MarineBiotech

MARINE BIOTECH NEWSLETTER

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CONTENT

EDITORIAL

Challenges reaching "proof of concept"

The EU-commission's president has clearly communicated that one of the core goals for public investments in European research and innovation is to achieve impacts to create value for better societies and lives. This gives good guiding for our ERA-NET project developing an enabling technology like Marine Biotechnology. However, the challenge is to find good ways to make the most out of public money in the difficult transfer between academic innovations being patented giving opportunities for monetary benefits by private investments.

In all our three transnational calls we have emphasised the applied aspect needed in the proposed projects. This has been an evaluation parameter influencing their qualitative ranking. A TRL level of up to 5 has been sought for, and industries encouraged applying and/or participating.

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Photocredit: Silje Holte

The *Marine Biotechnology ERA-NET* (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.

During the lifetime of the project the following activities will be carried out, supporting the European Bioeconomy:

- Launching three thematic calls to generate joint European research and development activities.
- Arranging a number of stakeholder events to promote dialogue between science, industry and policy and to identify requirements for successful developments within the area.
- Performing outreach activities to seek complementarities and avoid overlap with other activities sharing common interest with ERA-MBT.
- Establishing a Strategic Roadmap with the support of the International Advisory Group, an expert panel reflecting views and expertise from the scientific, policy and business sectors.
- Developing a perspective on the future of marine biotechnology research and development and its likely impacts.
- Providing information about marine biotechnology in an online and open access portal with a wiki function.

Marine Biotechnology ERA-NET (ERA-MBT) is funded under the European Commission's Seventh Framework Programme. | Grant Agreement Number 604814
December 2013 - November 2017

These operational measures to achieve impact of the public money funded transnational projects, have given good and industry relevant collaborations and applied directions in projects led from academic institutions. Although not finished or evaluated, we are confident that valuable knowledge taken up by industry will result from these investments. This covers an important part of the value chain where academy and industry need to interact to generate valuable knowledge and develop ideas.

A more challenging part of the value chain is where academic innovations need resources to achieve "proof of concept" and enter a development path leading to products and services in a market. There are practical, financial and cultural hurdles to be overcome at this breakpoint. Too often the scientists do not have a culture to pursue commercial developments, and funding agencies often do not have well established funding tools for those who want to develop their innovations. A solution sought by many academic inventors is to establish a micro-SME by finding investors and continue the development towards "proof of concept" with private money combined with their research. An inherent pitfall in this model is at least twofold; firstly the often immature basis for the innovation, and secondly the possibility of not reaching the goal before investor money runs out. Many have failed and investors lose confidence.

A model tried by some funding agencies in this phase has been to introduce a funding scheme where the scientists are given the possibility to refine an innovation towards "proof of concept" and a defined market application. To achieve this, the funding agency has to change what kind of information is asked for in the application and the evaluation criteria. The emphasis shifts from scientific excellence to refinement of existing data to underpin the innovation. A core element in this is to connect the scientists closely with a competent technology transfer office who can guide them, and during the project period establish a first version commercialisation plan. In practice, academic and publishable results are no longer asked for, but a clear and tangible plan with specific milestones are evaluated and followed up. A demanding exercise for all three parties, but experiences show that maturing academic innovations in academia gives better chances for success than when private money are introduced at a too early and immature stage.

Dr Steinar Bergseth
The Research Council of Norway (RCN), Norway

SECOND JOINT CALL RESULTS

In the 2nd ERA-MBT call entitled "Biodiscovery - Bioactive molecules from the marine environment", five projects were selected for funding, with a total budget of € 5.8 million.

After the submission date on 16 March 2016, 41 proposals were received, requesting a total of € 45 million. Five transnational collaborative R&D projects were selected for funding based on an international peer-review assessment of proposals and within the possibilities of national budgets.

The main purpose of this call was to **explore bioactive molecules in organisms from the oceans**, including those from fishery and aquaculture activity, or in materials which result from the processing of marine organisms. The aim is to further explore the potential and to provide compounds that offer chemical diversity and bioactive potency of value in meeting the needs of society.

More information on the selected projects, which are expected to start early 2017, can be read in the **factsheets below**.

- BlueShell - Exploring Shellfish By-products as sources of Blue Bioactivities
- BLUETEETH - Marine Origin Biopolymers as Innovative Building Blocks from the Sea for the Development of Bioresorbable Multilayered Membranes for Guided Bone Regeneration
- CYANOBESITY - Cyanobacteria as a source of bioactive compounds with effects on obesity and obesity-related co-morbidities
- MARPLAST - Marine microorganisms for bioplastics production
- Novofeed - Novel feed ingredients from sustainable sources

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BlueShell

Exploring Shellfish By-products as sources of Blue Bioactivities

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PROJECT FACTSHEET

CALL 2 | DECEMBER 2016

ABSTRACT

About 70% of annual shellfish production ends up as by-products. Apart from use in chitin/chitosan, this marine biomass is either used to make fertilizer/low value products or is sent to landfill, incinerated or dumped at sea. BlueShell will address this problem by exploring 3 typical shellfish by-products; shrimp shells, crab shells and defect mussels, for potential (bio)active compounds targeted at the sustainable supply of safe, healthy foods. Research indicates that the abundance of hepatopancreas tissue, the open circulatory system, the filtering nature and the shell structures render crustaceans and bivalves as sources of unique proteins/peptides, unusual fatty acids, pigments and chitin. Applying enzymatic hydrolysis or fermentation will enhance bioactivity through controlled proteolysis, lipolysis and production of low molecular weight compounds. It will facilitate fractionation through lipid-protein disconnections and demineralization/de-proteinisation. Different starter cultures will be tested against a standardized enzymatic hydrolysis as reference. Peptide-, lipid- and chitin-enriched fractions will be explored for (bio)activities relevant to: (i) functional foods development, (ii) food safety applications and (iii) plant health applications. Molecular characterisation of the most active fractions will help identify the specific compounds involved. BlueShell will investigate upscaling feasibility and market potential for the most interesting cases.

Katleen Raes, Project Coordinator
Ghent University, Belgium

Topic:

- Shellfish by-products

Marine biomass:

- Crustacea

Source of marine biomass:

- marine biomass processing by-products and waste fractions

Keywords:

fermentation, enzymatic hydrolysis, mussel, crab, shrimp, nutrition, food safety, plant health, antifouling, antimicrobial

Total costs*: € 1.319.000

Funding granted*: € 1.152.000

Duration: 3 years (2017-2019)

** Exact amount may change after completion of national contracts*

CONSORTIUM

Name	Organisation	Country
Katleen Raes	Ghent University	Belgium/ Flanders
Johan Robbens	Institute of Agricultural and Fisheries Research	Belgium/ Flanders
Ingrid Undeland	ChalmersUniversity of Technology	Sweden
Donatella de Pascale	National Research Council	Italy
Ragnhild Whitaker	Whitaker Nofima	Norway
Michelle Giltrap	Dublin Institute of Technology	Ireland
Karl Bonner	Irish Fish Canners Ltd	Ireland

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BLUETEETH

Marine Origin Biopolymers as Innovative Building Blocks from the Sea for the Development of Bioresorbable Multilayered Membranes for Guided Bone Regeneration

MarineBiotech

PROJECT FACTSHEET

CALL 2 | DECEMBER 2016

ABSTRACT

Natural origin polymers from algae and arthropods can be obtained in large scale, and a great effort has been paid to find applications for such high-added value materials. Periodontal disease is frequent in humans and constitutes, together with dental caries, the principal cause of tooth loss in adults. Currently, one of the available treatment strategies for periodontal disease comprises the use of non-resorbable or resorbable membranes as barrier membranes for guided tissue/bone regeneration (GTR/GBR). Such membranes will act as a physical barrier to protect the defect site and to prevent soft tissue to reach the injured area, as well as "guide" the bone regeneration process. Several synthetic and natural membranes are currently being used for GTR/GBR to improve periodontal regeneration but, so far, complete regeneration has not yet been reported. In this concern, BLUETEETH intends to create a pioneering and innovative biocompatible and bioresorbable free-standing (FS) multilayered membrane that would address the limitations of the current ones, in terms of regeneration potential, by promoting an effective GTR/GBR to treat periodontal disease. Such multilayered membrane will have a special design and composition, thus allowing the spatiotemporal control of several parameters, including biocompatibility, biodegradability, mechanical performance, bioactivity and bioadhesion. This project attempts to develop the entire pipeline, bridging the isolation of the marine raw materials up to the final device, with expected improved medical performance and technical characteristics suitable to accelerate market entry.

João Mano, Project Coordinator
University of Aveiro (UAVR), Portugal

Topic:

- Marine origin biopolymers

Marine biomass:

- Crustacea

Source of marine biomass:

- marine biomass processing by-products and waste fractions

Keywords:

Blue biotechnology, Marine environment, Value-added marine origin by-products, Chitosan/Chitosan chemical modification, Bioactive agents, Layer-by-Layer assembly, Bioresorbable membranes, Biomedical applications, Guided bone regeneration, Periodontal disease

Total costs*: € 1.005.000

Funding granted*: € 797.000

Duration: 3 years (2017-2019)

CONSORTIUM

Name	Organisation	Country
João Mano	University of Aveiro (UAVR)	Portugal
Már Másson	University of Iceland (UI)	Iceland
Hélène Lauzon	Primex ehf (PRIMEX)	Iceland
Janne Reseland	University of Oslo (UiO)	Norway

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CYANOBESITY

Cyanobacteria as a source of bioactive compounds with effects on obesity and obesity-related co-morbidities

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PROJECT FACTSHEET

CALL 2 | DECEMBER 2016

ABSTRACT

An urgent demand for new anti-obesogenic compounds is present, and marine cyanobacteria promise to be an excellent source for natural-derived molecules and novel nutraceuticals. Some strains of cyanobacteria are commercially available for consumption due to their beneficial properties to human health. Preclinical studies have been performed in various animal models and demonstrated hypolipidemic activities in rats and mice, lowering hepatic cholesterol and triglyceride levels. In the proposed project, marine cyanobacterial strains of a culture collection will be screened for beneficial properties towards obesity and obesity-related co-morbidities (obesity, fatty liver disease, diabetes, appetite and hyperlipidaemia) and the chemical structure will be elucidated. By applying an innovative biotechnological platform, the interactions from oral administration to the blood stream will be analyzed, and with different target tissues *in vitro*. A proof of concept regarding the improvement of metabolism will be performed in a relevant physiological model. The general aim of the project is to develop novel nutraceuticals that have the potential to improve the quality of life for millions of people worldwide.

Ralph Urbatzka, Project Coordinator
CIIMAR - Interdisciplinary Center of Marine and Environmental Research, Portugal

Topic:

- Nutraceuticals

Marine biomass:

- Bacteria
- Microalgae

Source of marine biomass:

- Biobanks and repositories that are held within institutions/companies

Keywords:

obesity, metabolic disorders, white and brown adipocyte differentiation, phenotypic screening, cell-based bioassays, zebrafish-based bioassays, cyanobacteria collection, nanotechnology platform, lab-on-a-chip, chemical proteomics

Total costs*: € 1.893.000

Funding granted*: € 1.289.000

Duration: 3 years (2017-2019)

CONSORTIUM

Name	Organisation	Country
Ralph Urbatzka	CIIMAR - Interdisciplinary Center of Marine and Environmental Research	Portugal
Susana Cristobal	Linköping University	Sweden
Siegfried Ussar	Hemholtz Center Munich	Germany
Finnur Eiriksson	ArcticMass ehf.	Iceland
Margreth Thorteinsdóttir	University of Iceland	Iceland

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MARPLAST

Marine microorganisms for bioplastics production

MarineBiotech

PROJECT FACTSHEET

CALL 2 | DECEMBER 2016

ABSTRACT

The steady increase in microplastic concentration could result in dramatic effects on the vulnerable wildlife of the oceans and marine food supplies. It is therefore of immediate importance to develop novel types of polymeric materials that can be sustainably produced to address these environmental concerns. MARPLAST focuses on Polyhydroxyalkanoates (PHAs), a class of biodegradable bioplastics which are considered to be feasible replacements for current petroleum-based plastics. PHAs are polymers occurring in nature, produced among others by bacteria, and with properties similar to oil-derived polypropylene and polyesters, rendering them useful as an attractive biodegradable replacement. However, the naturally occurring PHA production pathways are not sufficiently understood, and currently known technologies for production are too costly to allow for a full-scale replacement. MARPLAST aims to develop and provide tools (bacteria, enzymes, and pathways) to enable efficient production of sustainable and biodegradable bioplastics from low-cost unexploited biomass. Focus will be on PHA-producing cold-adapted marine bacteria, which have a range of properties that make them especially suitable for industrial applications. MARPLAST will utilize expertise from the Univ of Tromsø (Norway), Univ of Bucharest (Romania) and Umeå University (Sweden) to make important progress and contributions to the transition to a bio-based European economy.

Arne Smalås, Project Coordinator
University of Tromsø – the Arctic University of Norway

Topic:

- Biodegradable bioplastics

Marine biomass:

- Bacteria

Source of marine biomass:

- culture collections
- from fishery or aquaculture activity
- marine biomass processing by-products and waste fractions
- biological materials collected from the foreshore (coastal areas between the limits of low and high water)

Keywords:

Marine bacteria, microbiology, enzymes, genomics, polyhydroxyalkanoates, bioplastic, biodegradable, sustainable resources, biomass conversion

Total costs*: € 1.793.000

Funding granted*: € 1.261.000

Duration: 3 years (2017-2020)

CONSORTIUM

Name	Organisation	Country
Arne Smalås	University of Tromsø – the Arctic University of Norway	Norway
Knut Irgum	Umeå University	Sweden
Ana-Maria Tanase	University of Bucharest	Rumania

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Novofeed

Novel feed ingredients from sustainable sources

MarineBiotech

PROJECT FACTSHEET

CALL 2 | DECEMBER 2016

ABSTRACT

The European aquaculture industry holds great promise as a provider of nutrient rich food to an increasing population. To ensure a sustainable and continued growth of the production, there is a need for an increased focus directed towards the development of effective approaches to prevent and control diseases in aquaculture species. One possibility is to develop functional feed ingredients that provide specific benefits to the fish. Such ingredients may be biologically active compounds, recovered from seafood processing by-products. This project aims to develop novel functional feed ingredients for the aquaculture industry through facilitating the recovery and utilization of valuable bioactive peptides from the salmon industry in Norway and the sea bass/sea bream industry in Italy. State of the art techniques within peptidomics and bioinformatics (often referred to as the in silico approach) will be used to identify peptides with predicted anti-inflammatory, immunostimulatory or anti-microbial properties in the different fractions of by-products. Based on the results, targeted hydrolysis and processing of the by-products will be performed to obtain fractions enriched in the relevant bioactive peptides. Assessments will be made of the degree of purification and up-concentration required before inclusion of these fractions in the feed formulations. The efficacy of the compounds as health promoting and disease-preventing ingredients will be assessed through in vitro studies and in vivo fish feed trials.

Fiona Provan, Project Coordinator
International Research Institute of Stavanger, Norway

Topic:

- Novel feed ingredients

Marine biomass:

- Fish

Source of marine biomass:

- from fishery or aquaculture activity
- marine biomass processing by-products and waste fractions

Keywords:

peptidomics, bioinformatics, peptides, bioactive, functional feed ingredients, aquaculture, value creation, in vitro, in vivo trials

Total costs*: € 1.421.000

Funding granted*: € 1.283.000

Duration: 3 years (2017-2019)

** Exact amount may change after completion of national contracts*

CONSORTIUM

Name	Organisation	Country
Fiona Provan	International Research Institute of Stavanger	Norway
Lennart Martens	Ghent University	Belgium/ Flanders
Alessio Bonaldo	University of Bologna	Italy
Raja Mansingh Rathore	Nutrimar AS	Norway
Helgi Thorarensen	Holar University College	Iceland
Åge Oterhals	Nofima	Norway

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JOINT CALLS WITH IB2 AND COFASP

One of the tasks foreseen within ERA-MBT activities includes "**Exploring the possibility of launching the 4th call with other initiatives**," with the intention to build fruitful cooperation between "sister" initiatives. Considering this goal, two actions were implemented in collaboration with ERA-IB-2 (Industrial Biotechnology) and COFASP (Cooperation in Fisheries, Aquaculture and Sea food Processing), respectively.

COLLABORATION WITH ERA-IB-2

In November 2015, six of the ERA-MBT partners (IWT, FCT, UEFISCDI, RCN, IFD and MINECO) joined the ERA-IB-2 7th call launched under the topic: "Industrial Biotechnology for Europe: an integrated approach." This topic foresees the utilization of biomass for the development of innovative and industry relevant Industrial Biotechnology projects. The inclusion of ERA-MBT participation highlights the possibility for the utilization of marine biomass, as a valuable alternative source for academia and industries to apply the biotechnology toolbox. Out of the 37 full proposals accepted for evaluation, three projects utilized marine biomass, namely the projects with the acronyms: VALORIZE, Fish for Future and HABVAL, however none of these projects were funded.

More information on the ERA-IB2 website.

COLLABORATION WITH COFASP

In March 2016, two of the ERA-MBT partners (RCN and RANNIS) joined the 3rd call of ERA-NET COFASP, which was launched in selected topics within the areas cross boarding the two ERA-NETs, where new biotechnological approaches and developments have the potential to enable new and innovative developments within the fisheries, aquaculture and seafood processing sectors covered by COFASP. The selected topics were the following:

- **Topic 1:** Fisheries stock assessment and dynamic modelling
- **Topic 2**: Genome based approach to genetic improvement of aquaculture species
- **Topic 3:** Explore opportunities for the use of biotechnological tools, including targeted enzymes to develop more efficient seafood processing methods and high value products

Applications were required to demonstrate a significant biotechnology component, using elements of the marine biotechnology "toolbox" with a clear potential to promote innovative solutions for the three COFASP main areas.

Out of 12 eligible full proposals accepted for evaluation, 5 projects could be funded. All of them include a relevant element of biotechnology, as required:

- RobustBass - Advanced selective breeding for robustness, disease and stress resistance in European sea bass (*Dicentrarchus labrax*) through the use of Next generation Sequencing technique for genetic Improvement (GR, NO, FR), led by Costas Tsigenopoulos, Greece
- STURGEoNOMICS - Genome-based approaches for improvement of aquaculture in two marine sturgeon species: Atlantic sturgeon (*Acipenser oxyrinchus*) and Beluga (*Huso huso*) (DE, FR, RO), led by Matthias Stöck, Germany
- AntiFoul - Applying novel biotechnological tools to utilize compounds isolated from the red algae *S. coronopifolius* as eco-friendly Antifouling Agents (TR IS GR FR), led by Antonios Makris, Turkey
- CHITOWOUND - Biotechnological tools implementation for new wound healing applications of byproducts from the crustacean seafood processing industry (GR RO NO EE), led by Kjell Morten Varum, Greece
- AquaCrispr - Optimization of the CRISPR/Cas9 knock-in technology and application in salmon and trout (NO FR DE), led by Rolf Edvardsen, Norway

The research themes addressed in these five selected projects, clearly illustrate the added value in merging these two areas. It is therefore a priority to join forces in future activities, working towards a stronger commitment and building a better position within the H2020 framework such as e. g. Cofund ERA-NETs and other EU-initiatives.

More information on the selected projects, which are expected to start early 2017, can be read in the **factsheets below**.

More information on the COFASP website.

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AntiFoul

Applying novel biotechnological tools to utilize compounds isolated from the red algae *S. coronopifolius* as eco-friendly antifouling agents

COFASP ERA-net

MarineBiotech

PROJECT FACTSHEET

JOINT CALL COFASP – ERA-MBT

DECEMBER 2016

ABSTRACT

Biofouling is the undesirable growth of living organisms (bacteria, algae, mollusks etc.) on structures submerged in water which causes serious problems for the aquaculture and maritime industries. A number of physical and chemical technologies have been applied in antifouling paints (AF), the most effective of them being the use of tributyltin coatings. However, due to toxicity caused by tributyltin and heavy metals, in September 2008, the International Maritime Organization (IMO) banned the use of self-polishing tributyltin coatings and there is increasing opposition to the use of copper. Preventing the settlement of fouling organisms in a non-toxic manner would be the ideal solution. To this end, there has been a multitude of physical, chemical and biomimetic approaches. Likely, a successful method of AF will need to combine all methods.
Over the past few years several marine metabolites were characterized for their eco-friendly antifouling potential. Among them, a very promising halogenated terpene, bromosphaerol from *S. coronopifolius* isolated by our group. Currently, the major hurdle of the use of marine metabolites is the limited available quantities. To address this limitation, our consortium will approach bromosphaerol biosynthesis in an interdisciplinary manner utilizing all available new tools in biotechnology, genomics, bioinformatics, biochemical and chemical analysis and in-vivo assays. In preliminary work, we have applied Next Generation Sequencing (NGS) to identify several thousands of expressed genes from *S. coronopifolius* including candidate terpenoid biosynthetic genes. In the current project we will expand the NGS approach in additional fresh material, analyze bioinformatically the expressed genes to quantify expression levels, isolate candidate biosynthetic genes, perform enzymatic analysis and metabolic modeling and flux analysis, reconstitute the biosynthetic pathway in heterologous species, refine the chemical analysis tools to identify compounds from tiny amounts of algal material and settlement-inhibition assays of barnacles.

More information can be found on the COFASP website.

Sector:

- Seafood processing

Topic:

- Explore opportunities for the use of biotechnological tools

Total costs*:
€ 512.400

Funding granted*:
€ 276.100

Duration:
3 years (2017-2019)

** Exact amount may change after completion of national contracts*

Antonios Makris, Project Coordinator
Centre for Research and Technology Hellas, Greece

CONSORTIUM

Name	Organisation	Country
Antonios Makris	Centre for Research and Technology Hellas	Greece
gamze turan	Ege University Fisheries Faculty Aquaculture Department	Turkey
Steinn Gudmundsson	University of Iceland	Iceland
Claire Hellio	Université de Bretagne Occidentale	France

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AquaCrispr

Optimalization of the CRISPR/CAS9 knock-in technology and application in salmon and trout

COFASP ERA-net

MarineBiotech

PROJECT FACTSHEET

JOINT CALL COFASP – ERA-MBT

DECEMBER 2016

ABSTRACT

Recent biotechnological innovations currently allow the development of new approaches to apply genetic engineering to non-model organisms, including economically important salmonid species. This has been mediated by the introduction of the highly efficient CRISPR-Cas9 methodology, which allows mutating specific DNA sequences in any organism, thus permitting genetic studies on key traits for aquaculture. In recent years several studies have revealed that single SNPs in the genomes of salmonids can explain important traits such as time of maturity and disease resistance. Based on these findings further studies need to aim at elucidating how single nucleotide exchanges can alter important traits for aquaculture such as growth, reproduction and disease resistance. Hence, there is a need to develop technologies that can precisely alter single nucleotides in the genome. This can be obtained by knock in- by a combination of gene editing and homology-directed repair as previously done in zebrafish. So far knock out by gene editing has been established in both rainbow trout and Atlantic salmon. Both species of fish have a long generation time, therefore it will be necessary to perform double allelic knock in by homologous recombination already in the F0, which is challenging considering current low efficiencies of homologous recombination. We have successfully established a methodology using pigmentation as a tracer for double allelic mutations in Atlantic salmon, this methodology can be further explored for knocking in traits. The project will therefore focus on establishing an efficient knock in technology in salmon and rainbow trout. This will be done in combination with exploring the technology further in zebrafish and medaka as efficiency is still low in this species and also since testing out technologies is much faster in these model fish species with their short generation time and fast development. By doing so, we will focus our technology development on genes essential for pigmentation, sex determination, reproduction and egg quality since our groups have been exploring these fields for a long time and results produced can in addition to providing technological improvements explain mechanisms behind some key biological features in fish and other species.
More information can be found on the COFASP website.

Sector:

- Aquaculture

Topic:

- Genome based approach to genetic improvement of aquaculture species

Total costs*:
€ 1.719.200

Funding granted*:
€ 894.100

Duration:
3 years (2017-2019)

** Exact amount may change after completion of national contracts*

Rolf Edvardsen, Project Coordinator
Institute of Marine Research, Norway

CONSORTIUM

Name	Organisation	Country
Rolf Edvardsen	Institute of Marine Research	Norway
Julien Bobe	Institut National de la Recherche Agonomique	France
Anna Wargelius	Institute for Marine Research	Norway
Uwe Irion	Max-Planck-Institut für Entwicklungsbiologie	Germany

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CHITOWOUND

Biotechnological tools implementation for new wound healing applications of byproducts from the crustacean seafood processing industry

PROJECT FACTSHEET

JOINT CALL COFASP – ERA-MBT

DECEMBER 2016

ABSTRACT

Crustacean shells are an abundant marine biomass containing valuable compounds with unique biological, physical/chemical and mechanical properties. Global aquaculture and catch of crustaceans yield > 10 million tons of biomass annually and the considerable amount of shells from this industry is currently a waste byproduct. The annual global catch the shrimp species *P. borealis* is more than 350 000 MT (FAO), and today only a minor fraction of the available harvested raw material is utilized for chitin/chitosan production. The most important product from crustacean shells is chitosan which is manufactured at about 13 000 tons per year and serve growing multi-sectorial markets. At present the chitosan produced is mainly used for water treatment as a flocculant, and for production of glucosamine for the health food market. However, chitosan is also used as a wound healing promoting component in gels, bandages and dressings for treatment of chronic wounds.

Current bottlenecks for expanded applications relates to the processes for their extraction and recovery which suffer from low yields and batch to batch variations with low reproducibility in the end product. Furthermore, current production processes for chitosan involves use of harsh chemicals and is highly energy consuming. Especially, in Asian countries were production of chitosan mainly takes place, this leads to both an environmental burden and also a significant hazard for the workers at such productions facilities. Thus, there is a great potential and motivation for improving these processes by introducing green chemistry, i.e. exploring the use of biotechnological tools like enzymes.

In the current project we will focus on developing more efficient and environmentally friendly processes for manufacturing of chitosan, and to produce chitosans that are targeting the wound healing market.

More information can be found on the COFASP website.

Sector:

- Seafood processing

Topic:

- Explore opportunities for the use of biotechnological tools

Total costs*:
€ 884.000

Funding granted*:
€ 847.000

Duration:
3 years (2017-2019)

** Exact amount may change after completion of national contracts*

Kjell Morten Varum, Project Coordinator
Norwegian University of Science and Technology, Norway

CONSORTIUM

Name	Organisation	Country
Kjell Morten Varum	Norwegian University of Science and Technology	Norway
Vassilis Bouriotis	Institute of Molecular Biology and Biotechnology, Foundation of Research and Technology	Greece
Vasile OSTAFE	West University of Timisoara	Romania
Håvard Sletta	SINTEF	Norway
Rando Tuvikene	Tallinn University	Estonia

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RobustBass

Advanced selective breading for robustness, disease and stress resistance in European sea bass (*Dicentrarchus Labrix*) through the use of next generation sequencing techniques for genetic improvement

COFASP ERA-net

MarineBiotech

PROJECT FACTSHEET

JOINT CALL COFASP – ERA-MBT
DECEMBER 2016

ABSTRACT

The project aims at developing biotechnological tools to improve our understanding of the genomic basis for growth and robustness in European sea bass (*Dicentrarchus labrax*), one of the most intensively farmed teleost species in the Mediterranean. Particular concern will be granted to increase species resistance to diseases, namely vibriosis [*Vibrio (Listonella) spp.*], pasteurellosis [*Photobacterium (Pasteurella) damselae subsp. piscicida*] and Viral Nervous Necrosis (VNN) infection. A family based breeding program, running high quality disease challenge tests on siblings to breeding candidates, can improve resistance by selecting broodstock from genetically best families. Exposing breeding candidates directly to disease to identify superior individuals is not indicated, but genomic analysis can be applied to efficiently discriminate among breeding candidates from the same family that otherwise will be ranked equally if only using family values. Therefore, genetic improvement of European sea bass through advanced selective breeding and molecular tools is expected to reduce production cost in the long term while minimizing production vulnerabilities and risk. In addition, the species shows high susceptibility to stress and displays high basal cortisol concentrations. Preliminary results showed that cortisol responsiveness was a repeated trait and fish with constantly Low (LR) or High (HR) resting and post-stress cortisol concentrations were identified. Interestingly, some quantitative trait loci (QTL) that influence cortisol concentrations seem to be located in the same genomic regions with QTL suggested having an effect on weight. Since stress is being considered as an important co-factor for reproductive dysfunctions and disease outbreaks in this species which in turn hampers production, we aim to investigate more deeply how stress response measured by cortisol level and weight/growth interfere in order to develop a promising selection index in future breeding programmes. Selection based on rigorous phenotype and genotype measurements for increased survival against pathogens and response to acute stress conditions is expected to lead to more robust future generations in the European sea bass populations.
More information can be found on the COFASP website.

Sector:

- Aquaculture

Topic:

- Genome based approach to genetic improvement of aquaculture species

Total costs*:
€ 1.091.900

Funding granted*:
€ 650.000

Duration:
3 years (2017-2019)

** Exact amount may change after completion of national contracts*

Costas Tsigenopoulos, Project Coordinator
Hellenic Centre for Marine Research, Greece

CONSORTIUM

Name	Organisation	Country
Costas Tsigenopoulos	Hellenic Centre for Marine Research	Greece
Dimitrios Chatziplis	ATEI of Thessaloniki	Greece
Leonidas Papaharisis	NIREUS Aquauculture SA	Greece
Michail Pavlidis	University of Crete	Greece
Sergio Vela Avitua	Akvaforst Genetics Center AS	Norway
Bruno Guinand	Institut des Sciences de l'Evolution de Montpellier	France

Marine Biotechnology ERA-NET (ERA-MBT) is funded under the European Commission's Seventh Framework Programme. | Grant Agreement Number 604814
December 2013 - November 2017

STURGEoNOMICS

Genome-based approaches for improvement of aquaculture in two marine sturgeon species: Atlantic sturgeon (*Acipenser oxyrinchus*) and Beluga (*Huso huso*)

COFASP ERA-net

MarineBiotech

PROJECT FACTSHEET

JOINT CALL COFASP – ERA-MBT

DECEMBER 2016

ABSTRACT

This project will use whole genome-based approaches for the improvement of aquaculture in two marine sturgeon species: Atlantic sturgeon (*Acipenser oxyrinchus*) and Beluga (*Huso huso*), characterized by large size, fast growth and relatively compact genomes.
Based on advanced preliminary work, the first common objective is to generate high quality genomes for *H. Huso* and *A. oxyrinchus*. The second objective is to characterize the genetic sex determination, using genomics and gonadal transcriptomics to prepare future molecular biotechnological tools for commercial aquaculture (female-biased breeding, meat, caviar) and species conservation. The third objective is to improve aquaculture breeding and re-stocking using population genomics, specifically elucidating the genomic substructure of native Atlantic sturgeons and re-stocking populations and of the remaining Beluga stocks from the Danube. This will avoid inbreeding in aquaculture and improve genetic make-up and broodstock management for ongoing restoration programs of endangered sturgeons and for sustainable fishery. The fourth objective is to experimentally extract genomics-derived candidate genes related to target traits (growth, disease resistance, sex determination) in captive-bred offspring using whole genome information (positively selected genes) and transcriptome (RNAseq) analyses in order to improve management strategies and breeding for commercial and conservation-related aquaculture.

More information can be found on the COFASP website.

Sector:

- Aquaculture

Topic:

- Genome based approach to genetic improvement of aquaculture species

Total costs*:
€ 1.829.400

Funding granted*:
€ 856.800

Duration:
3 years (2017-2019)

** Exact amount may change after completion of national contracts*

Matthias Stöck, Project Coordinator
Leibniz-Institute of Freshwater Ecology and Inland Fisheries, Germany

CONSORTIUM

Name	Organisation	Country
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Manfred Schartl	University of Würzburg	Germany

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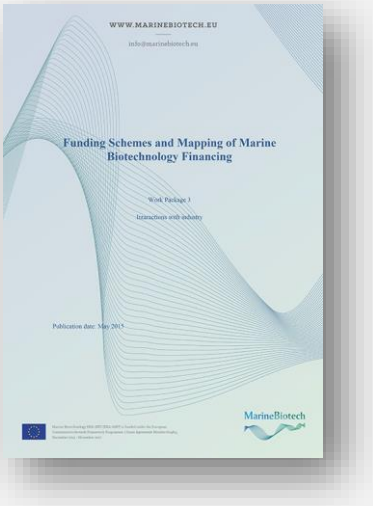
FUNDING MARINE BIOTECNOLOGY

One of the objectives of ERA-MBT's work programme is to "identify needs and gaps in the value chain from research to 'proof of concept', and even into industrial research & development". As a part of addressing this objective, one of the work packages aims at identifying **funding schemes and make a mapping of MBT financing**. A study was made, in which capital sources, both private and public, were identified at national and European levels.

Many mechanisms, both in the form of grants and in the form of loans to fund research, development and innovation (RDI) activities exist, but the funding environment is complex and diverse, leaving many opportunities untaken. This raises the question how well marine biotechnology stakeholders, and especially SMEs, are actually informed, understand and successfully utilize the available funding options. However, most of the bottlenecks identified are not specific to marine biotechnology, but part of a general picture where elements such as collaboration gaps between science and industry, administrative burdens etc. are found.

It is concluded that on the road for finding solutions to the identified funding challenges, further work should aim at 1) defining complementarities and synergies within existing partnerships, and 2) exploring reasons for the success of some and failure of other funding mechanisms. The final aim should be to identify solutions to support marine biotechnology RDI and thus bring promising technologies to the market.

Read the full report here on the ERA-MBT outreach page.



THE VOICE OF A STAKEHOLDER

PhD. Øyvind Enger, Sarsia Seed, *Bergen Norway*

ERA-MBT is in close dialogue with a range of stakeholders, and in this interview, Øyvind Enger, partner and investment advisor at Sarsia Seed shares his experiences and insights with Steinar Bergseth. In Sarsia Seed, Øyvind Enger invests seed capital in promising life science projects.

Q: What is your background and what is Sarsia Seed AS?

A: I did my Ph. D. in marine microbiology and fish diseases at the University of Bergen, and did some R&D in that area for some years. I have always been interested in how to best apply academic knowledge in value creating projects with industrial relevance, so I took up a position in the technology transfer office (TTO) at the University of Bergen. This was at the same time as the universities in Norway got the responsibility to handle IP generated from its researchers - challenging times for the universities. From the TTO I moved to Sarsia Seed as a seed fund investor, and have been doing this for the last 10 years.
Sarsia Seed has a capital base of 380 mNOK (45m€) financed 50/50 from public and private money. We are investing in life sciences and have a portfolio consisting mainly of pharma related projects, but we are also in clean energy and fish feed. Our investments fund around 70 % of the project budgets we go into in return for shares. Sarsia Seed is now closed for new investments, but a new fund of the same size and structure is under establishment.

Q: How do you see the possibilities for seed fund money directed towards projects utilizing marine biotechnology?

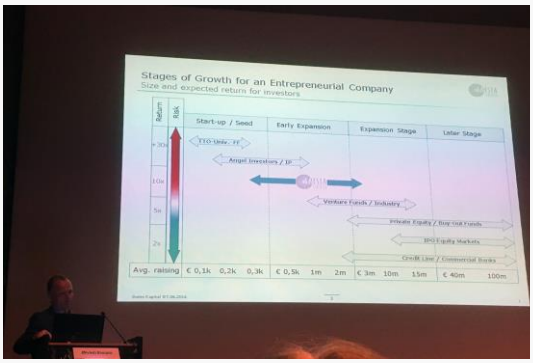
A: In principle, at least here in Norway, there are no lack of good ideas and sound projects in this area, but too often I do not see the "value proposition" in these projects. Remember, when seed capital comes in, we are quite far to the right in the value chain (industry uptake) and at technology readiness levels (TRL) 6 to 7. For us to make an investment, there must be an identified buyer of a project developing an idea, and then of course a market for the product or service. Investors are looking for returns on their investments, and this is much easier seen in pharma based projects and in technology related areas. Compared to other investors we are still investing very early and at a point where there is still an 80% risk that the company will fail due to technical or other reasons. Since 8 out of 10 companies fail we need to see that all projects we invest in have the potential to give us an 8 to 10 times return on our investment.

Q: What is preventing marine biotechnology based projects to develop?

A: Much too often I see that the ideas are "backloaded", meaning that an exit for us can be expected only when a product is on the market, and unmet needs are too often not clearly and easily identified. This is too much uncertainty and long term for investors who are used to see upfront payment possibilities and concrete milestones where exits can be done. A concrete possibility can be an exit based on the buyout of an SME developed on the project. However, this is rare in this area and again the investment horizon is working against it. Marine based pharma projects are exceptions since the unmet needs are easily identified, but for commodity directed industrial biotech projects like we most often see from marine biotechnology, this is much harder to define and the same for exits. The idea of where the money will be generated in the future also guides where the investments will be placed.
Utilisation of marine biology by applying biotechnology is still a young area and therefore success stories as seen in e. g. the pharma area is lacking, and so far we see no big industries in Europe developing products and services from the marine area. However, Norway is in a somewhat better position with the aquaculture industries actively utilizing biotechnology in their developments, and we also have national strategies focusing on marine, biotechnological developments.
The hard truth is that bio takes time and investors are looking for much more specific and shorter horizons than 10+ years.

Q: Can you give us the recipe for a successful investor ready project?

A: in my daily work I have acquired some tangible experiences about what makes a project idea sing in an investor's ears, and I am happy to share some of them with you. First, the technology must be founded on good science, be protectable (IPR) and be new or much better than something already on the market. Second, the team and management must be knowledgeable, have experience from industrial development and sale, and be trustworthy and able to handle changes. Third, there must be an identified and growing market with scalability. Finally, but not least, the business model must be scalable, clear and the risk/return picture have to be understood by all parties involved. These are some of the core elements and there are of course lots of details and judgements to handle, but are the mentioned elements in place – then the idea is in a very good starting position for a seed fund investment. In addition, my experience is that co-investors always will come in on tangible and well managed projects. Please keep in mind that no guarantees are given, and therefore "fast failures" are the next best that can happen in my area.



Øyvind Enger, Sarsia Seed, presenting at the ERA-MBT Stakeholder meeting, Brussels
Photocredit: Steinar Bergseth

Q: What should be done to raise the awareness of investment possibilities in the marine biotech based area?

A: Unfortunately, the investors are not enough guided by knowledge, but too much like a herd of sheep following the bell sheep. Therefore, the investors need to work closer together and create functional systems. This is best done through physical networking arenas created by the stakeholders with knowledge in the area. Here the investors can meet and build knowledge about possible investment areas and cases, and be showcased good projects with specific info about success stories.

ØYVIND ENGER

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See also Ø. Enger's presentation at the ERA-MBT second stakeholder meeting.

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ERA-MBT IN INTERNATIONAL EVENTS

THE BALTIC BLUE BIOTECHNOLOGY ALLIANCE MATCHMAKING EVENT

A pitching and matchmaking meeting was held by the Baltic Blue Biotechnology Alliance (BBBA) in Helsinki, 26-27 October 2016, and gathered partners and case owners interested in the BBBA-project's call for ideas based on the utilization of Baltic marine bioresources. The ideas should lead to concrete products or processes. There was a fascinating series of short pitches ending up in support being given to some of them to help them develop further. The BBBA is an applied project within the SUBMARINER network with a concrete focus on practical results with value for society and development of the blue bioeconomy.

The ERA-MBT coordinator presented the recently launched "Marine Biotechnology Strategic Research and Innovation Roadmap", and he also mentioned the ongoing initiative to form a European consortium working towards an ERA-NET Cofund project on blue bioeconomy. A dialogue with the EU-commission to launch this in the last call from Horizon 2020 (autumn 2017) is ongoing. He also contributed to a panel discussion on the way forward for the integration of Baltic resources in the further developments of marine biotech in Europe. A good dialogue followed the presentation of the roadmap, and participants could easily see how the roadmap has potential to support further development of MBT in Europe, both nationally and on a European scale, as also a joint Cofund ERA-NET effort will have.

Participants at the Baltic Blue Biotechnology Alliance matchmaking event, 26-27 October 2016. Photocredit: SUBMARINER NETWORK

Participants at the San Diego meeting in January 2017. Photocredit: Steinar Bergseth

FUNCTIONAL ANNOTATION OF SALMONID GENOMES (FAASG)

The **FAASG initiative** follows in the tradition **of functional annotation initiatives in human and mouse (ENCODE)** and more recently, **terrestrial animals (FAANG)**. This international initiative is based on salmonid knowledge, reference genome sequences and stakeholder's needs, that can be constructively taken forward in an international collaboration.

In January 2017, more than 50 interested stakeholders from academia, industry and funders met for the second time in San Diego to establish a **governance structure** and discuss how to take the initiative forward. A good structure was agreed and will be established during the first quarter of 2017, and the funders are concretely looking into possibilities to support the development of FAASG.

The initiative is **open for all** interested in salmonid R&D, and **functional data** will be shared on an open and standardized platform. For the meeting report and further details please check the http://www.faasg.org website.

COFASP POLICY DAY

ERA-NET COFASP is coming to an end, and called for a Policy Day 10 January 2017 in Covent Garden, Brussels. At this meeting the funding partners of the COFASP ERA-NET presented the main findings to invited representatives from the European Commission and other central stakeholders with the purpose of discussing how to utilise the results in future policy work and collaborations in the research area. ERA-MBT was represented by Torger Børresen at this meeting, acknowledging the good results having been obtained in the ERA-NET COFASP. The meeting gathered around 45 participants.

The Coordinator of COFASP, Niels Gøtke, and Sigi Gruber, Head of Unit, EC DG RTD, welcomed the participants to the policy day and the two main sessions, one concerning COFASP achievements in the research funding landscape, and one on societal needs and addressing needs for future research in the policy landscape.

Major COFASP achievements included a tool for mapping EU and national research projects, an overview of shared research infrastructures, mobility and training activities, and the outcome of the joint calls and their expected impact. The ERA-NET has published several case studies within the areas Fisheries, Aquaculture and Seafood processing, and a foresight was presented, containing mid-term needs and long-term challenges. A COFASP Strategic Research Agenda has also been worked out. All results have been documented in reports being available both in hard copies and available electronically at www.cofasp.eu.

ERA-NET COFASP and ERA-MBT have been working closely together, and have collaborated in a joint call for research proposals. The many common interests have made it clear that the two ERA-NETs should join forces in pursuing follow-up activities together. Several indications were presented during the discussions at the policy day. Niels Gøtke made an excellent summing up in his presentation 'Capitalising on COFASP findings'. This presentation, and a range of other documents are available at the COFASP website.

Participants at the COFASP Policy Day. Photocredit: Torger Børresen

SYNERGIES WITH OTHER INITIATIVES

ERA-NET COFUND MARTERA

"The consortium of the ERA-NET Cofund MarTERA, Maritime and Marine technologies for a new era, launched a joint call for transnational research and innovation projects on different thematic priority areas.

This call is initiated by funding organisations from 16 countries of the former ERA-NET MARTEC consortium and JPI OCEANS members.

The transnational call has a budget of about **30 Mio €** for collaborative research and innovation projects in the following areas:

- Environmentally friendly maritime technologies
- Development of novel materials and structures
- Sensors, automation, monitoring and observations
- Advanced manufacturing and production
- Safety and security

MarTERA will implement the Call 2017 as a two-step procedure. Step 1 deadline for submission of pre-proposals is **31th March 2017**. Further detailed information are available in the Call Announcement.

More information about MarTERA is available on the MarTERA website.

THE FUTURE OF MARINE BIOTECHNOLOGY

In the previous ERA-MBT newsletter 4, it was reported how the IAG had discussed a future of marine biotechnology after the present project period, and it was encouraged to seek partnership with ERA COFASP and JPI Oceans to promote the development of an ERA Cofund on Blue Bioeconomy. The planning has continued, and it seems feasible to gather financial support from funding agencies reaching the goal of 20 M euro. A further leverage is expected by the European Commission by launching additional activities at national and transnational level, including additional calls. The minimum leverage effect to be expected is 5 relative to the EU support. A briefing document has been prepared taking into account the justification of European Union intervention criteria, not least a description of the expected impacts on EU and at national level.

Several aspects of marine biotechnology are included in the proposed Cofund action, like the following statement: 'New developments within biotechnology make it possible to target new genetic resources, and utilise close to 100 % of the available biomass in new biorefineries, thereby adding novel marine derived biomolecules to the market through circular economy concepts'. This is in line with a statement in the EC's Scoping Paper for Horizon2020 work programme 2018-2020, Societal Challenge2, where it is said that 'Investments will exploit the high innovation potential of some of the emerging sectors of the blue economy: algae biorefineries, offshore multi-use platforms, bioprospection, bio-mimicry and the production of novel marine-derived biomolecules'.

The Strategic Research and Innovation Roadmap prepared by ERA-MBT was recently discussed at the Executive Committee of the European Marine Board, and its members were positive about supporting the work of ERA-MBT in promoting the main messages of the roadmap. Based on the statement by the ExCom that 'Marine Biotech is a strategically important area and European Marine Board would like to ensure it supports the efforts of the ERA-MBT', it was agreed that ERA-MBT and EMB should publish a joint policy brief with the purpose of raising the profile of blue biotech and identifying important avenues for future funding and coordination.

ERA-MBT
AT A GLANCE

Project Coordinator

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ERA-MBT Partners

The ERA-MBT partners welcome you to ERA-MBT and invite you to become involved in the shaping of a common ERA in Marine Biotechnology. Contact the individual project partners using the partner information page at the project website.

Stay connected

Subscribe to the newsletter mailing list
Follow us on Twitter @ERA_MBT

Contribute to

The MarineBiotech wiki-pages which aggregate information on marine biotechnology to inform funding agencies, stakeholders and the interested public about developments, achievements and knowledge in this area.

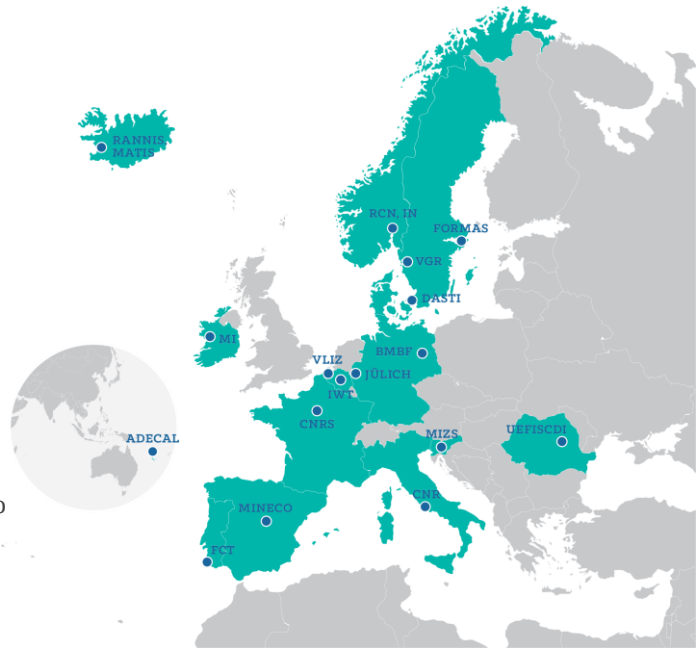
A LinkedIn communication forum to support exchanges between stakeholders and to highlight opportunities for interlinkage and collaboration.

Comments? Suggestions?

Please contact us at info@marinebiotech.eu.

Upcoming events

We are collecting information on all events related to the field of marine biotechnology.
To stay up to date, please visit our upcoming events page. If you cannot find the event you are organising or attending and would like to have it featured in our events calendar, please contact us.



Newsletter acknowledgements

The newsletter has been brought to you by the ERA-MBT editorial team: Steinar Bergseth (RCN), Torger Børresen (RCN), Dermot Hurst (MI), Fien De Raedemaecker (VLIZ) and Kim Turk (MIZS) with the input of ERA-MBT partners.