG Mare) all consider how new uses of marine resources should be taken into account in Maritime Spatial Planning and Integrated Coastal Zone Management Plans (i.e. they develop pilot

## LICENSING GUIDELINES FOR AQUACULTURE INVESTORS IN SCHLESWIG-HOLSTEIN PART OF THE STRATEGY FOR DEVELOPING SUSTAINABLE AQUACULTURE IN SCHLESWIG-HOLSTEIN

- **Duration:** 2015
- **Budget:** unknown
- **Main source of funding:** unknown
- **Baltic Sea countries:** Germany
- **Bodies involved:** Ministry of Energy, Agriculture, the Environment and Rural Areas Schleswig-Holstein

Obtaining or extending licences in the field of aquaculture is a very complex process as it involves several different areas of law and is administered by various public authorities. In order to make this process more transparent, the ministry published comprehensive guidelines as a support for aquaculture entrepreneurs inland and along the Baltic Sea coast. The guidelines contain information on all the relevant legal background and on the respective public authorities responsible. They also offer useful advice for the successful completion application forms and information on relevant contact persons.

[www.schleswig-holstein.de/UmweltLandwirtschaft/DE/LandFischRaum/o8\\_Fischerei/09\\_Aquakultur/Aquakultur\\_node.htm](http://www.schleswig-holstein.de/UmweltLandwirtschaft/DE/LandFischRaum/o8_Fischerei/09_Aquakultur/Aquakultur_node.htm)

plans in various regions, develop criteria for “suitable sites”).

Four initiatives aim to arrive at recommendations encouraging BSR-wide agreement on integrating reed and mariculture cultivations as an environmental remediation measure. Meanwhile, recommendations for a common approach to use fish aquaculture as a suitable measure for restocking are pursued by Schleswig-Holstein initiatives on mariculture. Furthermore, the Baltic Blue Biotechnology ALLIANCE will contribute to assessing tools to ensure the exploitation rights for all actors involved in the finding phase, development and commercialisation of blue biotechnology products.

### Remaining gaps

As indicated above, several attempts to create better legal and regulatory conditions to foster innovative uses of marine resources have been identified.

However, these are generally focused on specific uses – a holistic approach to the subject is still lacking. In consequence, several important actions are still not directly covered (see above). Following up initiatives identified under the action field Ecosystem Services will be very useful, as some of these may also cover topics related to the action field Regulation.

### Main trends

Mariculture is gaining increasing attention in the BSR – also thanks to the European Fisheries Fund, co-financed by MS national funding. In consequence, an increased number of local and regional initiatives aim to build durable and efficient regulatory frameworks for mariculture. Implementation of the MSP Directive has also put some pressure on BSR stakeholders and several on-going or planned initiatives are of high importance for the SUBMARINER Network



**Figure 16:** An improved regulatory framework in areas such as marine aquaculture provides greater security for investors (pictures: Joanna Przedzrymirska, Maritime Institute in Gdańsk).



and should be followed closely (e.g. BALTSACE, Baltic Blue Growth, AquaSpace, Smart Coast and SuMBays). Some of the initiatives that are “under construction” will be strongly supported by the

SUBMARINER Network, such as recently submitted applications to the BONUS Programme on sustainable aquaculture, and the application to the South Baltic Programme titled ‘Save The Bay’.

IN PRACTICE

**BALTSACE – TOWARDS SUSTAINABLE GOVERNANCE OF BALTIC MARINE SPACE**

- **Duration:** 2015–2018
- **Budget:** EUR 2 000 000
- **Main source of funding:** BONUS Programme
- **Baltic Sea countries:** Denmark, Germany, Lithuania, Poland, Sweden
- **Lead Partner:** Södertörn University (Sweden)

BALTSACE is the first transnational, interdisciplinary Maritime Spatial Planning research project in the Baltic Sea Region, complementing past and current MSP projects in the BSR. BALTSACE is working towards a better understanding of key challenges in MSP and will offer science-based practical lessons for MSP planners and policy makers. The project aims to provide approaches and tools to clarify and improve the capacity of MSP as a policy integrator. This will enhance the capabilities of society to respond to current and future challenges faced by the Baltic Sea region. Through continuous knowledge brokerage with peer groups and other research projects, it is anticipated that outcomes will make significant contributions towards sustainable governance of Baltic marine space.

[www.baltspace.eu](http://www.baltspace.eu)

### 3.11 Image: Create positive image for products and services from marine resources

#### 16 survey initiatives contribute to the action field Image

- 44% of lead partners come from Germany
- National R&I funding supports 31% of initiatives
- implementation of this action field is a mid-term goal
- need to involve different kinds of actors

#### SUBMARINER ROADMAP ACTIONS IN ACTION FIELD "DATA"



#### LEVEL OF IMPLEMENTATION:

- Action addressed by survey initiatives to large extent
- Action addressed by survey initiatives to some extent
- Action poorly or not at all addressed by survey initiatives
- Unknown / lack of information



THE OVERALL OBJECTIVE OF THE ACTION FIELD “IMAGE” is to raise awareness on the environmental functions and services provided by new uses of marine resources and to create markets for products from aquatic resources.

## Contribution to action field, actions addressed & type of actors

A number of projects and initiatives contribute to the action field “Image” through awareness-raising and educational activities directed towards the general public and/or school pupils. These are mainly driven by actors from Denmark, Germany and Sweden and often focus on new environmentally friendly aquaculture practices and nutrient reduction measures through the use of algae or mussels.

Local grass-root initiatives lead by NGOs such as the Coastal Union Germany (EUCC-D) or the Gotland-based association “Forum Östersjön” (Forum Baltic Sea) form a second group. These initiatives involve and educate coastal communities about the important contributions that aquatic resources can make both to improving the environmental status of smaller water bodies and to creating sustainable blue growth at the local level.

A series of newly developed projects under the SUBMARINER Network (e.g. Baltic Blue Biotechnology ALLIANCE, Smart Blue Regions, Baltic Blue Growth, InnoAquaTech) includes activity lines related to the action field “Image”, such as:

- Identifying and creating success stories,
- Undertaking regional campaigns on the value of nutrient recycling for targeted stakeholder groups,

### IN PRACTICE

#### ALGAE INNOVATION WORKSHOP (ALGEINNOVATIONS VÆRKSTED)

- **Duration:** 2014–2015
- **Budget:** EUR 42 700
- **Main source of funding:** Ministry of Housing, Urban and Rural Districts’ Rural District Pool (Denmark)
- **Baltic Sea countries:** Denmark

Cultivation and use of algae is an innovative new use of marine products. Promoting the use and image of algae as biomass and algae-related products, the Algae Innovation Workshop targeted schools and colleges. On the basis of Green Center / AgroTech algae cultivation technology competences, teaching materials for schools and colleges were developed within the project Algae Innovation Workshop. As well as the teaching materials, the project has included four open “workshop” events throughout the school year 2014/2015. These offered students and teachers the opportunity to learn more in general about algae research and development potentials of algal biomass in rural areas. They were hands-on, practical experiences for the students and guests. The project will be disseminated nationally and concluded at the national teachers’ annual event regarding nature, technology and society in mid March 2016 (Big Bang) in Aarhus.

[www.agrotech.dk/nyheder/alger-paa-skoleskemaet](http://www.agrotech.dk/nyheder/alger-paa-skoleskemaet)

Figure 17: Beach cleaning initiatives raise awareness of the BSR as a resource of unique natural capital (picture: Dunescg, shutterstock).



- Conducting market surveys for algae and mussel products both within the Baltic Sea Region as well as abroad,
- Carrying out information campaigns and involving companies to raise awareness of new products.
- Identifying scientific market knowledge and regulation gaps associated with innovative aquaculture products,
- Conducting media and regulation constraint analysis regarding innovative aquaculture systems.

## Main trends & remaining gaps

A main trend is that image activities are – with the exception of the Blue Biotechnology ALLIANCE project – not usually at the core of the projects' and initiatives' activities, but rather accompanying communication activities. None of the surveyed initiatives focuses solely on large-scale public awareness campaigns or full-scale market surveys. The

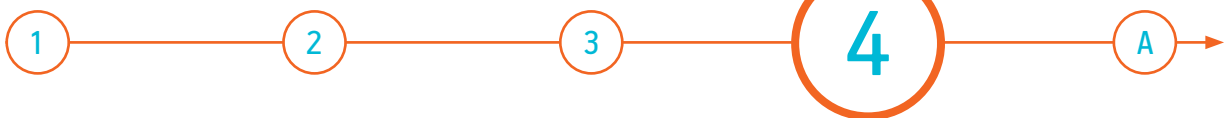
creation of a Baltic Sea brand and distribution networks for aquaculture or blue biotechnology products remain as yet untackled. It seems that both suitable funding programmes as well as actors (i.e. big retailers / supermarkets) are missing and/or have not yet been sufficiently attracted to this kind of activity.

It should be noted, however, that this activity has been seen as a “mid-term” goal from the outset in the SUBMARINER Roadmap, with the implementation expected to start once earlier project initiatives have brought the development of innovative and more sustainable products from aquatic resources a step further.

Nevertheless, the survey results indicate that future projects should concentrate more on tools such as market surveys, general awareness-raising as well as the creation of proper distribution networks and targeted marketing activities for given local / regional products.



# Outlook, conclusions and recommendations



The survey clearly shows overall progress towards realising innovative and sustainable blue-green solutions throughout the Baltic Sea Region. The sheer number of individual activities and actors involved is in itself proof of this. Nevertheless, important gaps remain.

Especially those projects and initiatives that can be counted among the “new generation” (i.e. those about to enter the implementation phase in spring 2016) clearly show the move towards a more systematic and structured approach across the whole Baltic Sea Region. It can therefore be anticipated that these initiatives may be able to draw together the results from much more specific projects, focusing either on research on a very specific issue and/or site.

Nevertheless – even taking these projects into account – some important gaps remain:

For many strategic action fields it was noted that there is a lack of a “pan-Baltic” approach, which

is backed by the respective policy agendas of the Baltic Sea Region’s countries and/or their regions. With the exception of the “Smart Blue Regions” initiative of the SUBMARINER Network, regional as well as national administrations are underrepresented in this set of projects and initiatives. Even though in some cases those institutions may not need to come in as direct partners, it is also difficult to detect from the current set of projects, whether and how they would reach out to these decision-makers.

Swedish regions and institutions are clearly among the forerunners when it comes to blue bio-economy initiatives, and the German federal states Schleswig-Holstein and Mecklenburg-Vorpommern

Figure 18: A new generation of projects and initiatives show the move towards pan-Baltic approaches systematically involving a variety of “blue” actors (picture: Stefan Holm, shutterstock).



**Figure 19:** Engaging the local population in education activities creates a sense of the Baltic Sea as a shared natural resource (picture: Imfoto / shutterstock).



also feature strongly together with its various “blue” actors. In other countries, however, the policy level is much less involved and there still seems to be a lack of awareness and/or interest in driving the road towards the blue-green economy.

This is also evident in our detailed assessment of the strategic action field “Regulation”, which still has a lack of initiatives working towards a structured pan-Baltic policy development fostering the innovative use of Baltic Sea resources. Some attempts can be noted to create better legal and regulatory conditions, but these still focus on one single specific use only. A holistic, integrated approach is missing. Some very local initiatives form a notable exception, where a combined view and a strategy taking into account all types of uses, actors and regulations has been fostered.

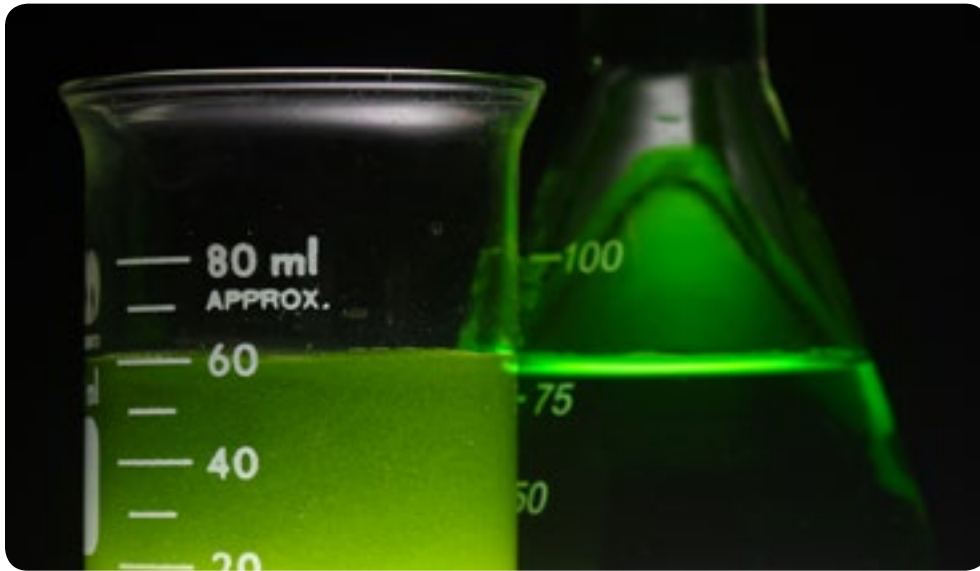
The table showing the correlation between SUBMARINER topics with some of the action fields (Figure 4 on p. 14) gives further evidence. Some very important “actions” are not picked up at all or only to a very minor extent by some topics. Thus hardly any project covers the issue of data and technology

development for reed harvesting or environmental impacts of wave energy and/or new uses within offshore installations. Finance, regulation and image are in any case action fields completely underrepresented for almost all given uses. But it is interesting to note that finance and image are in particular not featured in initiatives related to fish aquaculture, where obviously the “end product” is most directly consumer oriented.

Some of the most important gaps identified include the following:

- A systematic pan-Baltic mapping of private actors;
- An assessment of the educational capabilities, resources and programmes related to blue-green innovations;
- A systematic approach to monitoring and mapping Baltic marine biomass resources
- Environmental impact assessments of some of the SUBMARINER uses (e.g. for wave installations, removal of beach-cast /free-floating macroalgae);

Figure 20: Harnessing the natural resources of the BSR to advance blue biotechnology is a key challenge for the years ahead (picture: кутан, shutterstock).



- The environmental capacity in case of larger-scale applications;
  - Pan-Baltic pilot sites accessible for actors across the whole Baltic Sea Region;
  - Pilot sites for marine biorefinery and large-scale microalgae cultivation as well as an initiative on how to integrate blue bioresources into regional energy strategies and initiatives;
  - Technology solutions and regulatory / financial incentives and subsequent realisation of pilot cultivation installations within offshore wind parks;
  - A pan-Baltic methodology for ecosystem valuation and an assessment of the effect / applicability of new marine uses on ecosystem services in given Baltic Sea sub-regions (even though initiatives for development of compensation schemes are about to start);
  - Technology solutions for blue biomass harvesting and cultivation and Baltic Sea Region specific conditions;
  - Suitability of Baltic Sea Region specific organisms for various applications;
  - A systematic approach to promote a concrete set of investment projects potentially to be realised in public-private partnerships as well as designing / making use of innovative ways of financing beyond classical funding methods;
  - Market surveys and marketing campaigns together with the relevant private actors (i.e. retail companies) – but also related producer networks are almost completely missing so far.
- This “long” list should, however, not be perceived as discouraging. It merely shows that a lot still remains to be done, especially in cooperation with companies and regions. At the same time the survey has shown that the resource base on which the Baltic Sea Region can build has actually been substantially increasing over the course of the last two and half years and that there is an increasing number of actors not only active in this field, but also increasingly working together – in most cases in partnerships no longer created by “accident” or “coincidence” – based on a good knowledge of each others’ resources and capabilities and a joint awareness that more can be achieved together than individually.





# Annex

Survey entries and their contribution  
to SUBMARINER topics and strategic action  
fields of the SUBMARINER Roadmap

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A

Name of the initiative or project	Duration		Funding	Lead / coordinating partner country
	Start year	End year		
1 3D – Implementation of new generation 3D spatial seismic exploration methodology	2013	2015	unknown	Lithuania
2 Adaptation of sea osmoconformers to different conditions of sea salinity on an example of mussel <i>Cerastoderma glaucum</i> *	2015	2018	Polish National Science Center	Poland
3 Algae Cultivation at pulp and paper mills for sustainable production of bio-oil *	2012	2015	Vinnova	Sweden
4 Algae Innovation Workshop (AlgeinnovationsVærksted)	2014	2015	Ministry of Housing, Urban and Rural Districts' Rural District Pool (Denmark)	Denmark
5 Algaeolsynth – Towards improving biofuel production – Oil synthesis and accumulation pathways in promising oleaginous microalgae	2014	2017	FP7	Germany
6 Amicrex-Development of a Microwave Assisted Cell Disruption of Biomass and Extraction of Valuable Compounds	2015	2017	Horizon 2020	Germany
7 AquaSpace – Ecosystem Approach to making Space for Aquaculture	2015	2018	Horizon 2020	Scotland
8 ARRAINA – Advanced Research Initiatives for Nutrition & Aquaculture	2012	2016	FP7	France
9 BaltCOAST – A Systems Approach Framework for Coastal Research and Management in the Baltic	2015	2018	BONUS Programme	Germany
10 Baltic Blue Biotechnology ALLIANCE	2016	2018	Interreg Baltic Sea Region Programme	Germany
11 Baltic Blue Growth Initiation of full scale mussel farming in the Baltic Sea	2016	2019	Interreg Baltic Sea Region Programme	Sweden
12 Baltic EcoMussel: Commercial mussel farming, processing and end-use in the Baltic Sea Region	2012	2013	Interreg Central Baltic Programme	Sweden
13 Baltic Mussel Feed	2015	2015	BSR stars innovation express	Sweden
14 Baltic Sea Box *	2014	2016	Norddeutsche Stiftung für Umwelt und Entwicklung, Klara Samariter-Stiftung	Germany
15 BALTICAPP – Wellbeing from the Baltic Sea – applications combining natural science and economics	2015	2018	BONUS Programme	Finland

Participation of partners from...										SUBMARINER topics										SUBMARINER action fields									
DK	EE	FI	DE	LV	LT	PL	RU	SE		Macroalgae	Mussel Cultivation	Reed Harvesting	Microalgae Cultivation	Blue Biotechnology	Wave Energy	Fish Aquaculture	Offshore Combinations	Actors	Data	Environmental Impacts	Pilot Sites	Energy	Ecosystem Services	Technology	Blue Biotechnology	Finance	Regulation	Image	
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Name of the initiative or project	Duration		Funding	Lead / coordinating partner country
	Start year	End year		
16 BALTSPEACE – Towards sustainable governance of Baltic marine space	2015	2018	BONUS Programme	Sweden
17 BENEFISH – The economic impact of the welfare of fish in European fish farming	2007	2012	FP6	Germany
18 BEPPO: Blue Energy Production in Ports	2013	2014	Interreg North Sea Region	Belgium
19 Better utilization of raw materials for aquaculture *	2014	2018	Innovation Fund Denmark *	Denmark
20 Bioactive substances in the Baltic Sea macroalgae: structure-property relations and potential applications *	2015	2019	FP7	Estonia
21 Biogas – new substrates from the sea	2009	2012	regional structural funds Småland and the Islands	Sweden
22 BIOWALK4BIOFUELS – Biowaste and Algae Knowledge for the Production of 2nd Generation Biofuels	2010	2015	FP7	Italy
23 Blue Energy	2012	2013	Vinnova	Sweden
24 BlueGenics – From gene to bioactive product: Exploiting marine genomics for an innovative and sustainable European blue biotechnology industry	2012	2016	FP7	Germany
25 BLUEPHARMTRAIN	2013	2017	FP7	Nederlands
26 BUCEFALOS – BIUe ConcEpt For A Low nutrient/carbOn System –regional aqua resource management	2012	2015	LIFE / LIFE+	Sweden
27 CEFOW – Clean energy from ocean waves	2015	2020	Horizon 2020	Finland
28 CFE – Centre for Renewable Energy Conversion (I II and III) *	2007	2015	Swedish Energy Agency, Vinnova and Uppsala University	Sweden
29 CleanHatch	2010	2012	FP7	Malta
30 COFASP – Sustainable marine renewable resources	2013	2017	FP7	Denmark

Participation of partners from...													SUBMARINER topics								SUBMARINER action fields									
DK	EE	FI	DE	LV	LT	PL	RU	SE	Macroalgae	Mussel Cultivation	Reed Harvesting	Microalgae Cultivation	Blue Biotechnology	Wave Energy	Fish Aquaculture	Offshore Combinations	Actors	Data	Environmental Impacts	Pilot Sites	Energy	Ecosystem Services	Technology	Blue Biotechnology	Finance	Regulation	Image			
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Name of the initiative or project	Duration		Funding	Lead / coordinating partner country
	Start year	End year		
31 COLUMBUS – Monitoring, Managing and Transferring Marine and Maritime Knowledge for Sustainable Blue Growth	2015	2018	Horizon 2020	Ireland
32 COMA – copepod egg Mass production in Aquaculture	2013	2017	Innovation Fund Denmark *	Denmark
33 COMBI rearing *	2011	2015	GUDP – Green Development and Demonstration Programme*	Denmark
34 Coordination Support Action in Marine Biotechnology	2011	2013	FP7	Norway
35 D-FACTORY – THE MICRO ALGAE BIOREFINERY	2013	2017	FP7	UK
36 DEAMMRECIRC – The development of a deammonification treatment to remove nitrogen from recirculated water used in aquaculture	2011	2012	FP7	Switzerland
37 DEMA – Direct Ethanol from MicroAlgae	2012	2017	FP7	Ireland
38 Demonstration of an Electrical Energy Wave Power Plant using New Technology	2010	2019	Swedish Energy Agency	(Sweden)
39 Develop and test a scale demonstration of innovative, compact module for generating electricity from biomass *	2014		Polish National Programme DEMONSTRATOR+	Poland
40 Development of innovative fertilizers based on alternative sources of raw materials *			Polish National Programme called BIOSTRATEG	Poland
41 Development of integrated technology of fuels and energy production from biomass, agricultural waste and other *			Polish National Programme for Research and Development	Poland
42 Development of methods for assessment and mapping of ecosystem services of marine and inland waters *	2014	2015	EEA Grants and Norway Grants	Estonia
43 Development of techniques for collecting fish faeces in marine open sea aquaculture *			mainly financed by private funding	Germany
44 Diamond Semiconductors renewable electric offshore energy conversion *	2009	2012	Swedish Energy Agency	Sweden
45 Durability analysis of cables and moorings used in systems for harvesting of renewable ocean energy	2012	2015	Swedish Energy Agency	Sweden

Participation of partners from...														SUBMARINER topics										SUBMARINER action fields									
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Name of the initiative or project	Duration		Funding	Lead / coordinating partner country
	Start year	End year		
46 Effect of exposure of rainbow trout's ( <i>Oncorhynchus mykiss</i> , Walbaum 1792) gametes to ionizing radiation and UV and impact of pressure on the effectiveness of androgenesis and mitotic gynogenesis *	2015	2018	Polish National Science Centre	Poland
47 Efficient wave – CorPower Ocean *	2012	2013	Vinnova	Sweden
48 EnAlgae – Energetic Algae	2009	2015	Interreg North-West Europe	UK
49 EnviGuard – Development of a biosensor technology for environmental monitoring and disease prevention in aquaculture ensuring food safety	2013	2018	FP7	Germany
50 Establish an extractive ore multitrophic aquaculture at the Baltic in Schleswig-Holstein *	2014	2017	European Fisheries Fund (EFF), co-financed by Schleswig-Holstein	Germany, Schleswig-Holstein
51 Experimental plant for marine current power launched in Dalälven Söderfors *	2013	2015	Formas – The Swedish Research Council *	Sweden
52 Extracting Novel Values from Aqueous Seafood Side Steams – NOVAqua	2015		Nordic Marine Innovation Programme	Sweden
53 Floating Power Plant	1998		mainly private funding	Denmark
54 From waste to food microorganisms for sustainable fish farming (Från avfall till livsmedel mikroorganismer för uthållig fiskodling)	2012	2013	Vinnova	Sweden
55 Fuel4Me – future European League 4 Microalgal Energy	2013	2016	FP7	Netherlands
56 Further development of gravitational accumulator for wave power	2012	2016	Swedish Energy Agency	Sweden
57 Generator to wave power plants *	2013	2014	Vinnova	Sweden
58 Green fuel additives *	2005	2020	FP6	Estonia
59 Green Pigs – remediation with algae in the pig industry *	2014	2016	GUDP – Green Development and Demonstration Programme *	Denmark
60 H2OCEAN – Development of a wind-wave power open-sea platform equipped for hydrogen generation with support for multiple users of energy	2012	2014	FP7	Spain



Participation of partners from...										SUBMARINER topics								SUBMARINER action fields												
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Name of the initiative or project	Duration		Funding	Lead / coordinating partner country
	Start year	End year		
61 HABFISH – Harmful algae and fish kills	2012	2016	The Danish Council for Strategic Research (Det strategiske Forskningsråd)	Denmark
62 High rate algal biomass production for food, feed, biochemicals and biofuels	2010	2014	The Danish Council for Strategic Research (Det strategiske Forskningsråd)	Denmark
63 IDEALG Seaweed for the future *	2011	2019	French government	France
64 IMMFEED – Immunoglobulin for fish production: Fighting infections without antibiotics. *	2014	2017	GUDP – Green Development and Demonstration Programme *	Denmark
65 IMPAQ – Improvement of Aquaculture high quality fish fry production	2011	2016	The Danish Council for Strategic Research *	Denmark
66 Improved mitigation and management strategies of toxic algal blooms using a molecular biological approach	2011	2014	Formas – The Swedish Research Council *	Sweden
67 INMARE: Industrial Applications of Marine Enzymes: Innovative screening and expression platforms to discover and use the functional protein diversity from the sea	2015	2019	Horizon 2020	UK
68 InnoAquaTech – Development and transfer of innovative and sustainable aquaculture technologies in the South Baltic area	2015	2015	Interreg South Baltic Programme	Germany
69 InnoMarBio	2016	2019	Interreg Baltic Sea Region Programme	Finland
70 Innovative hatchery – implementation of semen cryopreservation for improvement of salmonids farming *	2014		National Science Center (Poland)	Poland
71 Innovative technology extracts of algae – components, fertilizers, feed and cosmetics *			Polish Applied Research Programme	Poland
72 Licensing guidelines for aquaculture investors in Schleswig-Holstein (part of the strategy for developing sustainable aquaculture in Schleswig-Holstein) *	2015	2015	State Funding	Germany
73 LIFE-ENERGA Living Lab-PL – ENERGA Living Lab for the improvement of the energy end-use efficiency	2014	2017	LIFE / LIFE+	Poland
74 MAB3 – The MacroAlgaeBiorefinery – sustainable production of 3G bioenergy carriers and high value aquatic fish feed from macroalgae	2012	2016	The Danish Council for Strategic Research *	Denmark
75 MacroBiotech			Nora Atlantic Cooperation	Faroe Islands

Participation of partners from...										SUBMARINER topics								SUBMARINER action fields											
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Name of the initiative or project	Duration		Funding	Lead / coordinating partner country
	Start year	End year		
76 MacroValue: Improving the understanding of seasonal variation in cultivated macroalgae	2015		Nordic Marine Innovation Programme	Faroe Islands
77 MaCUMBA – Marine Microorganisms: Cultivation Methods for Improving their Biotechnological Applications	2012	2016	FP7	The Netherlands
78 Mar3Bio	2016	2018	FP7	Norway
79 MarBioShell – Marine bio-production and shellfish research: development of sustainable off-shore shellfish mariculture in Denmark	2008	2012	The Danish Council for Strategic Research *	Denmark
80 MAREX – Exploring Marine Resources for Bioactive Compounds: From Discovery to Sustainable Production and Industrial Applications	2010	2014	FP7	Finland
81 Marine Biogas	2014	2017	Swedish Energy Agency and EU	Sweden
82 Marine Biotechnology ERA-NET	2013	2017	FP7	Norway
83 Marine Fungi – Natural products from marine fungi for the treatment of cancer	2011	2014	FP7	Germany
84 Marine sponges – an untapped resource for the treatment of cancer?	2011	2014	FP7	Germany
85 MARINET – Marine Renewables Infrastructure Network for Emerging Energy Technologies	2011	2015	FP7	Ireland
86 MARISURF – NOVEL, SUSTAINABLE MARINE BIO-SURFACTANT / BIO-EMULSIFIERS FOR COMMERCIAL EXPLOITATION	2015	2020	Horizon 2020	UK
87 MICROALGAE – Cost efficient algal cultivation systems – a source of emission control and industrial development	2014	2017	BONUS Programme	Estonia
88 MicromBT	2016	2018	FP7	Norway
89 MINOTAUR – Metabolic interactions in oceanic photosymbioses	2015	2017	Horizon 2020	Germany
90 MIRACLE – Mediating integrated actions for sustainable ecosystem services in a changing climate	2015	2018	BONUS Programme	Sweden

Participation of partners from...										SUBMARINER topics										SUBMARINER action fields									
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Name of the initiative or project	Duration		Funding	Lead / coordinating partner country
	Start year	End year		
91 MUMIHUS – Production of Mussels – Mitigation and Feed for Husbandry	2010	2013	The Danish Council for Strategic Research (Det strategiske Forskningsråd)	Denmark
92 Mynälahti general planning project *	2010	2014	VELHO / Rural Development Programme	Finland
93 NÄRFISK test bed technology (NÄRFISK testbädd teknik)	2012	2014	Vinnova	Sweden
94 NOMORFILM – Novel marine biomolecules against biofilm. Application to medical devices.	2015	2019	Horizon 2020	Spain
95 Nordic Network on Recirculating Aquaculture Systems	2011		Nordic Council of Ministers	Denmark
96 Northern Network on Marine Biotechnology (Nordverbund Marine Biotechnologie)	2006		mainly financed by private funding	Germany
97 Nutrients of reed growths to fields *	2015		VELHO / Rural Development Programme	Finland
98 NutriTrade	2015	2018	Interreg Central Baltic Programme	Finland
99 OPERATION SWAT – High algal recovery using a Salsnes Water to Algae Treatment (SWAT) filter technology	2011	2013	FP7	Norwegen
100 PHOTO.COMM – Design & Engineering of Photosynthetic Communities for Industrial Cultivation	2012	2016	FP7	Denmark
101 Preliminary study: Investigate the possibility of establishing a staging area for offshore power generation (Förstudie: Utreda möjligheterna att etablera ett testområde för havsbaserad elproduktion)	2013	2013	Vinnova	Sweden
102 ProAqua – Reducing antibiotic use in marine larviculture by a novel combinatory probiotic strategy	2013	2016	The Danish Council for Strategic Research *	Denmark
103 Production of hydrolysed collagen from fishery products	2015		Nordic Marine Innovation Programme	Iceland
104 Production of macroalgae in the Baltic Sea – a pilot project	2016	2018	not financed	Denmark
105 PROECOWINE – Development of a process to generate a novel plant protection product enriched with micronutrients to replace copper in organic viticulture	2012	2014	FP7	Germany

Participation of partners from...											SUBMARINER topics								SUBMARINER action fields								
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Name of the initiative or project	Duration		Funding	Lead / coordinating partner country
	Start year	End year		
106 ProffAqua	2015		Nordic Marine Innovation Programme	Sweden
107 RemCap – Resource Efficient Maritime Capacity	2012	2015	FP7	UK
108 Samarbete mellan Kina och Sverige för hållbar tillverkning av marina högvärdessubstanser från mikroalger	2012	2013	Vinnova	Sweden
109 Save the Burgs Bay *	2012	2013	Leader Gotland / Rural development programme	Sweden
110 Save your Bay! Remediation of enclosed marine waters as a driver for sustainable blue growth	2015	2016	Swedish Institute (SI) seed funding	Sweden
111 SDWED – Structural Design of Wave Energy Devices	2010	2014	The Danish Council for Strategic Research (Det strategiske Forskningsråd)	Denmark
112 Sea farms – now far offshore *	2011	2015	GUDP – Green Development and Demonstration Programme*	Denmark
113 SEABIOTECH – From sea-bed to test-bed: harvesting the potential of marine microbes for industrial biotechnology	2012	2016	FP7	UK
114 Seafarm – Macroalgae for a bio-based society	2013	2017	Formas – The Swedish Research Council *	Sweden
115 SeAGIS – Cooperation for ecosystem based planning of the marine environment using GIS *	2011	2014	Interreg Botnia-Atlantica	Finland
116 SeaRefinery	2016	2018	FP7	Denmark
117 SEAS-ERA – Towards Integrated Marine Research Strategy and Programmes	2010	2014	FP7	(Spain)
118 Seaweed bioactive ingredients with verified in-vivo bioactivities	2015	2018	Nordic Marine Innovation Programme	Iceland
119 Seaweed cultivation project in Estonia			Other (please specify)	Estonia
120 Seaweed Symposium for Growth in the Blue Bio-economy	2015		NORA	Faroe Islands (Denmark)





Name of the initiative or project	Duration		Funding	Lead / coordinating partner country
	Start year	End year		
121 Seaweed-Turf for thatched roofs *	2015	2016	MUDP – Environment Technology Development and Demonstration Programme *	Denmark
122 Smart Blue Regions – Smart Specialisation and Blue Growth in the BSR	2016	2019	Interreg Baltic Sea Region Programme	Germany
123 Smart Coast	2014	2015	EUSBSR Seed Money Facility	Åland
124 SmartSEA – Gulf of Bothnia as Resource for Sustainable Growth	2015	2021	Finnish Academy / Strategic Research Council	Finland
125 SPECIAL – Sponge Enzymes and Cells for Innovative Applications	2010	2013	FP7	Portugal
126 SPLASH – Sustainable PoLymers from Algae Sugars and Hydrocarbons	2012	2016	FP7	The Netherlands
127 SumBays – Sustainable Management of Baltic Sea Bays	2016	2019	Interreg Central Baltic Programme	Sweden
128 SUNBIOPATH – Towards a better sunlight to biomass conversion efficiency in microalgae	2010	2013	FP7	Belgium
129 SUPRA-BIO – Sustainable products from economic processing of biomass in highly integrated biorefineries	2010	2014	FP7	UK
130 Sustainable protein production	2014	2015	Nordic Council of Ministers	Denmark
131 SWEAWEED – Seaweed production systems with high-value applications *	2015	2019	Swedish foundation for strategic research	Sweden
132 Technique development mussel farming *	2014	2015	LOVA Local Water projects to decrease nutrients to the sea	Sweden
133 The Value Chain from Microalgae to PUFA	2013	2017	FP7	Germany
134 Theory, experimental validation and resource assessment for marine current energy conversion at CFE	2013	2015	Swedish Energy Agency	Sweden
135 ThermoFactories	2016	2018	FP7	Norway

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	Start year	End year		
136 WASTE-TREAT – Cost-effective solutions to end processing of nutrients from salt water fish farming *	2014	2017	GUDP – Green Development and Demonstration Programme *	Denmark
137 Water on Gotland *	2014	2017	Swedish Agency for Marine and Water Management	Sweden
138 WaveDemo	2012	2012	Swedish Energy Agency	Sweden
139 WESA – Wave Energy for a Sustainable Archipelago	2011	2013	Interreg Central Baltic Programme	Sweden

\* unofficial English translation of the official title in original language

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This status report presents the progress made to date towards the goals set out in **the SUBMARINER Roadmap**. It reflects action taken on key issues requiring joint effort in the Baltic Sea Region in order to enhance blue-green growth while sustaining and improving its natural capital and, in particular, the Baltic Sea itself. In reference to the SUBMARINER Roadmap, this review surveys the most important strategic advances and remaining issues to be addressed in a broad range of initiatives in which the SUBMARINER Network continues to be engaged.

**SUPPORTED BY**  
BioCon Valley Mecklenburg-Vorpommern e.V.



**EUSBSR FLAGSHIP**

The SUBMARINER Network is a flagship of the EU Strategy for the Baltic Sea Region (EUSBSR).

