

# Marine Biotechnology RTDI in Europe

## Inventory of strategic documents and activities

Deliverable No. 3.5

Inventory report of marine biotechnology RTDI in Europe

Part of Task 3.1

Inventory of Marine Biotechnology RTDI Strategies, Programmes and Initiatives

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# Introduction

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This document aims to provide a first high level overview of the current Marine Biotechnology science policy landscape in terms of the prevailing policies, strategies, programmes and major activities/initiatives that are in place in Europe at the national, macro-regional and pan-European level. It entails Deliverable D3.5 (Report on Inventory of Marine biotechnology RTDI in Europe) which is one of the core outputs of Work Package 3 (Mapping the Marine Biotechnology RTDI Landscape) of the CSA MARINEBIOTECH. The main aim of this CSA is to prepare the foundation for a potential ERA-NET in the area of Marine Biotechnology.

This report includes information on research strategies, plans and/or policies designed to promote national or regional marine biotechnology RTDI activities; national/regional research programmes which support marine biotechnology research; national, regional and/or multi-national research infrastructures and practical supports specifically targeted at or directly relevant to marine biotechnology RTDI; and major collaborative initiatives at national, regional and pan-European level. The document is structured in three main sections: (1) pan-European level coordination initiatives, projects and activities; (2) European Regional Sea basin profiles; and (3) national profiles.

This document has a descriptive purpose, providing an inventory of relevant documents and information with links to more specific information and source documents. The profiles are based on available online information sources and contributions from various *experts* and stakeholders. It does not aim nor claim to be complete or final, but should be considered as a starting point for a dynamic and living online information resource (available on [www.marinebiotech.eu](http://www.marinebiotech.eu)) that will be elaborated, updated and improved as more information becomes available, including further inputs from experts and stakeholders.

A high-level analysis of *the* obtained information can be found in D3.6: Report on Strategic Analysis of Marine Biotechnology RTDI in Europe.

# **Pan-European level**

# Europe



## Situation

Covering over 50% of the territory of the European Union, the marine waters under European jurisdiction include four seas and two oceans stretch from the Arctic through the North Sea, Baltic, Atlantic, Mediterranean and Black Sea. *In* addition, European jurisdiction also includes the waters surrounding Europe's ultra-peripheral regions, many of which are located in tropical latitudes with high biodiversity. The European landmass has a coastline of 74,000km which is equivalent to about eight times that of the USA and four times that of Russia. Hence, Europe is a truly maritime continent, with access to an enormous range of marine habitats from coastal lagoons, to inshore waters to shelf seas and the deep ocean.



The coasts, seas and oceans around Europe host a very diverse set of ecosystems and habitats ranging from coastal marshes to lagoons, bays, *deepsea*, polar and tropical marine environments, tropical and cold coral reefs, deep-sea anoxic sediments and brine lakes, continental margin cold seeps and mudvolcanoes, and coastal and deep-sea hydrothermal vents. These ecosystems, in turn, host an extraordinary biodiversity.

Europe's seas and coasts are also important for the economy and employment. According to the European Commission<sup>1</sup>, if we count all *economic* activities that depend on the sea, then the EU's blue economy represents 5.4 million jobs and a gross added value of just under €500 billion per year.

Europe has a long-standing tradition of marine bio-science research as well as a strong biotechnology expertise, and hosts significant research *infrastructures* relevant for marine biotechnology research and development. This includes one of the largest fleet of research vessels in the world, an extensive network of marine stations, some of which are among the oldest in the world, and world class biotechnology laboratories such as the European Molecular Biology Laboratory (EMBL) and associated bio-informatics infrastructures.

## Overarching regional science strategies, plans and policies:

There is no overarching pan-European RTD policy, plan or strategy agreed among EU Countries and Associated Members States at the *governmental* level or at EC level specifically targeting Marine Biotechnology.

However, a substantial number of strategic documents have been developed over the years as a result of a wide range of science policy initiatives (see below). These culminated into a generally accepted vision and strategy for marine biotechnology research in Europe, published in 2010 by the European Marine Board, shared by at least by 34 Leading European Marine Science *Organisations* including a large number of national funding agencies (see Marine Board-ESF Position Paper 15 on Marine Biotechnology available from [www.marineboard.eu/publications](http://www.marineboard.eu/publications)).

The EU research policy has responded to the growing interest in marine genetic resources to some extent, notably through support for the Marine Genomics and Marine Biodiversity (MarBEF) FP6 Networks of Excellence and other on-going collaborative projects. Recent efforts to support and coordinate European coastal and marine research infrastructures to improve, for example, access to research vessels, stations and laboratories indicate some level of recognition that action is needed to fully exploit the vast but fragmented research infrastructure available for marine sciences in Europe, including for Marine Biotechnology research.

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<sup>1</sup> Communication from the Commission to the European Parliament, the Council, the European Economic And Social Committee and the Committee of the Regions on Blue Growth, opportunities for marine and maritime sustainable growth, and based on data from the Blue Growth Study 'Scenarios and drivers for sustainable growth from the oceans, seas and coasts', ECORYS, 2012. <https://webgate.ec.europa.eu/maritimeforum/content/2946> by volume.

## Research Funding Schemes and Programmes:

Marine Biotechnology RTDI at pan-European level is funded through a range of instruments including

- EU Framework Programmes for Research. In FP7 this was done mainly under THEME 2 on Agriculture, Fisheries and Biotechnology as well as via cross-cutting calls under the “Oceans of Tomorrow”  
[http://cordis.europa.eu/eu-funding-guide/home\\_en.html](http://cordis.europa.eu/eu-funding-guide/home_en.html)
- Structural funds  
[http://ec.europa.eu/research/era/instruments/instruments/structural\\_funds\\_en.htm](http://ec.europa.eu/research/era/instruments/instruments/structural_funds_en.htm)
- ESF EUROCORES which is currently being phased out  
(<http://www.esf.org/activities/eurocores.html>)
- COST Actions - A flexible, fast, effective and efficient tool to network and coordinate nationally funded research activities, bringing good scientists together under light strategic guidance. COST is based on networks centered around research projects in fields that are of interest to at least five COST countries.  
([http://www.cost.eu/domains\\_actions](http://www.cost.eu/domains_actions))
- In the future, pan-European collaborations may also receive funding from a potential ERA-NET in Marine Biotechnology Research (as being developed by the CSA MARINEBIOTECH) as well as under the framework of the Joint Programming Initiative on Healthy and Productive Seas and Oceans (JPI Oceans)  
[www.marinebiotech.eu](http://www.marinebiotech.eu) and <http://www.jpi-oceans.eu>.

## Research priorities:

Marine Board-ESF Position Paper 15 on Marine Biotechnology together with the scoping paper of the EU KBBE-net Coordinated Working Group on Marine Biotechnology (CWG-MB) provide a comprehensive overview of the European research priorities for marine biotechnology research and identify some potential areas of common interest which might benefit from transnational cooperation in Europe.

**Marine Board Position Paper 15 on Marine Biotechnology** analysed the contributions Marine Biotechnology can make to address key societal challenges and identified the associated future research priorities. These are summarised in below table.

Marine Biotechnology research priorities to address key societal challenges	
Target research area for development	Research priorities and objectives
<b>Food:</b> Development of food products and ingredients of marine origin (algae, invertebrates, fish) with optimal nutritional properties for human health.	<ul style="list-style-type: none"> <li>- Develop innovative methods based on -omics and systems biology for selective breeding of aquaculture species;</li> <li>- Develop biotechnological applications and methods to increase sustainability of aquaculture production, including alternative preventive and therapeutic measures to enhance environmental welfare, sustainable production technologies for feed supply, and zero-waste recirculation systems;</li> <li>- Integration of new, low environmental impact feed ingredients to improve quality of products and human health benefits.</li> </ul>
<b>Energy:</b> Development and demonstration of viable renewable energy products and processes, notably through the use of marine algae	<ul style="list-style-type: none"> <li>- Produce an inventory of microalgae resources for biofuel production to support optimisation of the most appropriate strains;</li> <li>- Improve knowledge of basic biological functions, tools for steering the metabolism and cultivation methods of marine microalgae to improve the photosynthetic efficiency, enhance lipid productivity and obtain microalgae with optimum characteristics for mass cultivation (mixed &amp; mono cultures), biofuel production and biorefinery;</li> <li>- Develop efficient harvest, separation and purification processes for micro- and macro-algae.</li> </ul>

<p><b>Health:</b> Development of novel drugs, treatments and health and personal care products</p>	<ul style="list-style-type: none"> <li>- Increase the focus on the basic research (taxonomy, systematics, physiology, molecular genetics and (chemical) ecology of marine species and organisms from unusual and extreme environments to increase chances of success in finding novel bioactives;</li> <li>- Improve the technical aspects of the biodiscovery pipeline, including the separation of bioactives, bio-assays that can accommodate diverse material from marine sources, dereplication strategies and structure determination methods and software;</li> <li>- Overcome the supply problem to provide a sustainable source of novel pharmaceutical and healthcare products through scientific advances in the fields of aquaculture, microbial and tissue culture, chemical synthesis and biosynthetic engineering.</li> </ul>
<p><b>Environment:</b> Development of biotechnological approaches, mechanisms and applications to address key environmental issues</p>	<ul style="list-style-type: none"> <li>- Develop automated high-resolution biosensing technologies allowing in situ marine environmental monitoring to address coastal water quality, including prediction and detection of HABs and human health hazards;</li> <li>- Develop cost-effective and non-toxic antifouling technologies combining novel antifouling compounds and surface engineering;</li> <li>- Consolidate knowledge on DNA-based technologies for organism and population identification and support the development of commercial tools and platforms for routine analysis.</li> </ul>
<p><b>Industrial Products and Processes:</b> Development of marine derived molecules exploitable by industry including enzymes, biopolymers and biomaterials.</p>	<ul style="list-style-type: none"> <li>- Develop enabling technologies for high throughput enzyme screening and for the expression of marine proteins and enzymes through dedicated hosts;</li> <li>- Produce marine biopolymers as novel competitive commercial products in food, cosmetics and health.</li> </ul>

Marine Board Position Paper 15 further identified a number of Research and Development priorities associated with key marine biotechnological toolkits presented in table below.

Marine Biotechnology toolkit research priorities	
Target research area for development	Research priorities and objectives
<p><b>Genomics and meta-genomics, molecular biology in life sciences</b></p>	<ul style="list-style-type: none"> <li>- Implement genomic analyses of marine organisms, including the systematic sampling of different microorganisms (viruses, bacteria, archaea, pico and micro-plankton), algae and invertebrate taxa;</li> <li>- Implement metagenomic studies of aquatic microbiomes and macrobiomes.</li> </ul>
<p><b>Cultivation of marine organisms</b></p>	<ul style="list-style-type: none"> <li>- Develop enabling technologies for culture and isolation of uncultivated microorganisms;</li> <li>- Develop innovative culture methods adapted to vertebrate or invertebrate cell lines for production of active compounds.</li> </ul>
<p><b>Bio-engineering of marine micro-organisms</b></p>	<ul style="list-style-type: none"> <li>- Optimise microalgal cultivation systems with respect to energy supply, productivity and cost;</li> </ul>

	<ul style="list-style-type: none"> <li>- <i>Develop innovative photobioreactors adapted to different species of interest and production sites;</i></li> <li>- <i>Promote research on the biorefinery approach based on microalgae production to develop a long-term alternative to petrochemistry.</i></li> </ul>
<b>Marine Model Organisms</b>	<ul style="list-style-type: none"> <li>- <i>Identify and prioritise new marine model organisms that are still not investigated in the tree of life and which are needed to fill critical knowledge gaps;</i></li> <li>- <i>Investigate identified marine model organism cultivation and perform genomic and chemical analysis.</i></li> </ul>

The **EC KBBE-NET Coordinated Working Group on Marine Biotechnology** (CWG-MB) made an inventory of ongoing and planned activities and fields of interest in Belgium, Denmark, France, Germany, Ireland, Norway, Turkey, United Kingdom which revealed substantial overlap in some areas and more scattered interests in others. Four specific areas of activity were identified as those most likely to benefit from a co-ordinated approach, giving possibilities for development on a fully-transeuropean scale. These are:

- Marine bioprospecting/biodiscovery
- Robust, biotechnology-based state of the art R&D tools and infrastructures tailored for marine biotechnology
- Molecular aquaculture
- Biomass production for bioenergy and fine chemicals

## Overview of key Marine Biotechnology Science Policy events and documents since 2000

Marine biotechnology is recognised as being central in delivering on the potential of the oceans to contribute to the sustainable delivery of food, energy and biomaterials, as well as to improvements in environmental and human health. Scientists, policy makers and industry representatives have contributed to the development of this vision for marine biotechnology.

Below is an overview of the most important documents and recent events highlighting the relevance of marine biotechnology and providing key recommendations and guidance on how to develop a thriving European marine biotechnology sector<sup>2</sup>.

- **2011-2013 – CSA MARINEBIOTECH**  
FP7 Coordination and Support action aiming to prepare the foundation for an ERA-NET in the area of marine biotechnology  
[www.marinebiotech.eu](http://www.marinebiotech.eu)
- **2012 –Communication from the European Commission on Blue Growth, opportunities for marine and maritime sustainable growth.**  
The Communication identified Marine Biotechnology as one of five areas where additional effort at EU level could stimulate long-term growth and jobs in the blue economy, in line with the objectives of the Europe 2020 strategy.  
[http://ec.europa.eu/maritimeaffairs/policy/blue\\_growth/documents/com\\_2012\\_494\\_en.pdf](http://ec.europa.eu/maritimeaffairs/policy/blue_growth/documents/com_2012_494_en.pdf)
- **2010 - Marine Board-ESF Position Paper 15: Marine Biotechnology: a New Vision and Strategy for Europe**  
([www.marineboard.eu/publications](http://www.marineboard.eu/publications))  
This paper calls for the development of a European marine biotechnology strategy. In doing so, it highlights the potential of marine biotechnology to impact Europe's economy and stresses the importance of including marine biotechnology topics in future Framework Programmes.
- **2009 - EU KBBE-net Coordinated Working Group on Marine Biotechnology (CWG-MB)**  
(<http://www.marine.ie/NR/rdonlyres/B8CD4BDE-FE7B-4218-AB2F-DEDFE5421F9D/0/CWGMbtoKBBEenreportdistributed.pdf>)

<sup>2</sup> Largely based on information overview available from the website of the Irish Marine Institute at <http://www.marine.ie/home/research/SeaChange/NationalMarineBiotechnology/Marine+Biotechnology+Policy+Initiatives.htm>

In this marine biotechnology scoping paper, EU member states identified marine research priorities to contribute to the structure of EU Framework Programme for Research and Technological Development.

- **2008 - “Blue Book”** from the EC-US Task Force on Biotechnology Research - Workshop - Principality of Monaco, 2008 ([http://ec.europa.eu/research/biotechnology/eu-us-task-force/index\\_en.cfm?pg=workshop\\_past](http://ec.europa.eu/research/biotechnology/eu-us-task-force/index_en.cfm?pg=workshop_past))  
Microbes play an important role in the marine and indeed global ecosystem. The importance of developing marine genomics expertise, including the need for research to strengthen Europe’s bioinformatics research capability was the focus of this Task Force meeting.
- **2007 - “The Bremen meeting”** of European marine biotechnology experts, hosted by the German EU presidency ([http://www.marine.ie/NR/rdonlyres/813867B4-C1B6-4259-BE06-7B25C62815BF/0/37bremenmarinebiotechnologyresearch\\_en.pdf](http://www.marine.ie/NR/rdonlyres/813867B4-C1B6-4259-BE06-7B25C62815BF/0/37bremenmarinebiotechnologyresearch_en.pdf))  
Led by the European Commission and attended by representatives from industry and Europe’s marine biotechnology research community, this meeting highlighted the importance of the EU Framework Programme in supporting marine biotechnology research and called for the development of a European marine biotechnology research strategy.
- **2006 - EC background paper no. 10 on Marine Biotechnology** (<http://www.marine.ie/NR/rdonlyres/C756DB2F-4A83-4E67-9C66-168A0EC17CCA/0/ECbackgroundpaperNo10onMarineBiotechnology2006.pdf>)  
This paper recognised the commercial potential of marine biotechnology research in the development of different industry sectors, such as agriculture, health, food products, process engineering, environment and energy. It identified a range of commercial applications that marine biotechnology would support, including: biodiscovery; improving the production of marine organisms; novel products - both food and feedstock; and uses in diagnostics and biosensor applications.
- **2005 – The CIRCA Report on Marine Biotechnology** ([http://www.marine.ie/NR/rdonlyres/9FC1F9CA-5B8A-4442-A273-9B0C2060DDFE/0/CIRCA\\_2004.pdf](http://www.marine.ie/NR/rdonlyres/9FC1F9CA-5B8A-4442-A273-9B0C2060DDFE/0/CIRCA_2004.pdf))  
An Irish funded study providing an overview of marine biotechnology and makes recommendations about how Ireland could develop capabilities in marine biotechnology.
- **2002 - US National Academy of Sciences published a report entitled Marine Biotechnology in the Twenty-first Century: Problems, Promise, and Products.**
- **2001 - ESF Marine Board Position Paper 4: A European Strategy for Marine Biotechnology** ([www.marineboard.eu/publications](http://www.marineboard.eu/publications))

Other (indirectly) relevant strategic documents which are relevant to Marine Biotechnology are

- **Europe 2020 - Europe’s economic growth strategy aiming at smart, inclusive and sustainable growth** [http://ec.europa.eu/europe2020/index\\_en.htm](http://ec.europa.eu/europe2020/index_en.htm)
- **Bio-economy 2020** - The European Commission adopted a strategy to shift the European economy towards greater and more sustainable use of renewable resources. The Commission's strategy and action plan, "Innovating for Sustainable Growth: a Bioeconomy for Europe", outlines a coherent, cross-sectoral and interdisciplinary approach to the issue. [http://ec.europa.eu/research/bioeconomy/press/press\\_packages/index\\_en.htm](http://ec.europa.eu/research/bioeconomy/press/press_packages/index_en.htm)
- **Innovation Union** [http://ec.europa.eu/research/innovation-union/index\\_en.cfm](http://ec.europa.eu/research/innovation-union/index_en.cfm)
- **Blue growth communication (2012)** - EC Communication which launches a process to stimulate the blue economy. Marine Biotechnology is one of five focal areas. [http://ec.europa.eu/maritimeaffairs/policy/blue\\_growth/index\\_en.htm](http://ec.europa.eu/maritimeaffairs/policy/blue_growth/index_en.htm)
- **European Strategy for Marine and Maritime Research from the European Commission (2008)** - The strategy among others highlights the need for marine biodiversity and biotechnology research and recognises their potential to contribute new knowledge for high value added products and processes. ([http://ec.europa.eu/research/press/2008/pdf/com\\_2008\\_534\\_en.pdf](http://ec.europa.eu/research/press/2008/pdf/com_2008_534_en.pdf))

## Major infrastructures coordination and support initiatives:

- **EC Expert Group on Marine Research Infrastructures (MRI)** - The MRI Experts group was set up by the European Commission to identify key MRI needs and gaps and to improve governance at EU level. A Final Report is available from the website  
<https://webgate.ec.europa.eu/maritimeforum/taxonomy/term/401>
- **European Marine Biological Resource Centre (EMBRC)** brings together 12 leading marine stations and EMBL to provide access to marine organisms (microbes, plants, animals) and newest techniques to the scientific community at large, including universities and industry. Medicines, blue energies (fuel made from algae) and many other end-products will be produced from the sea in the future, and EMBRC wishes to facilitate these discoveries.  
<http://www.embrc.eu/>
- **Eurofleets (Towards an alliance of European Research fleets)** is an FP7 Research Infrastructures Project aiming at bringing together the European research fleets to enhance their coordination and promote the cost effective use of their facilities.  
<http://www.eurofleets.eu/np4/home.html>
- **Association of European Marine biological Laboratories (ASSEMBLE)** is an FP7 Research Infrastructure Initiative comprising a network of marine research stations which aims to provide transnational access to a coastal marine ecosystems, research vessels, state-of-the-art experimental facilities and to a wide variety of marine organisms; either as research visits or by shipment. It also performs networking activities to enhance interoperability both within and outside of the ASSEMBLE network. This includes organizing workshops as well as establishing a virtual tool-box and a common database for marine organisms. Joint research is conducted to improve the provision of marine biological and/or ecological models with an emphasis on models for marine genomics.  
<http://assemblemarine.org/>

## Major science policy and coordination initiatives:

- **2011-2013 – CSA MARINEBIOTECH**  
FP7 Coordination and Support action aiming to prepare the foundation for an ERA-NET in the area of marine biotechnology  
[www.marinebiotech.eu](http://www.marinebiotech.eu)
- **The Knowledge Based Bio-Economy Network (KBBE-NET)** is a high-level expert group launched in 2006, with members from all EU Member States and Associated Countries to the Seventh Framework Programme (FP7). The main role of the KBBE-NET is to support the European Commission and EU Member States to achieve a coordinated approach for the development and implementation of a European research policy related to the Knowledge Based Bio-Economy (KBBE). It acts in coordination with the Standing Committee on Agricultural Research (SCAR).  
[http://ec.europa.eu/research/bioeconomy/policy/coordination/kbbe\\_net/index\\_en.htm](http://ec.europa.eu/research/bioeconomy/policy/coordination/kbbe_net/index_en.htm)
- **MarBef+** (completed in 2009) was an FP6 Network of Excellence (NoE) focused on marine biodiversity research funded by the European Union and consisting of 94 European marine institutes. The platform aimed to integrate and disseminate knowledge and expertise on marine biodiversity, with links to researchers, industry, stakeholders and the general public.  
<http://www.marbef.org>
- **Marine Genomics Europe (MGE)** was an FP6 Network of Excellence (NoE) composed of 44 institutions from 16 countries (within and outside Europe) focussing on research using genomic to study marine organisms. The overarching aim of Marine Genomics Europe was to promote, develop and spread throughout the European Union a broad range of genomic approaches, to investigate a wide range of questions related to the functioning of marine ecosystems and to the biology of marine organisms.  
<http://www.marine-genomics-europe.org/>
- **Marine Genomics for Users (MG4U)** is an FP7 coordination action which aims to facilitate knowledge transfer, technology transfer, and technology translation between high-throughput marine genomics, industry and society. Marine genomics has enormous potential to improve our lifestyles and prosperity, and to assist with governance and sustainable management of the marine environment. However, many end users of marine genomics knowledge are not yet aware of how marine genomics hold great potential for problem solving and

industrial commercial advantage. Valuable knowledge needs to be made accessible and disseminated in user friendly contexts. MG4U aims to spread results from recent and on-going projects in marine genomics and facilitate rapid, efficient knowledge transfer to generate interdisciplinary research capacity in Europe.

<http://www.mg4u.eu/>

- **EuroMarine** is a FP7 coordination and support action designed to bring together the three FP6 marine Networks of Excellence (NoE) communities; EUR-OCEANS, MarBEF and Marine Genomics Europe. In doing so, EuroMarine will provide a rich and diverse source of the best expertise and innovation available in European Marine Research, that can respond rapidly to societal needs, environmental demands, well-being and sustainability.  
[www.euromarineconsortium.eu](http://www.euromarineconsortium.eu)
- **European Federation for Biotechnologies (EFB)** is Europe's non-profit federation of National Biotechnology Associations, Learned Societies, Universities, Scientific Institutes, Biotech Companies and individual biotechnologists working to promote biotechnology throughout Europe and beyond. EFB has integrated the specific sector of marine biotechnology  
[www.efb-central.org/](http://www.efb-central.org/)
- **Joint Programming Initiatives**
  - o **Joint Programming Initiative Healthy and Productive Seas and Oceans (JPI-OCEANS)** is a coordinating and integrating platform of EU Member States and Associated Countries who invest in marine and maritime research. JPI Oceans will focus on making better and more efficient use of national research budgets, which represent 85% of the marine-maritime funding within Europe. One of the JPI's goals is to develop joint research programs in which countries can be involved on a voluntarily basis (variable geometry). Participating countries will also decide what contribution to make: this may include institutional, project-related or new funds. Among different cross-cutting topics identified by the JPI Oceans, particular attention will be paid to further advance in the development of marine biotechnologies for the discovery of new products, including new drugs and antibiotics derived from marine organisms. Therefore, it is expected that the JPI Oceans will have a main role on the development of new medical products to combat antimicrobial resistance. In this sense strong synergies will be generated between the JPI Oceans and the JPI The microbial challenges.  
[www.jpi-oceans.eu](http://www.jpi-oceans.eu)
  - o **Joint Programming Initiative on Agriculture Food Security and Climate Change (FACCE)**  
<http://www.faccejpi.com/>
  - o **Joint Programming Initiative on A Healthy Diet for a Healthy Life (HDHL)**  
<https://www.healthydietforhealthylife.eu/>
  - o **Joint Programming Initiative on Antimicrobial Resistance (AMR)**  
<http://www.jpiamr.eu/>
- **European Research Area Networks (ERA-NETs)**. There are a number of ERA-NETs which have relevance for Marine Biotechnology research and development. These include:
  - o **Seas-ERA (2010-2014)** is a partnership of the leading Marine RTD Funding Organizations in 18 countries aiming at coordinating national and regional marine RTD activities. While not the sole focus of the Seas-ERA Project, marine biotechnology has a role within their activities and identified as one of the high potential research areas of strategic importance for several of the European sea basins.  
<http://www.seas-era.eu/np4/homepage.html>
  - o **ERA-IB2** is an ERA-NET in industrial biotechnology (IB) involving 19 partners, which builds on the success of the FP6 project ERA-IB and develops the network further into a pan-European approach to IB R&D funding. ERA IB2 defines industrial biotechnology much in the same way as the CSA MarineBiotech defines marine biotechnology, as the toolbox of biotechnology used to solve industrial issues. The definition of ERA-IB2 does not exclude these industrial issues to be marine related, and as such, may include support to marine biotechnology research. However, the industrial area covered by ERA-IB2 is vast, and so far issues related to marine biotechnology have not been in focus for the calls that have been issued.  
<http://www.era-ib.net>

- **EurotransBio** is an international funding initiative supported by European program owners. It has established itself as the preferred funding instrument for small and medium sized enterprises (SMEs), collaborating in the area of modern biotechnology.  
<http://www.eurotransbio.eu/>
- **BIODIVERSA** is a network of national funding organisations promoting pan-European research that offers innovative opportunities for the conservation and sustainable management of biodiversity  
<http://www.biodiversa.org/>
- **ERASynBio - ERA-NET on Synthetic Biology**  
<http://www.erasynbio.eu/project>
- **SUSFOOD - ERA-NET on Sustainable Food Production**  
<http://www.susfood-era.net/>
- **SAFEFOOD ERA – European Excellence in food safety research programming**  
<http://www.safefoodera.net/>
- **ANIHWA – ERA-NET on Animal Health and Welfare**  
<http://www.anihwa.eu>
- **ERA ARD II – ERA-NET on Agricultural Research for Development**  
<http://www.era-ard.org>
- **ERASysBio - ERA-NET Plus on Systems Biology**  
<http://www.erasysbio.net/>
- **ERA-NanoSci ERA-NET on Nanosciences**
- **ERA-NET BIOENERGY**  
<http://www.eranetbioenergy.net/website/exec/front>
- **ERA-NET PLATFORM** is not an ERA-NET itself but, as the name suggests, a platform set up by ERA-IB-2 with and for ERA-Nets related to Industrial Biotechnology and innovative technologies, as well as the European Commission/DG Research and Innovation and the ETP SusChem/IB. The platform has the following objectives: (i) Exchange of information and experiences; (ii) Alignment of relevant activities; and (iii) Strengthen the collaboration between initiatives.  
<http://www.era-ib.net/era-net-platform>
- **European Technology Platforms (ETPs)** are industry-led stakeholder fora charged with defining research priorities in a broad range of technological areas. They are characterised by addressing challenging issues for growth, embodying major technological advances in the medium to long term, creating community added-value, involving high research intensity and requiring an European approach. They are driven by industry, compared with ERA-Nets, which are driven by research funding agencies. In the Knowledge-Based Bio-Economy (KBBE) sector, five ETPs of the total 9 are directly or indirectly relevant for marine biotechnology and utilisation of marine bioresources:
  - **Sustainable Chemistry Technology Platform (SusChem TP)** for industrial biotechnology
  - **European Biofuels Technology Platform (Biofuels TP)** has an Algae fuels task force
  - **European Aquaculture Technology and Innovation Platform (EATIP)**
  - **European Technology Platform ‘Food for Life’ (Food for Life TP)**
  - **European Technology Platform ‘Plants for the Future’ (Plant TP)** – many aspects applicable to marine algae
  - An ETP that grouped the biological platforms together, the **Bio-Economy Technology Platforms (BECOTEPS)**, has produced a final paper The European Bioeconomy in 2030, which is also relevant.

## Major Research initiatives:

- **Relevant EC FP6 Projects (see also Annex 2)**
  - **AQUABREEDING: Towards enhanced and sustainable use of genetics and breeding in the European aquaculture industry.**

- **AQUAFUNC:** Integrated knowledge on functional genomics in sustainable aquaculture.
  - **BIODIVERSA:** An ERA-Net in Biodiversity Research.
  - **ERATS:** Ecological risk-assessment of transgenic fish.
  - **FISH & CHIPS:** Towards DNA chip technology as a standard analytical tool for the identification of marine organisms in biodiversity and ecosystem science.
  - **HERMES:** Hotspot Ecosystem Research on the Margins of European Seas.
  - **MARBEF:** Marine biodiversity and ecosystem functioning.
  - **MARINE GENOMICS:** Implementation of high-throughput genomic approaches to investigate the functioning of marine ecosystems and the biology of marine organisms.
  - **SPONGES:** Sustainable production, Physiology, Oceanography, Natural products, Genetics and Economics of Sponges
- **Relevant EC FP7 Projects (see also Annex 3 and 4)**
- **ASSEMBLE:** Association of European marine biological laboratories.
  - **ELIXIR:** European Life-Science Infrastructure for Biological Information.
  - **EMBRC:** European Marine Biological Resource Centre.
  - **MAMBA:** Marine metagenomics for new biotechnological applications.
  - **MIDTAL:** Microarrays for the detection of toxic algae
  - **Pharmasea:** Innovative marine biodiscovery pipelines for novel industrial products
  - **BlueGenics:** Innovative marine biodiscovery pipelines for novel industrial products
  - **AQUATERRE: BIOMASS SUPPLY AND IMPACT -** Identification of optimal terrestrial and aquatic biomass and waste for Bioproducts
  - **BAMMBO:** Sustainable culture of marine microorganisms, algae and/or invertebrates for high added value products
  - **BIOCLEAN:** Biotechnological solutions for the degradation of synthetic polymeric materials (The Ocean of Tomorrow)
  - **GIAVAP:** Modification of marine or freshwater algae to better suit industrial applications
  - **KILL•SPILL:** Innovative biotechnologies for tackling oil spill disasters (The Ocean of Tomorrow)
  - **MACUMBA:** Improved cultivation efficiency of marine microorganisms
  - **MAGICPAH:** Molecular approaches to bioremediation of polyaromatic hydrocarbon compounds
  - **MAREX:** Novel marine bioactive compounds for European industries
  - **CSA MARINEBIOTECH:** Marine biotechnology ERA-NET preparatory action
  - **MARINEFUNGI:** Sustainable culture of marine microorganisms, algae and/or invertebrates for high added value products
  - **METAEXPLORE: ACTIVITY MINING IN METAGENOMES –** Exploring molecular microbial diversity in aquatic environment or the soil
  - **MG4U:** Learning from research projects: specific dissemination action to potential users in marine genomics
  - **MICRO B3:** Marine microbial diversity – new insights into marine ecosystems functioning and its biotechnological potential
  - **RADAR 125:** Innovative aquatic biosensors
  - **SEABIOTECH:** Innovative marine biodiscovery pipelines for novel industrial products
  - **SPECIAL:** Sustainable culture of marine microorganisms, algae and/or invertebrates for high added value products

- **SUNBIOPATH: Sustainable use of seas and oceans - Biomass from micro- and macro-algae for industrial**
- **ULIXES: Approaches towards bioremediation of the Mediterranean Sea by exploring its microbial diversity – SICA (Mediterranean Partner Countries)**
- **Relevant EUROCORES (being phased out)**
  - **Bio-inspired Engineering of Sensors, Actuators & Systems (EuroBioSas) – 2011-2014**  
<http://www.esf.org/index.php?id=6400>
  - **Synthetic Biology: Engineering Complex Biological Systems (EuroSYNBIO) – 2010-2013**  
<http://www.esf.org/activities/eurocores/running-programmes/eurosynbio.html>
  - **Ecological and Evolutionary Functional Genomics (EuroEEFG) – 2010-2013**  
<http://www.esf.org/activities/eurocores/running-programmes/euroeefg.html>
  - **Challenges of Biodiversity Science (EuroDIVERSITY) – 2006-2009**  
<http://www.esf.org/activities/eurocores/completed-programmes/eurodiversity.html>
  - **Ecosystem Functioning and Biodiversity in the Deep Sea (EuroDEEP) – 2007-2010**  
<http://www.esf.org/activities/eurocores/completed-programmes/eurodeep.html>

## Major observations, trends and future prospects:

Development of an **ERA-NET on Marine Biotechnology (MBT)** would clearly be an important factor to step up the cooperation and coordination of marine biotechnology research activities carried out at national or regional level in the Member States and Associated States. This should allow to stimulate the development of new strategies, policies and support programmes for marine biotechnology research and to better align those that exist already at the local, regional and national level. As such the ERA-NET should contribute significantly to realise the vision and strategy for Marine Biotechnology shared by the research community.

Considering the economic and social crisis in Europe, and notably the North-South gradient in the ability to fund national RTD projects, an ERA-NET is a necessary component of the future policy but might not be sufficient to keep national policies aligned during the next decade. Additional mechanisms should be discussed and the European Commission should keep a direct support to marine biotechnology research projects, in relation with health, food, energy and environmental policies. An important instrument to provide this support is the next European Framework Programme called Horizon 2020.

Boosting marine innovation through biotechnology-related activities is specifically mentioned in **Horizon 2020** under the priority 'Better Society'. In particular under the Challenge 'Food security, sustainable agriculture, marine and maritime research and the bio-economy', marine biotechnology is to support the development of sustainable approaches to further explore and exploit the large potential offered by marine biodiversity and aquatic biomass to bring new innovative processes, products and services on the markets with potential application for example in sectors including chemical, biochemical and material industries, pharmaceuticals, fisheries and aquaculture or energy and biofuels supply. Under the priority 'Competitive Industries', key enabling technologies in marine biotechnology will be further advanced for use in multiple sectors, industries and services using a new, technology-driven approach. At the heart of Horizon 2020 objectives will also be the need to develop cross cutting marine and maritime scientific and technological knowledge with a view to unlock the blue growth potential across the marine and maritime industries. This strategic coordinated approach for marine and maritime research across all challenges and pillars of Horizon 2020 will be key to support the implementation of relevant Union policies and to help deliver blue growth objectives.

On 13 February 2012, the Commission launched a new **European Bioeconomy Strategy** entitled *Innovating for Sustainable Growth: a Bioeconomy for Europe*<sup>3</sup> to stimulate the transition from a fossil-based economy to a sustainable bioeconomy in Europe, with research and innovation at its core. It puts forward a cross-sectoral and interdisciplinary approach to develop the European bioeconomy aimed to generate an added value and create new jobs via increased research funding for the bioeconomy under Horizon 2020 combined with the stronger innovation drive and reinforced policy interaction. As a high potential contributor to the European bioeconomy, marine biotechnology is likely to benefit substantially from these increased resources and additional strategic actions.

<sup>3</sup> Innovating for Sustainable Growth: a Bioeconomy for Europe – available at [http://ec.europa.eu/research/bioeconomy/press/press\\_packages/index\\_en.htm](http://ec.europa.eu/research/bioeconomy/press/press_packages/index_en.htm)

At the same time, the recent impetus from the European Commission to strengthen the European Blue Economy is likely to have a positive impact on the development of the European marine biotechnology sector. In its 2012 Communication on **Blue Growth**<sup>4</sup>, the European Commission identified Marine Biotechnology as one of five areas where additional effort at EU level could stimulate long-term growth and jobs in the blue economy, in line with the objectives of the Europe 2020 strategy. In its assessments to develop the blue economy, the Commission expects the blue biotechnology sector to develop on three phases. In the very short term, the sector is expected to emerge as a niche market focused on high-value products for the health and cosmetic sectors. By 2020, it would grow as a medium-sized market producing metabolites and primary compounds (lipids, sugars) as inputs for the food and feed processing industries. In a third stage, in around 15 years' time and subject to technological breakthroughs, the biotechnology sector could become a provider of mass product markets<sup>5</sup>.

A number of global activities are currently taking place which may provide additional visibility, support and/or framework conditions for marine biotechnology activities to grow. In particular, the recent work at the Organisation for Economic Co-operation and Development (OECD) Division for Science and Technology Policy may stimulate activities in countries around the world. OECD work in this area considers the twin tensions of ocean productivity and sustainability faced by those countries seeking to realise the potential of marine biotechnology. In its activities, the OECD aims to identify the potential of the field and the support required to realise that potential. It also explores the challenges, and possible next steps for policy development, to sustainable development, recognising the unique features of the marine environment and maximising the integrity and sustainability of that ecosystem for future generations.

Finally, with progress at various geographic scales and political levels of organisation, one of the main challenges will be to keep stock of these developments and ensure appropriate level of alignment, and integration where required, of the activities at the local, sub-national regional, national, macro-regional (sea basin level), pan-European and international level.

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- European Commission, COM(2012) 473 final, Green Paper on Marine Knowledge 2020 - from seabed mapping to ocean forecasting, Brussels, 29.8.2012 - available at <http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=COM:2012:0473:FIN:EN:PDF>
- Calewaert, J.-B.; Dixon, B.; Jaspers, M.; McDonough, N. (2011). A new dawn for marine biotechnology in Europe *Biotechnol. Adv.* 29(5): 453-456.
- European Commission, COM(2012) 494 final, Blue Growth - opportunities for marine and maritime sustainable growth, Brussels, 13.9.2012 - available at [http://ec.europa.eu/maritimeaffairs/policy/blue\\_growth/documents/com\\_2012\\_494\\_en.pdf](http://ec.europa.eu/maritimeaffairs/policy/blue_growth/documents/com_2012_494_en.pdf)
- Marine Board Position Paper 15 Marine Biotechnology: A New Vision and Strategy for Europe
- EC Collaborative Working Group on Marine Biotechnology (CWG-MB) Scoping paper – available at [http://ec.europa.eu/research/bioeconomy/pdf/cwg-mb\\_to\\_kbbenet\\_report\\_final.pdf](http://ec.europa.eu/research/bioeconomy/pdf/cwg-mb_to_kbbenet_report_final.pdf)
- Various EC Interim Catalogues of FP Projects, among others on Marine and Biotechnology research available at <http://ec.europa.eu/research> - for Theme to [http://ec.europa.eu/research/bioeconomy/pdf/cwg-mb\\_to\\_kbbenet\\_report\\_final.pdf](http://ec.europa.eu/research/bioeconomy/pdf/cwg-mb_to_kbbenet_report_final.pdf)
- DG MARE ATLAS of the Sea - available at [http://ec.europa.eu/maritimeaffairs/atlas/index\\_en.htm](http://ec.europa.eu/maritimeaffairs/atlas/index_en.htm)

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<sup>4</sup> Blue Growth, Opportunities for marine and maritime sustainable growth – available at [http://ec.europa.eu/maritimeaffairs/policy/blue\\_growth/documents/com\\_2012\\_494\\_en.pdf](http://ec.europa.eu/maritimeaffairs/policy/blue_growth/documents/com_2012_494_en.pdf)

<sup>5</sup> Marine Biotechnology in the European Research Area: Challenges and Opportunities for Europe. Book of Abstracts. Final CSA MarineBiotech conference. Royal Flemish Academy of Belgium for Science and the Arts, Brussels, Belgium, 11-12 March 2013. VLIZ Special Publication 64. Available from [www.marinebiotech.eu/conference](http://www.marinebiotech.eu/conference)

- Marine Biotechnology in the European Research Area: Challenges and Opportunities for Europe. Book of Abstracts. Final CSA MarineBiotech conference. Royal Flemish Academy of Belgium for Science and the Arts, Brussels, Belgium, 11-12 March 2013. VLIZ Special Publication 64. Available from [www.marinebiotech.eu/conference](http://www.marinebiotech.eu/conference)

# **European Regional Sea Basins**

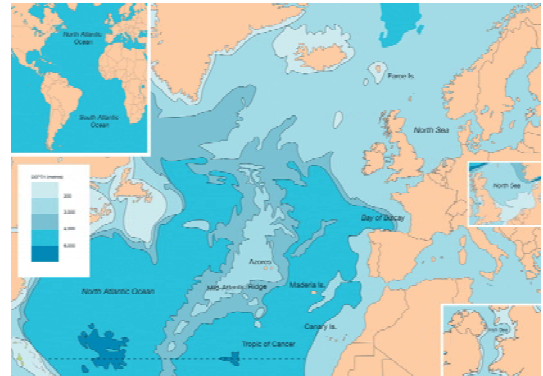
# Atlantic Sea Basin

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## Situation<sup>6</sup>

The European Atlantic Sea Basin contains a range of diverse habitats from semi-enclosed seas (North Sea and Irish Sea), exposed bay (Bay of Biscay) to the open Atlantic Ocean. Its coastline is equally varied and includes indented rocky coastlines, sandy beaches and sheltered estuarine mudflats.

The European Atlantic Sea Basin includes the sea surface, the water column and seabed off the European Atlantic coastline (including North Sea and the Irish Sea) extending westwards to include the OSPAR wider Atlantic region and the participating countries Exclusive Economic Zone (EEZ) and extended Continental Shelves. It also includes the maritime territories surrounding the Canary Islands, the Azores and Madeira.



The area is richly endowed with Centres of Excellence in science, technology and innovation, has a strong engineering base, a stable political and governance system and many knowledge based SMEs. Together this represents a unique opportunity to work together to add value to the existing resource base and develop new knowledge-based and globally traded products and services that will invigorate the local population and improve their quality of life.

## Overarching regional science strategies, plans and policies:

Currently, an Atlantic macro-regional strategy is being developed which may provide a wider framework for regional collaboration to address common goals, among other on science and technology matters also in the area of marine biotechnology research and development.

## Research Funding Schemes and Programmes:

At regional level, the main funding comes from the European Regional Development Fund (ERDF)<sup>7</sup>, among others via various Interreg Programmes that aim to stimulate cooperation between regions in the European Union. The current Programme is Interreg IV, covering the period 2007–2013.

## Research priorities<sup>8</sup>:

The European Atlantic is well placed geographically to maximise the potential of marine biotechnology. A long standing maritime heritage; an acknowledged competence in marine sciences; extensive marine territories comprising highly diverse marine habitats (including the deep ocean) represent opportunities to collaborate on the development and commercial exploitation of marine bio-resources.

In the Atlantic, marine biotechnology is already contributing to almost every industry sector, from healthcare to environmental bioremediation, from cosmetics to food and including novel advanced materials with industrial applications. The as yet largely untapped resources of the marine environment are very promising for the discovery of new enzymes, biomaterials, biopolymers, and other related products such as bio-pharmaceuticals and nutraceuticals, filling the gap for novelty demanded by industry in order to maintain a competitive position in global markets.

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<sup>6</sup> The geographic coverage of the Atlantic Sea Basin of the CSA MarineBiotech landscape profiling is that of the SEAS-ERA project.

<sup>7</sup> See [http://ec.europa.eu/regional\\_policy/thefunds/regional/index\\_en.cfm](http://ec.europa.eu/regional_policy/thefunds/regional/index_en.cfm)

<sup>8</sup> Based on the Seas-ERA ([www.seas-era.eu](http://www.seas-era.eu)) Atlantic Sea Basin Strategic Research Agenda (SRA)

### **Indicative research issues of high importance for the Atlantic Sea Basin**

1. Molecular biology investigation in life science- Genomic and meta-genomic analysis of systematically sampled marine organisms, including microorganisms (i.e. bacteria, viruses, archaea, pico and microplankton), algae and invertebrates;
2. Cultivation of marine organisms and cell lines- Development of technologies to isolate and culture previously uncultivated microorganisms. Develop culture methods for vertebrates and invertebrate cell lines for the production of active compounds;
3. Bio-mass production-Development and application of new effective systems, including bio-engineering, bio-reactors and cultivation systems, for the production, use and transformation of biomass from marine organisms. The production systems and the organisms are optimized to target specific applications (e.g. bio-refinery, aquaculture, etc.);
4. Marine model organisms – Identify and prioritise new organisms of marine origin to increase life science knowledge and provide new opportunities for biotechnological exploitation;
5. Production of biofuel from marine algae.

### **Strategic documents:**

- Seas-ERA Atlantic Strategic Research Agenda  
<http://www.seas-era.eu/np4/19.html>

### **Infrastructures and coordination and support capacities / initiatives:**

There are a number of infrastructures, support capacities and major initiatives relevant for marine biotechnology research and development in the individual countries of the Atlantic Sea Basin area, there are no major efforts or capacities organised at the regional level at this time.

### **Major observations, trends and future prospects:**

One of the main current science policy developments at this moment involves the development and implementation of an EU Strategy for the Atlantic Region (EUSA) and associated Action Plan. Several Macro-Regions are being identified throughout the European territory, covering large areas across national borders. The EU Strategies for the Baltic Sea Region and for the Danube Region have already been developed (adopted in October 2009 and starting implementation in June 2011 respectively). The EUSA aims to provide a strategic framework and action plan to foster better cohesion at the level of the Union by working on overall coordination of actions across a range of policy areas. Science, research and Development, including management of research infrastructures, is clearly a policy area which will benefit from more coherent regional approaches as well as stimulating technology transfer and innovation and this will likely make a significant contribution which will also shape regional marine biotechnology activities.

# Baltic Sea Basin

## Situation

The Baltic Sea is one of largest semi-enclosed bodies of brackish water in the world. Its shape, location and history have crucially influenced its present hydrological and biological features, in turn making it very sensitive to pollution and overuse. Geographically the Baltic Sea is a longitudinally stretched sea, divided into sub-basins with specific conditions, a diverse coastline and plenty of islands. It is almost entirely land-locked (surrounded by nine countries) with very limited water exchange with the ocean via Kattegat and the Danish Straits and with great riverine input. As a result, the water residence time is typically 25–30 years. Also striking is the fact that, compared to many other coastal areas, the Baltic Sea is almost entirely lacking recurrent tides.

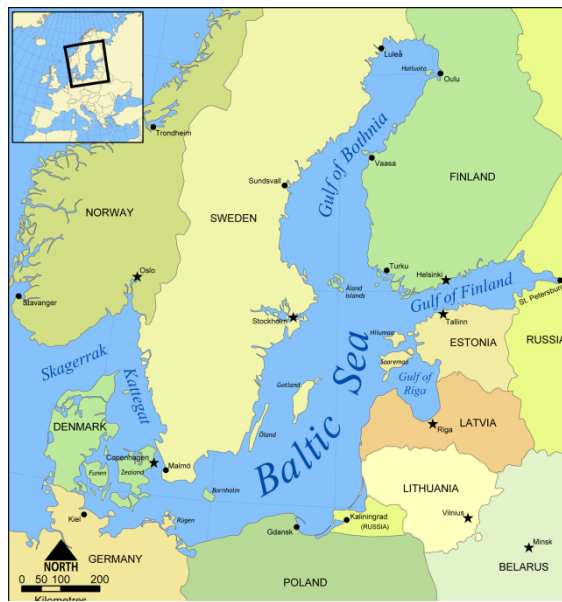
As highlighted by the SUBMARINER Project<sup>9</sup>, there is no commonly accepted definition of the Baltic Sea Region (BSR). Its practical delimitation is based on functional relations, intensity of cooperation and interactions, as well as the nature of the problems requiring joint transnational action. Defining criteria may vary depending on the organisations and their purposes: they may be natural criteria such as catchment area (e.g. used by HELCOM), socioeconomic ones like the intensity of trade or migration, administrative or political ones such as membership in Baltic organisations (e.g. used by the Baltic Development Forum, the Council of the Baltic Sea States or the Baltic Sea Region Programme), spatial ones (e.g. used by VASAB) or cultural, historical and ethnic criteria like self-determination or common culture or values.

The Baltic is faced with serious marine environment problems related to the accumulation of industrial and urban waste carried by waterways or discharged directly into its waters. Its populated shores feature many growing industrial centres, particularly in Russia. These phenomena come on top of eutrophication of poorly renewed waters, overexploitation of key fish stocks and contamination of fish by dioxin and heavy metals. The Baltic Sea has 86 protected marine areas that add up to 29 000 km<sup>2</sup> or 6.5% of its total surface area (Kattegat included). Twenty-five other sites, in the planning stages, will bring this figure to 9.7%.

## Overarching regional science strategies, plans and policies:

At this stage there is no specific BSR Strategy for marine biotechnology but there are growing calls from the scientific and industry communities to develop one based on the huge potential from the available biological, human and infrastructure resources in the area (see also below for future prospects).

Despite different perspectives on its identity, the Baltic Sea Region is a well-established functional macro-region with a long tradition of multilateral collaborations at political and scientific level. This includes pioneering work by the Joint Baltic Sea Research and Development Programme (BONUS)<sup>10</sup> in support of scientific research and the HELCOM, an intergovernmental organisation of the nine Baltic coastal countries and the EU aimed at protecting the Baltic marine environment from all sources of pollution. These and other positive regional experiences have evolved and found expression in the EU Strategy for the Baltic Sea Region (EUSBSR)<sup>11</sup>, the first EU macro-regional strategy for one of the Sea Basins.



Source: Norman Einstein

<sup>9</sup> <http://www.submariner-project.eu/>

<sup>10</sup> [http://www.bonusportal.org/about\\_bonus](http://www.bonusportal.org/about_bonus)

<sup>11</sup> <http://www.balticsea-region-strategy.eu/>

## Research Funding Schemes and Programmes:

There are no specific regional research funding schemes or programmes specifically targeting marine biotechnology at this stage. However, marine biotechnology activities can be funded by a wide range of instruments including for research, innovation and economic development. Below is a list of some of the more well-known schemes but this list is not exhaustive by all means.

- Joint Baltic Sea Research and Development Programme (Bonus) Program  
<http://www.bonusportal.org/>
- Baltic Sea Region Stars Programme. The BSR Stars Programme aims to speed up innovation in the Baltic Sea Region through transnational cooperation to strengthen competitiveness and sustainable growth. The BSR Stars programme is a framework programme (2010-2020) within the EU macro-regional strategy and the ambition is to add on financial instruments to further develop the BSR Stars programme.  
<http://www.bsrstars.se/>
- European Territorial cooperation programmes - transnational programme
  - o Baltic Sea Region Programme (former Interreg IVB) aims to strengthen development towards a sustainable, competitive and territorially integrated Baltic Sea region by connecting potentials over the borders.  
<http://eu.baltic.net/>
- European Territorial cooperation programmes - cross-border cooperation programmes
  - o Latvia–Lithuania Cross Border Cooperation Programme (2007–2013) aims to promote sustainable and equal socio-economic development in border regions to make it competitive for economical and business development and attractive for living and visiting.  
[www.latlit.eu](http://www.latlit.eu)
  - o Estonia–Latvia Cross Border Cooperation Programme (2007–2013) aims to promote sustainable development and economic competitiveness of the Programme area through achieving an integrated and cross-border approach to economic, social and environmental development in ways, which involve and benefit local people and communities.  
[www.estlat.eu](http://www.estlat.eu)
  - o Lithuania–Poland Cross-Border Cooperation Programme (2007–2013) aims to foster the sustainable development of the border region through enhanced economic, social and territorial cohesion of the areas on both sides of the border.  
[www.lietuva-polska.eu](http://www.lietuva-polska.eu)
  - o South Baltic Cross-Border Cooperation Programme (2007–2013) aims to strengthen the sustainable development of the South Baltic area through joint actions increasing its competitiveness and enhancing integration among people and institutions.  
<http://en.southbaltic.eu>
  - o Cross-Border Cooperation Programme "North" (2007–2013) aims to strengthen the competitiveness and cohesion of the region.  
[www.bd.lst.se](http://www.bd.lst.se)
  - o Cross-Border Cooperation Programme "Botnia-Atlantica" (2007–2013) aims to strengthen the east-west dimension and contribute to increased integration and cooperation for stronger economic growth and sustainable development.  
[www.botnia-atlantica.eu](http://www.botnia-atlantica.eu)
  - o Cross-Border Cooperation Programme "Sweden - Norway" (2007–2013) aims to strengthen the attractiveness and competitiveness of the region through cross-border cooperation for the benefit of the local people and communities.  
<http://www.interreg-sverige-norge.com/>
  - o Cross-Border Cooperation Programme "Öresund - Kattegatt - Skagerrak" (2007–2013) aims to create a region which is attractive and competitive, and characterised by knowledge-based cooperation and sustainable development.  
<http://www.interreg-oks.eu/se>

- Cross-Border Cooperation Programme "Poland - Czech Republic" (2007–2013) aims to address these key issues and remove existing barriers that prevent the border area from being competitive and hinder integration of the area from the economic and social points of view.  
<http://www.mrr.gov.pl/English/Strony/default.aspx>
- Cross-Border Cooperation Programme "Germany (Saxony) - Czech Republic" (2007–2013) aims to promote sustainable development and economic competitiveness of the German-Czech border region through an integrated, cross-border approach to economic, social, and environmental development that involves and benefits local residents and their communities.  
<http://www.sachsen.de/>
- Cross-Border Cooperation Programme "Slovakia - Czech Republic" (2007–2013) aims to support joint development of the region within the common Schengen area by increasing cohesion and convergence of the cross border region.  
<http://www.build.gov.sk/mvrrsr/index.php>
- Cross-Border Cooperation Programme "Poland - Slovakia" (2007–2013) aims to use a partnership approach to intensify Polish-Slovak cooperation and support the sustainable development of the border region with improvements to cross-border infrastructure, support for socio-economic, environmental and cultural development, and implementation of micro projects based on people-to-people actions.  
<http://www.mrr.gov.pl/English/Strony/default.aspx>
- Cross-Border Cooperation Programme "Poland - Germany (Saxony)" (2007–2013) aims to promote the sustainable development and economic competitiveness of the German-Polish border region.  
<http://www.sachsen.de/>
- Cross-Border Cooperation Programme "Poland (Lubuskie) - Germany (Brandenburg)" (2007–2013) aims to promote sustainable development and economic competitiveness of the German-Polish border region through an integrated, cross-border approach to economic and social development that involves and benefits local residents and their communities.  
<http://www.mrr.gov.pl/English/Strony/default.aspx>
- Cross-Border Cooperation Programme "Poland (Zachodniopomorskie) - Germany (Mecklenburg-Vorpommern and Brandenburg)" (2007–2013) aims to contribute to the equal and balanced development of the cross-border area by strengthening links between citizens, businesses and institutions.  
<http://www.regierung-mv.de>
- Cross-Border Cooperation Programme "Syddanmark - Schleswig - K.E.R.N." (2007–2013) aims to help the cross-border area become an active player in the global market-place. The focus is on improving the area's attractiveness and further strengthening the cross-border cooperation that was developed under previous programming periods.  
<http://www.regionsyddanmark.dk>
- Cross-Border Cooperation Programme "Denmark - Germany" (2007–2013) (Fehmarnbelt Region Sjælland - Ostholstein-Lübeck-Plön) aims to turn the Baltic Sea space into a functional maritime region, thereby improving the attractiveness and the economic position of the Programme area along the Hamburg-Copenhagen/Malmö axis.  
<http://www.fehmarnbeltregion.net/de/main/index.php>
- European Territorial cooperation programmes - interregional programmes
  - INTERREG IVC (2007 – 2013) aims to improve, by means of interregional cooperation, the effectiveness of regional development policies in the areas of innovation, the knowledge economy, the environment and risk prevention as well as to contribute to economic modernisation and increased competitiveness of Europe.  
[www.interreg4c.net](http://www.interreg4c.net)
  - Urban Development Network Programme URBACT II (2007–2013) aims to improve the effectiveness of sustainable integrated urban development policies in Europe with a view to implementing the Lisbon-Gothenburg Strategy.  
[www.urbact.eu](http://www.urbact.eu)

- ESPON Programme (2007-2013) aims to support policy development in relation to the aim of territorial cohesion and a harmonious development of the European territory.  
[http://www.espon.eu/main/Menu\\_Programme/](http://www.espon.eu/main/Menu_Programme/)
- External border cooperation programmes within European Neighbourhood and Partnership Instrument
  - Estonia–Latvia–Russia Cross Border Cooperation Programme (2007–2013) within European Neighbourhood and Partnership Instrument aims to promote joint development activities for the improvement of the region’s competitiveness by utilising its potential and beneficial location in the cross roads between the EU and Russian Federation.  
[www.estlatus.eu](http://www.estlatus.eu)
  - Latvia–Lithuania–Belarus Cross Border Cooperation Programme (2007–2013) within European Neighbourhood Partnership Instrument aims to enhance the territorial cohesion of the Latvian, Lithuanian and Belarus border region, secure a high level of environmental protection and provide for economic and social welfare as well as promote intercultural dialogue and cultural diversity.  
[www.enpi-cbc.eu](http://www.enpi-cbc.eu)
  - Lithuania–Poland–Russia Cross-border Cooperation Programme (2007-2013) within European Neighbourhood and Partnership Instrument aims to promoting economic and social development on both sides of the common border; working together to address common challenges and common problems; promoting people to people co-operation.  
[www.cpe.gov.pl](http://www.cpe.gov.pl)
  - Kolarctic - Russia Cross-border Cooperation Programme (2007-2013) within European Neighbourhood and Partnership Instrument aims to reduce the periphery of the countries’ border regions and its related problems as well as to promote multilateral cross-border co-operation.  
<http://www.kolarcticenpi.info>
  - Karelia - Russia Cross-border Cooperation Programme (2007-2013) within European Neighbourhood and Partnership Instrument aims to increase well-being in the programme area through cross-border cooperation.  
<http://www.kareliaenpi.eu>
  - South East Finland - Russia Cross-border Cooperation Programme (2007-2013) within European Neighbourhood and Partnership Instrument to promote the position of the programme area as an integrated economic zone and a centre for transportation and logistics in order to strengthen its competitiveness and attractiveness to investors, and to improve the state of the environment and the standard of living and welfare of its citizens.  
<http://www.southeastfinrusnpi.fi/>

## Research priorities: n\

## Strategic documents:

- The EU Strategy for the Baltic Sea Region (EUSBSR), the first Macro Regional Strategy in Europe , adopted by the European Council at the end of October 2009 during the Swedish Presidency of the EU. The Baltic countries have united to develop this common Strategy aimed at overcoming environmental problems, but also to increase the region's competitiveness and prosperity.  
<http://www.balticsea-region-strategy.eu/>
- HELCOM Baltic Sea Action Plan  
[http://www.helcom.fi/BSAP/en\\_GB/intro/](http://www.helcom.fi/BSAP/en_GB/intro/)
- Baltic Development Forum: Going for Green Growth in the Baltic Sea - Policy Recommendations for Regional Co-operation  
[http://www.bdforum.org/cmsystem/wp-content/uploads/files/thematic\\_reports\\_going\\_green\\_growth\\_bsr\\_2010.pdf](http://www.bdforum.org/cmsystem/wp-content/uploads/files/thematic_reports_going_green_growth_bsr_2010.pdf)
- BONUS Strategic Research Agenda  
[http://www.bonusportal.org/bonus\\_2010-2016/strategic\\_research\\_agenda](http://www.bonusportal.org/bonus_2010-2016/strategic_research_agenda)

- Vision and Strategies around the Baltic Sea (VASAB) Long Term Perspective  
[http://www.vasab.org/conference/upload/dokumenti/vasab\\_ltp\\_final.pdf](http://www.vasab.org/conference/upload/dokumenti/vasab_ltp_final.pdf)
- Creating a Coherent Framework for Baltic Sea Cooperation Report from the Council of the Baltic Sea States (CBSS). CBSS is an overall political forum for regional inter-governmental cooperation. The Members of the Council are the eleven states of the Baltic Sea Region as well as the European Commission. The states are Denmark, Estonia, Finland, Germany, Iceland, Latvia, Lithuania, Norway, Poland, Russia, Sweden and a representative from the European Commission.  
<http://www.cbss.org/CBSS-The-Council/the-council>
- SUBMARINER BSR Roadmap ( to be published by fall 2013)  
<http://www.submariner-project.eu/>

## Infrastructures and coordination and support capacities / initiatives:

- ScanBalt® fmba (in short ScanBalt) is the organisation for the Baltic Sea or Nordic-Baltic Region's Health and Bio Economy community, named ScanBalt BioRegion. ScanBalt is a not-for-profit member association which serves as a service provider for the members and promotes the development of ScanBalt BioRegion as a globally competitive macro-region and innovation market. The aims of the regions and the regional networks constitute the basis for ScanBalt. ScanBalt acts according to a shared vision for ScanBalt BioRegion. ScanBalt has a return of investment by the members of more than 15 to 1 since 2001.  
<http://www.scanbalt.org/>

## Major Initiatives:

- EU Baltic Sea Region Program Project SUBMARINER – Sustainable Uses of Baltic Marine Resources. The SUBMARINER Network has been accepted as a new flagship project under the Priority Area “Innovation” of the revised Action Plan of the EU Strategy for the Baltic Sea Region (EUSBSR). It aims to be a transnational umbrella for future actions in the field of sustainable and innovative uses of Baltic marine resources. Based on the SUBMARINER Roadmap (to be published in early fall 2013), the Network will coordinate implementation of specific actions and ensure communication between projects and initiatives.  
<http://www.submariner-project.eu/>

## Major observations, trends and future prospects<sup>12</sup>:

In the Baltic Sea Region Blue Biotechnology has thus far not played a major role even though its marine organisms provide a great potential for exploration, with the added advantage of easier and thus more cost-efficient access and clearer legal conditions. The potential for development and wide implementation is particularly high in the Baltic, based on the existing expertise as well as the biotechnology equipment already present available in the region, which merely has to be put to use for the exploration from marine organisms. What is more: the Baltic Sea Region shows a great tradition in pursuing transnational cooperative strategies, which is a core requirement for turning Blue Biotechnology research into marketable applications.

A dedicated strategy for marine biotechnology research in the Baltic would allow for turning regional disparities into advantages, using laboratories in the new Eastern Baltic Sea countries while developing close links with the big pharmaceutical industry based more in the Western Baltic Sea region. Amplified coordination between potential contributing partners in the region would have substantial positive effects on scientific productivity, international success, foundation of new companies and growth of existing companies, financial support of investors, employment and most importantly contribute towards improved human health and environmental conditions of the Baltic Sea.

Hence, what is needed is a focused region-wide strategy for the implementation of Blue Biotechnology in the Baltic Sea area which is aligned with EU and international level developments. The strategy should be based on national action plans which take into account the respective strength of institutions and experts in the individual countries while also responding to most urgent market needs. Based on such a strategy a sequence of transnational priority

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- <sup>12</sup> Based largely on the finding in the SUBMARINER Compendium available at [http://www.submariner-project.eu/index.php?option=com\\_content&view=article&id=87&Itemid=224](http://www.submariner-project.eu/index.php?option=com_content&view=article&id=87&Itemid=224)

actions could be initiated such as the establishment of a “Baltic Sea Region Blue Biotechnology Network”, a centre for bioprospecting of Baltic Sea microorganisms or a distribution network for cosmetics, health care and wellness products using a Baltic Sea Region label, the scaling up of marine genomics as a source of novel enzymes from the Baltic Sea or the advancement of innovative marine technologies stemming from the region. The ongoing success of the ScanBalt network for the last ten years has shown that the BSR is well placed not only to develop but also to implement such kind of strategy.

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#### **Sources**

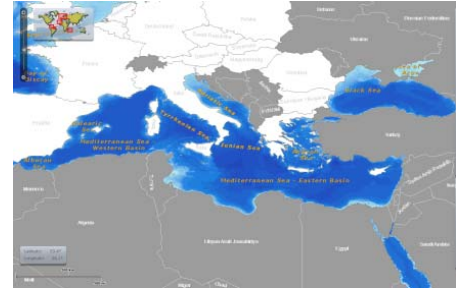
- European Atlas of Seas ([http://ec.europa.eu/maritimeaffairs/atlas/seabasins/balticsea/long/index\\_en.htm](http://ec.europa.eu/maritimeaffairs/atlas/seabasins/balticsea/long/index_en.htm))
- SUBMARINER Compendium ([http://www.submariner-project.eu/index.php?option=com\\_content&view=article&id=87&Itemid=224](http://www.submariner-project.eu/index.php?option=com_content&view=article&id=87&Itemid=224))
- Perspectives from the SUBMARINER Blue Biotechnology Cooperation Event, Kiel, Germany (9-10 May 2012) – Blue Biotechnology in the Baltic Sea Region: New Strategies and Future Perspectives (available from [http://im.gda.pl/images/Aktualnosci/blue\\_bio\\_magazine\\_web.pdf](http://im.gda.pl/images/Aktualnosci/blue_bio_magazine_web.pdf))

# Mediterranean Sea Basin

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## Situation

The Mediterranean Sea is a semi-enclosed basin with high temperature and salinity, and decreasing freshwater due to dams and river diversions. The Mediterranean Sea has unique characteristics as it communicates and is being affected by three seas and oceans with very diverse features: the Atlantic Ocean to the west, the Black Sea to the north-east and the Red Sea through the Suez Canal to the southeast. It is characterized by a combination of coastal and open sea dynamics and has been often referred to as a “miniature ocean” and a “physical laboratory” for marine environmental research.



The Mediterranean basin is ca. 3,680 km long with an average width of 700 km and is divided into the Western and Eastern basins, which are separated by the straits of Sicily. The Western basin (mean depth, ca. 1,600 m) consists of two deep basins: the Algero-Provençal basin and the Tyrrhenian Sea. The Eastern Mediterranean includes the Ionian, Adriatic and Aegean Seas, and the Levantine basin.

The principal traits of this semi-enclosed ‘miniature ocean’ can be summarized as:

- (i) limited freshwater inputs;
- (ii) microtidal regime;
- (iii) high oxygen concentrations;
- (iv) high deep-sea temperature (always above 12.8°C); and
- (v) oligotrophic conditions with low nutrient concentrations which typically decrease eastward.

Given its unique characteristics, changes in the world ocean affect the Mediterranean sooner than the world ocean itself. While the Mediterranean is very *diverse* in habitats and rich in biodiversity, it is a sensitive area with a highly stressed ecosystem which requires particular attention to protect the unique marine genetic resources.

Being a shared sea between European, North African and Middle East countries, the Mediterranean is an area of strong cultural, societal and economic gradients. Nevertheless, there is a strong Mediterranean heritage that acts as catalyst and transforms these gradients into opportunities rather than barriers. This is also the case for Marine Sciences which, despite important differences of capacities between countries, has always played an integrating role and promoted the regional cooperation in the Mediterranean Sea. Important stakeholders in this process are the regional commissions and conventions and the national research performing organizations (RPO) that have in some cases organized *regional associations* namely: CIESM (the intergovernmental science commission that works through committees, organizes workshops and conferences and publishes reports), UNEP/MAP (that supports the implementation of the Barcelona Convention for Environmental Protection), RAC/SPA (the Regional Activity Centre for Specially Protected Areas established by the Contracting Parties to the Barcelona Convention and its Protocols in order to assist Mediterranean countries in implementing the Protocol concerning Specially Protected Areas and Biological Diversity in the Mediterranean), MedGOOS (the regional alliance of the IOC GOOS program for ocean observations) and MOON (the Mediterranean component of EuroGOOS for the development of operational oceanography).

## Overarching regional science strategies, plans and policies:

There is currently no overarching regional science strategy or plan specifically focusing on marine biotechnology research and development. General marine science issues are considered by organisations such as CIESM and projects such as the SEAS-ERA Project.

## Research priorities<sup>13</sup>:

The recently published Marine Board position paper "Marine Biotechnology: A New Vision and Strategy for Europe" sets out a science and policy agenda for the next decade in this field and highlights pharmaceuticals as one of the main priorities for *Securing human health and wellbeing* in Europe. According to this report the other priorities in Europe in the field of marine biotechnology are the following: *Sustainable supply of high quality and healthy food, Sustainable alternative sources of energy, and Securing environmental health...*

For the SEAS-ERA Mediterranean SRA the priorities should be similar but due to some of the unique features of the Mediterranean (the Mediterranean is considered one of the 25 hot spots for global marine biodiversity with between 4% and 18% of the world marine species), some fields of research may have greater potential development compared to others. This has been taken into consideration in setting up the following priorities and also the research interests of the wider Mediterranean science community.

### 1. Bioprospecting for Marine Drugs and Fine Chemicals

Great biodiversity implies great chemical diversity. The Mediterranean with its high biodiversity in terms of species and habitats represents a huge potential source of new drugs, innovative treatments and diagnostic tools for human health and well-being (including pharmaceuticals, nutraceuticals and dietary integrators). Bioprospecting for Marine Drugs and Fine Chemicals should therefore be considered one of the major priorities for Marine Biotechnology within the Seas-ERA Net Mediterranean agenda with a focus on basic research (taxonomy, systematics, physiology, molecular genetics and chemical ecology) of marine species to increase chances of success in finding novel biologically active compounds as pharmaceuticals and health care products (including cosmetics) and industrial products and processes. In the Mediterranean Sea, the majority of bioactive (antibacterial, antiviral, cytotoxic or antifouling) molecules until now have been isolated from benthic species: algae and, particularly, animals such as sponges, bryozoans, echinoderms, ascidians and mollusks. For example, aplidine, a compound derived from the Mediterranean ascidian *Aplidium albicans* has been shown to be a powerful anticancer agent and is currently in clinical trials for a variety of cancers. But there is also great potential of finding new compounds from other marine sources such as microalgae and microbes that have been relatively unexplored until now. In addition to applications concerning human health, there is also great interest in discovering natural additives in foods, vitamins, oils, antioxidants and cofactors which enhance general well-being. Current high value chemical markets from marine organisms are focused on a limited number of high value chemicals such as carotenoids due to their high market value were projected to reach 77,000 million Euro in 2010. Finally, there is interest in discovering new enzymes, biopolymers and biomaterials for industrial applications.

### 2. Technologies to Increase Sustainability of Aquaculture Production

The growing demand for marine food will need to be increasingly delivered through intensive aquaculture especially in the Mediterranean where sea food is part of the traditional diet of most countries and is at the basis of what has become known world-wide as the "Mediterranean diet". Commercial aquaculture continues to face challenges in understanding and controlling reproduction, early life-stage development, growth, nutrition, disease and animal health management and environmental interactions and sustainability. Hence, the Seas-ERA Net Mediterranean agenda should promote technologies to increase sustainability of aquaculture production, including alternative preventive and therapeutic measures to enhance environmental welfare, sustainable production technologies for feed supply, and zero-waste recirculation systems.

### 3. Biofuels from Micro- and Macroalgae

There are many examples of the production of bio-energy from marine organisms, but Production of Biofuels from Micro- and Macroalgae perhaps represents one of the most promising options to harvest this huge energy potential. Microalgae (e.g. Chlorella) are renewable and there is no damage to the environment. Biomass can be converted by bacteria and microalgae to fuels such as methane and biodiesel. Unfortunately biomass is not economically competitive with current sources of energy. But biotechnology may make biomass more viable by enhancing photosynthesis to produce more of a fuel, or modifying biomass to favour fuel production. Algae genome sequencing can provide new insights and major breakthroughs in this field helping understand the molecular and physiological mechanisms and steps involve in the production of biofuel which are crucial to optimise its production

## Strategic documents:

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<sup>13</sup> Based on the Seas-ERA ([www.seas-era.eu](http://www.seas-era.eu)) Mediterranean Strategic Research Agenda (SRA)

- Seas-ERA Mediterranean Strategic Research Agenda  
<http://www.seas-era.eu/np4/19.html>
- Briand F (Ed.) (2011). New Partnerships for Blue Biotechnology Development: innovative solutions from the sea. Proceedings of the CIESM International Workshop, Monaco, 11-12 Nov 2010.  
[http://www.ciesm.org/WK\\_BIOTECH\\_REPORT\\_2010.pdf](http://www.ciesm.org/WK_BIOTECH_REPORT_2010.pdf)

## Infrastructures and coordination and support capacities / initiatives:

The Mediterranean Science Commission (CIESM)<sup>14</sup> represents the most important regional coordination and support capacity/initiative in the Mediterranean in relation to marine biotechnology research and development. CIESM was founded in 1908 and formally constituted in 1919, under the leadership of Prince Albert I of Monaco, to federate marine research and explorations across the Mediterranean and Black Seas. Egypt, France, Greece, Italy, Monaco, Spain, Tunisia and Turkey were founder members while this number grew steadily to reach 22 members in 2013<sup>15</sup>. Aspects of marine biotechnology have been covered by CIESM in its workshops since 1997, most recently looking at Mediterranean marine extremophiles<sup>16</sup>. CIESM produces authoritative, independent reports on the status and trends of their marine systems. These widely-read Monographs (now counting 43) cover a diversity of issues, from the control of coastal erosion to novel contaminants, or from the role of cetaceans to the function of marine viruses. Of CIESM's six committees, C4 works on marine microbiology and biotechnology. There are currently no specific research programmes in marine biotechnology but a recent report examined the role of blue biotechnology in answering a number of specific challenges in the Mediterranean marine ecosystem<sup>17</sup>. Subjects included integration of marine biotechnology and nanotechnology for control of ship ballast water bio-pollution; marine biomolecules for chemistry, health, cosmetics, flavours and fragrances and vaccine adjuvants and stabilisers; new marine biomaterials and polymers.

## Major Initiatives:

- CIESM operates a 'Blog' forum covering important Marine Biotech topics such as Access and Benefit Sharing (ABS) of Marine Genetic Resources (MGR) and geography of marine active biomolecules at  
<http://www.ciesm.org/forums/>

## Major observations, trends and future prospects:

The Mediterranean Science Committee (CIESM) is currently (in 2013) undertaking an assessment of the marine biotechnology potential of the region and of the different Mediterranean coastal states.

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<sup>14</sup> <http://www.ciesm.org>

<sup>15</sup> <http://www.ciesm.org/online/institutes/IndexInstituts.htm>

<sup>16</sup> <http://www.ciesm.org/online/monographs/index.htm>.

<sup>17</sup> [http://www.ciesm.org/WK\\_BIOTECH\\_REPORT\\_2010.pdf](http://www.ciesm.org/WK_BIOTECH_REPORT_2010.pdf)

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- Seas-ERA Mediterranean Strategic Research Agenda  
<http://www.seas-era.eu/np4/19.html>
- Climate Change and Marine Ecosystems Research (CLAMER) Scientific Synthesis Report, Mediterranean Chapter, available at [www.clamer.eu](http://www.clamer.eu)

# Black Sea Basin

## Situation

The Black Sea is a remarkable regional sea almost completely separated from the rest of the world's oceans and embodying an abyssal basin with maximum depth of 2300m adjoining a very wide continental shelf area.

It is characterised by strong stratification under the influence of fresh water supplied by large rivers and the inflow of Mediterranean water through the Bosphorus (Istanbul) Strait. European rivers, the Danube, Dnieper and Don via the Sea of Azov, flow into this sea but its only weak link with other seas is with the Mediterranean through the Bosphorus Strait, the Sea of Marmara and the Dardanelle. Main rivers such as the Rioni, Kodori and Inguri Chorokh, Kyzyl-Irmak, Eshil-Irmak, Sakarya, Southern Bug and Dniester also flow into the Black Sea. The Black Sea catchment area is about six times that of the sea surface area. For this reason, the Black Sea is very vulnerable to pressure from land based human activity and its health is equally dependent from the coastal and non-coastal states of its basin.



The thin upper layer of marine water (up to 150 m) supports the unique biological life in the Black Sea ecosystem. The deeper and more dense water layers are saturated with hydrogen sulfide, that over thousands years, accumulated from decaying organic matter in the Black Sea. Due to the unique geomorphological structure and specific hydrochemical conditions, specific organisms, basically on the level of protozoa, bacteria, and some multi-cellular invertebrates inhabit the deep-sea waters. Knowledge about biological forms of life in the deep waters of the Black Sea is very limited. The disturbance of the natural balance between the two layers could trigger irreversible damage to the people and ecosystem of the Black Sea.

## Overarching regional science strategies, plans and policies:

There is currently no overarching regional science strategy or plan specifically focusing on marine biotechnology research and development. General marine science issues are considered by organisations such the Black Sea Commission<sup>18</sup> (main focus on environmental protection of the Black Sea) and projects such as the Seas-ERA Project<sup>19</sup> and the Black Sea ERANET<sup>20</sup>, a network designed to intensify and coordinate research cooperation (January 2009 – December 2012).

## Research priorities<sup>21</sup>:

The Black Sea harbours a huge potential stock of marine plants – more than 2000 species of plankton and benthic microalgae and over 300 species of algae and sea grasses. The sea grasses constitute a natural biomass from which 1 million ton could be harvested annually to be used for energy production or other valuable extractions. The harvest of other algae, which are markedly less abundant, would threaten the ecosystem of the Black Sea.

An alternative path suggests the farming of biologically valuable micro/macroalgae, especially Black Sea microalgae with high restocking rates.

Research on the culture and biosynthesis of microalgae is a priority for the extraction of the industry of valuable products and biologically active substances (BASs) in the Black Sea. Pertinent examples to these products are food

<sup>18</sup> <http://www.blacksea-commission.org/>

<sup>19</sup> [www.seas-era.eu](http://www.seas-era.eu)

<sup>20</sup> <http://www.bs-era.net/>

<sup>21</sup> Based on the Seas-ERA ([www.seas-era.eu](http://www.seas-era.eu)) Black Sea Strategic Research Agenda (SRA)

proteins, oils, vitamins, compounds of high bactericidal action, toxicants, volatile oils, gelling agents, cytochromes, amino acids, chlorophyllcarotene complexes, etc. One major obstacle hindering the realization of marine algotechnology is the absence of the theoretical management of microalgal growth and biosynthesis; without which profitable farming of Black sea microalgae is unattainable.

The search for commercially promising microalgal species inhabiting the Black Sea is among the actively developing trends of the biotechnology, because of the:

- high biological importance of natural BASs as strong antioxidants, immunomodulators, radio-, UV- and chemoprotectors, antitumor agents, immune, cardio-vascular and nerve system stimulators;
- broad spectrum of application (pharmaceutics, production of nutraceuticals, natural food colorants, dietetic foodstuffs, fodder additives for aquaculture, poultry and cattle breeding, cosmetics, etc.);
- steadily increasing market need for natural BASs in response to the World Health Organization initiative for complete elimination of synthetic BASs from food and forage manufacture.

For rational use of microalgal biomass of the Black Sea, it is important to develop biotechnologies for culturing new species fit with optimal biochemical composition required for different purposes. Therefore elaboration of new approaches to produce mass quantities of micro/macroalgae and the corresponding BASs is essential for the advancement of small- and medium-scale businesses related to marine biotechnologies.

Key research issues:

- Growth management of cultured BS microalgae: the theoretical and experimental simulation.
- Microalgal screening for commercially promising producers of biologically active substances (BAS).
- Growing microalgal biomass as a biochemically optimal fodder stimulating growth and survival rates of different developmental stages of cultured bivalve molluscs, fishes and crustaceans.
- Designing the biotechnology for acquiring biologically important pigments from BS microalgae.
- Screening macrophytes having adapted to the present BS environment as commercially interesting objects for the biotechnologies.

### **Strategic documents:**

- Seas-ERA Black Sea Strategic Research Agenda  
<http://www.seas-era.eu/np4/19.html>

### **Infrastructures, coordination and support capacities/initiatives and major activities:**

Specific initiatives in the Black Sea countries can be found in the country profiles of this report (for European countries) and that of the global landscape report of the CSA MarineBiotech.

Other specific initiatives include:

- Black Sea Biotechnology Association is an international public non-profit organization which current focus is mainly on promoting land-based and agricultural biotechnology  
<http://www.bsbanet.org/en/>
- The FP7 Up-grade Black Sea SCENE Project (2009-2011) consisted of 51 partners of which 43 are located in the Black Sea countries. The aim of the project is to stimulate scientific cooperation, exchange of knowledge and expertise, and strengthens the regional capacity and performance of marine environmental data & information management, underpins harmonization with European marine data quality control/assessment procedures and adoption of international meta-data standards and data-management practices, providing improved data & information delivery services for the Black Sea region at a European level. While it is focussing on environmental data and information, the project website does cover marine biology topics, refers to databases of marine bioresources and relevant projects.  
<http://www.blackseascene.net>
- Gombori, an international company with activities in Georgia has an industrial biotech focus. The company holds a strain collection including extremophiles  
<http://gombori.eu/our-technologies>

- Black Sea ERANET (January 2009 – December 2012) a network designed to intensify and coordinate research cooperation.  
<http://www.bs-era.net/>
- Black Sea Research Network. The Black Sea Research Network (BSRN) is an action-focused and multidisciplinary network of policy-oriented research institutes that develop research programmes on issues of importance to the political, social and economic development of the Black Sea region. It represents an innovative attempt to structure and coordinate a network of research institutes (and researchers) focusing on the wider Black Sea region.  
<http://icbss.org>
- Black Sea Universities Network. The Black Sea Universities Network (BSUN) has been established based on the recommendation of the PABSEC Cultural, Education and Social Affairs Committee during the session held in Bucharest in August 1997. The BSUN was founded for the purpose of developing educational, scientific, and cultural cooperation and exchanges among the Universities of the BSEC Member States and other institutions with similar concern.  
[www.bsun.org](http://www.bsun.org)
- Black Sea Trust for Regional Cooperation. The Black Sea Trust will fund programs that strengthen cross-border ties, civic participation, democratic governance, and the rule of law in the wider Black Sea region. The broad goals of the Black Sea Trust include building trust among citizens in their public institutions and to strengthen this critical set of institutions; affirming the value of citizen participation in the democratic process; and fostering regional, cross-border ties in the public, private, and non-profit sectors.  
[www.gmfus.org/blacksea](http://www.gmfus.org/blacksea)
- Commission on the Black Sea. The Commission on the Black Sea is a civil society initiative developed and launched jointly in 2009 by the Bertelsmann Stiftung, the Black Sea Trust for Regional Cooperation, the Economic Policy Research Foundation of Turkey (TEPAV), and the International Centre for Black Sea Studies (ICBSS).  
[www.blackseacom.eu](http://www.blackseacom.eu)
- Landscape and Biodiversity Protocol. Sitting under the Bucharest Convention this Protocol aims to maintain the Black Sea ecosystem in the good ecological state and its landscape in the favourable conditions, to protect, to preserve and to sustainably manage the biological and landscape diversity of the Black Sea in order to enrich the biological resources.  
[http://www.blacksea-commission.org/OfficialDocuments/BLDCProtocol\\_main.htm](http://www.blacksea-commission.org/OfficialDocuments/BLDCProtocol_main.htm)
- The Commission on the Protection of the Black Sea Against Pollution. The Commission on the Protection of the Black Sea Against Pollution (the Black Sea Commission or BSC) via its Permanent Secretariat is the intergovernmental body established in implementation of the Convention on the Protection of the Black Sea Against Pollution (Bucharest Convention), its Protocols and the Strategic Action Plan for the Rehabilitation and Protection of the Black Sea.  
<http://www.blacksea-commission.org/main.htm>
- The Action Plan-BS. The aim of the Action Plan-BS Project has been the preparation of an Action Plan in Science and Technology for the Black Sea countries and its adoption at the level of relevant Ministers. To achieve its goal the project included preparatory work on a draft Action Plan and the organisation of two events: a High Level Officials meeting and a Ministerial Meeting.  
[http://icbss.org/index.php?option=com\\_content&task=view&id=18&Itemid=69](http://icbss.org/index.php?option=com_content&task=view&id=18&Itemid=69)
- The Black Sea Initiative. The Black Sea Synergy programme was developed by EU in order to tackle concrete initiatives looking at areas like transport, energy, the environment, maritime management, fisheries, migration, and the fight against organised crime, the information society and cultural cooperation.  
[http://ec.europa.eu/world/enp/pdf/com07\\_160\\_en.pdf](http://ec.europa.eu/world/enp/pdf/com07_160_en.pdf)
- The Inogate Programme. The INOGATE Programme is an international energy cooperation programme between the European Union, the littoral states of the Black & Caspian Seas and their neighbouring countries.  
[http://www.inogate.org/inogate\\_programme/about\\_inogate](http://www.inogate.org/inogate_programme/about_inogate)

**Note/Disclaimer:**

This regional profile is based on available online information sources and contributions from external experts and stakeholders. It does not aim nor claim to be complete or final, but should be considered as a dynamic and living information resource that will be elaborated, updated and improved as more information becomes available,

including further inputs from experts and stakeholders. The information on this page is based on information initially compiled by the European Marine Board as part of the CSA MarineBiotech Project activities (2011-2013) and is largely based on information from the Seas-ERA Project (in particular the Seas-ERA Strategic Research Agenda for the black Sea) available at [www.seas-era.eu](http://www.seas-era.eu). The Seas-ERA Project (October 2010 to December 2013) is funded by the EC Seventh Framework Programme with a total budget of 2 million euros.

#### **Sources**

- Seas-ERA Black Sea Strategic Research Agenda  
<http://www.seas-era.eu/np4/19.html>
- Website of the Boucharest Convention  
<http://www.blacksea-commission.org/>

# European Countries

# Austria



## Strategic documents:

- Several higher level strategic documents are available on the website of the Austrian Council for Research and Technology Development (<http://www.rat-fte.at/publications.html>). These include
  - o **Strategy 2020** – Research, Technology and Innovation for Austria;
  - o **Strategy for Excellence;**
  - o **Strategy 2010** – Perspectives for Research, Technology and Innovation in Austria; and
  - o **National Research and Innovation Plan**



## Infrastructures and coordination and support capacities / initiatives:

- There are a number of online databases and directories which provide information about biotech and life science research activities including
  - o The **Austrian Biotech Database** provides information and statistics about Biotech, Pharma and Medtech companies in Austria <http://www.austrianbiotech.com/austrianbiotech/db/index.php>
  - o The **Austrian Life Sciences Directory** provides a collection of profiles both from companies and major research institutes active in life sciences in Austria. <http://www.lifesciencesdirectory.at/>
- The **Austrian Centre of Industrial Biotechnology** groups several research actors active in the industrial biotechnology sector in Austria. It plans to make the development of bioprocesses more transparent, predictable and thus faster, calculable and cheaper. <http://www.a-b.tugraz.at/ACIB/>
- The **Research Centre Applied Biocatalysis** is involved in the Austrian Centre of Industrial Biotechnology. It aims to focus the expertise of all partners to form a Research Centre for Applied Biocatalysis with sustained international and national competitiveness that forms an attractive platform for applied biocatalysis. [http://www.a-b.tugraz.at/index\\_en.htm](http://www.a-b.tugraz.at/index_en.htm)

## Major initiatives:

While Austria might not be an obvious location for marine biotechnology, some companies and research institutes also focus on marine biotechnology research. Notable examples are:

- **Sealife Pharma**® (see <http://www.sealifepharma.com/>)  
The mission of the company is to discover and develop new active substances of marine origin to successfully treat infections caused by multi-drug resistant pathogens in the future.

# Belgium



## Overarching science strategies, plans and policies:

There are no specific Marine Biotechnology strategies, plans or policies in Belgium. Overarching Belgian Science & Technology Policy for the period 2010-2014 is described in different Policy documents, including

- **Annual Policy note** of the Belgian Federal Minister of Science Policy  
<http://www.dekamer.be/FLWB/PDF/53/1964/53K1964021.pdf>
- **Policy note** of the Flemish Minister of Science Policy  
<http://www4.vlaanderen.be/dar/svr/afbeeldingennieuwtjes/over-svr/2010-07-02-beleidsnota2009-2014.pdf>
- **Flanders In Action (VIA)**  
[http://vlaandereninactie.be/wp-content/uploads/2011/02/ViA\\_brochure1.pdf](http://vlaandereninactie.be/wp-content/uploads/2011/02/ViA_brochure1.pdf)



## Research funding schemes and programmes:

There are no specific National Research Funding Programmes dedicated specifically to Marine Biotechnology, but marine biotech research activities may be funded under a wide range of federal and regional instruments. The main research funding organisations are the Department of Economy Science and Innovation (**EWI**) of the Flemish government, the Research Foundation - Flanders (**FWO**) and the Flemish government agency for Innovation by Science and Technology (**IWT**) in Flanders, the Walloon Research Foundation (**FNRS**) in Wallonia and the Belgian Science Policy Office (**Belspo**) at the Federal level.

- At the federal level, Marine Research is supported under the Science for a **Sustainable Development Programme (SSD)** ([www.belspo.be/SSD](http://www.belspo.be/SSD)) managed by the Belgian Science Policy Office ([www.belspo.be](http://www.belspo.be)). A database of funded projects is available at [www.belspo.be/belspo/fedra/pres\\_en.stm](http://www.belspo.be/belspo/fedra/pres_en.stm). A description of the North Sea (sub)programme since 1970 is available at [www.belspo.be/northsea](http://www.belspo.be/northsea).
- At the regional level, funding from organisations such as FWO and IWT in Flanders and FNRS in Wallonia is based on excellence with yearly competitive proposal submissions for personal grants and working funds. In most cases, funding is bottom up and valorisation of research is an important criteria.

## Research priorities:

- Metabolomics
- Bioprospecting
- Feed production and disease control (vaccines, probiotics, ...) in aquaculture
- Metagenomics, model organisms
- Biofuels from Algae
- Omega 3, lipids and chitosan as functional foods
- Biosensors

## Strategic documents:

- A full comprehensive overview of science policy in Belgium at all levels (Federal, Regional and Communities) is provided in "**Belgian Report on Science, Technology and Innovation 2010**"  
[http://www.belspo.be/belspo/home/publ/pub\\_ostc/BRISTI/Bristi\\_tome1\\_2010\\_en.pdf](http://www.belspo.be/belspo/home/publ/pub_ostc/BRISTI/Bristi_tome1_2010_en.pdf)

## Infrastructures and coordination and support capacities / initiatives:

- In Flanders there are a range of relevant networks and research institutes with relevant activities. The most important ones are:
  - o **Vlaams Instituut voor Biotechnologie (VIB)** - VIB is a life sciences research institute in Flanders, Belgium. With more than 1200 scientists from over 60 countries, we perform basic research into the molecular foundations of life. VIB is an excellence-based entrepreneurial institute that focuses on translating basic scientific results into pharmaceutical, agricultural and industrial applications. VIB works in close partnership with four universities – UGent, K.U.Leuven, University of Antwerp and Vrije Universiteit Brussel and is funded by the Flemish government. There are a number of bio-incubators either linked to the universities or the VIB.  
[www.vib.be](http://www.vib.be)
  - o **Flemish Marine biotechnology Platform** ‘Mariene Biotechnologie Platform Vlaanderen’ is a multi-disciplinary collaboration between industry and academia in the field of marine biotechnology in the Flanders region, Belgium.
  - o The network “**Aquacultuur Vlaanderen**” provides a platform of researchers, industry representatives, ngo’s and other stakeholders involved or interested in aquaculture research and commercialization. It can be considered as an independent advisory body for research and policy in the area of aquaculture in Belgium and Europe.  
<http://www.aquacultuurvlaanderen.be/>
  - o **Flemish platform for Algae Research (Vlaams Algen Platform)**  
<http://www.fi-sch.be/nl/programmas/micro-algen/vlaams-algen-platform/>
  - o **Industrial Biotech Cluster Flanders (CINBIOS)**  
<http://cinbios.be>
  - o **Flanders strategic Initiative for Sustainable Chemistry (FISCH)**  
<http://www.fi-sch.be/>
  - o **Bio-based Europe** is an open innovation and education centre for the bio-based economy jointly supported by Flanders and The Netherlands. It offers state-of-the-art research and training facilities to speed up the economic growth, innovation capacity, and sustainable development of the economy. The Bio Base Europe Pilot Plant in Ghent (Belgium) offers the capability to use common research and pilot bio-refinery infrastructure, thus shortening development time and minimizing costs.  
<http://www.bbeu.org>
  - o There are a number of Technology parks installed in major cities such as Ghent, Leuven, Antwerp and Hasselt. While they are broader in scope they have important biotechnology activities including marine aspects.
- The Belgian Science Policy Office (BELSPO) is funding and coordinating the "**Belgian Co-ordinated Collections of Micro-organisms (BCCM™)**" (<http://bccm.belspo.be/index.php>) consisting of seven complementary research-based service culture collections among others diatoms and cyanobacteria collections. The BCCM™ consortium aims to share the biological material of its collections, related information, as well as its experience and know-how in the field of fundamental and applied (micro)biology, to the benefit of its partners and clients in the academic and industrial communities.
- The **Joint Experimental Molecular Unit (JEMU)** - <http://jemu.myspecies.info/about-jemu>) is an integrated research infrastructure funded by the Belgian Science Policy Office (BELSPO) and supported by the [Royal Belgian Institute of Natural Sciences](#) (RBINS, Brussels) and the [Royal Museum for Central Africa](#) (RMCA, Tervuren). JEMU aims at supporting scientific research on natural history collections in the fields of DNA barcoding, phylogeny reconstruction and archiving biological specimens.
- In 2012, Belgium operates 1 local/coastal vessels of 36 m (Simon Stevin); 2 regional vessels of 49,55 (Ter Streep) and 50,90 m (Belgica, operated by MUMM – [www.mumm.ac.be/NL/](http://www.mumm.ac.be/NL/)) and 1 oceanic vessel of 56,6 (Zeeleeuw, operated by VLIZ – [www.vliz.be](http://www.vliz.be)) registered at the European Research Vessels Infobase ([www.eurocean.org](http://www.eurocean.org)).
- In 2012, Belgium maintains about 3 large marine research equipments registered in the European large Exchangeable instruments database ([www.eurocean.org](http://www.eurocean.org)).

## Major initiatives:

There are currently no overarching national initiatives on Marine Biotechnology. There are some thematic and cross-cutting coordination activities in Flanders (see above).

One of the most important recent initiatives at the Flemish level is the establishment, early 2012, of **the Flemish Marine biotechnology Platform** 'Marine Biotechnologie Platform Vlaanderen'. This platform was initiated by Flanders Marine Institute (VLIZ), the Flemish Ministry of Science and Innovation (EWI), the Flemish Government to bring together researchers, industry, biodiversity users, policy makers/advisors and all other actors involved in marine biotech research in Flanders to discuss the opportunities and map the existing capacity and expertise in Flanders as well as the potential for the future. Members include relevant scientists and experts from all research performing organisations in Flanders (Universities, Flemish Institute for Biotechnology, Flemish Institute for Technological Research etc.) and two major research funding agencies (FWO Flanders and IWT) as well as private companies with an interest in marine biotechnology (ixX Pharma, Proviron, OVOLIFE, etc.). The platform aims to increase the visibility of marine biotechnology in Flanders which may contribute to the general recognition of the research, promote Interdisciplinarity and lead to improved cooperation with experts from the industry. A webportal is being developed and is expected to be accessible in 2013.

# Bulgaria



## Overarching science strategies, plans and policies:

There are no specific Marine Biotechnology strategies, plans or policies in Bulgaria. Bulgarian Science & Technology Policy for the period 2009–2019 is described in the National Strategy for Scientific Research.

- **National Strategy for Scientific Research** Ministry of Education, Youth and Science  
[http://www.mon.bg/opencms/export/sites/mon/en/top\\_menu/science/national\\_research\\_strategy-2020.pdf](http://www.mon.bg/opencms/export/sites/mon/en/top_menu/science/national_research_strategy-2020.pdf)



## Research funding schemes and programmes:

Funding for scientific research is provided by the National Science Fund ([www.bulfund.com](http://www.bulfund.com)). For the financial year 2012-2013 there was one competition for research programmes in the thematic priorities with a total annual budget for all thematic priorities of about 11 million euro. Most of the thematic priorities may contain marine biotechnology research elements including:

- Energy; energy efficiency and transport;
- Development of ec-technologies and innovations;
- New materials and nanotechnology;
- ICT;
- Health and quality of life biotechnologies.

National Research Funding Programmes which have a significant marine research element include:

- **Development of Scientific Potential** (<http://www.nsfb.net>) managed by the National Science Fund (<http://www.nsfb.net>).

## Infrastructures and coordination and support capacities / initiatives:

- In 2012, Bulgaria operates 1 local/coastal vessel of 34 m (Professor A. Valkanov) and 1 oceanic vessel of 55,5 (Akademic) registered at the European Research Vessels Infobase ([www.eurocean.org](http://www.eurocean.org)).
- In 2012, Bulgaria maintains about 4 large marine research equipments registered in the European large Exchangeable instruments database ([www.eurocean.org](http://www.eurocean.org)).
- The National Roadmap provides strategic and effective development of science and innovation, and serves as basis for negotiations with international and European partners for future investments in national infrastructure facilities selected to be part of the pan-European infrastructure networks.
- On 21 September 2010, the Bulgarian Council of Ministers adopted the National Roadmap for Research Infrastructures which was elaborated by the Bulgarian Ministry of Education, Youth and Science. This roadmap contains provisions in support of both biotechnology and marine research.  
<http://www.nrri-bg.com>

# Croatia



## Overarching science strategies, plans and policies:

There are no specific Marine Biotechnology strategies, plans or policies in Croatia. Relevant Croatian science strategies are described in different documents, including

- Ministry of Science, Education and Sports: “**Strategic plan 2012-2014**” describes the overall Croatian strategic short-term measures in education, science and sports  
<http://public.mzos.hr/Default.aspx?art=10679&sec=1933>
- Ministry of Agriculture, Fisheries and Rural Development: “**Strategic plan 2012-2014**” describes the overall Croatian short-term measures in agriculture, fisheries and aquaculture, including biotechnology issues  
<http://www.mps.hr/UserDocImages/strategije/Strateški%20plan%20MPRRR%202012-2014%20verzija1.pdf>
- The Croatian “**Marine strategy**” is currently under development but will become legally binding in the future (details defined by governmental “Act on establishing a framework for protecting the environment of the Republic of Croatia”)  
[http://narodne-novine.nn.hr/clanci/sluzbeni/2011\\_11\\_136\\_2724.html](http://narodne-novine.nn.hr/clanci/sluzbeni/2011_11_136_2724.html))



## Research funding schemes and programmes:

- **Ministry of Science, Education and Sports** funds research and innovation projects, all research topics,  
<http://www.mzos.hr>
- **Croatian Science Foundation** funds research and innovation projects, all research topics,  
<http://www.hrzz.hr>
- The **Business Innovation Centre of Croatia (BICRO)**, central institution in the national innovation system for supporting innovation and technology advancement  
<http://www.bicro.hr>
- **Croatian Institute of Technology** funds technological projects under the programme TEST, all research topics  
<http://www.hit.hr>
- **IPA programme (Instrument for Pre-accession Assistance)** has different funding lines: for Adriatic Cross-border Cooperation (<http://www.adriaticpacbc.org>), Regional Competitiveness (<http://public.mzos.hr/Default.aspx?sec=3249>), IPARD ([http://www.mps.hr/ipard/UserDocImages/dokumenti/IPARD/IPARD\\_ENGLESKI\\_2011.pdf](http://www.mps.hr/ipard/UserDocImages/dokumenti/IPARD/IPARD_ENGLESKI_2011.pdf)) and other
- EU Structural and Cohesion Funds will be available when Croatia enters the EU
- As part of the stabilisation process and Croatia’s accession to the European Union, the Government is promoting a shift to a knowledge-based economy. Croatia has established a national **Science and Technology Action plan** for 2006-2014. Biotechnology (agri-food / healthcare / industrial) has been recognised as one of the priorities which will contribute to the development of Croatian society. Currently, 55 biotechnology projects are funded by the Government.  
[http://www.bio-economy.net/bioeconomy/member\\_states/croatia/files/workshop\\_files/draft\\_summary\\_croatia.pdf](http://www.bio-economy.net/bioeconomy/member_states/croatia/files/workshop_files/draft_summary_croatia.pdf)

## Research priorities:

Relevant research priorities adopted by National Council for Science are:

- Food, Agriculture, Fisheries and Biotechnology;
- Health;
- Environment and climatic changes.

## Strategic documents:

- At this stage there are no specific strategic documents devoted for the marine biotechnology only.
- A report on the State of art of biotechnology research in Croatia can be found at <http://www.biotechgate.com/app/documents/14allbio/croatia.pdf>  
[http://gain.fas.usda.gov/Recent%20GAIN%20Publications/Agricultural%20Biotechnology%20Annual\\_Zagreb\\_Croatia\\_6-15-2012.pdf](http://gain.fas.usda.gov/Recent%20GAIN%20Publications/Agricultural%20Biotechnology%20Annual_Zagreb_Croatia_6-15-2012.pdf)

## Infrastructures and coordination and support capacities / initiatives:

- Faculty of Food Technology and Biotechnology, University of Zagreb: Academic institution which performs research activities on biotechnology, including marine biotechnology, <http://www.pbf.unizg.hr/en/>.
- A few research organisations, like the Ruđer Bošković Institute (Zagreb) and the Institute of Oceanography and Fisheries (Split), are performing very limited research activities related to marine biotechnology.
- Biotechnological Park Varaždin: Incubation park near the city of Varaždin where biotechnological, life sciences and hi-tech companies may set up and operate in an innovative, inspirational, safe and secure environment, <http://www.varazdinpark.com>.
- In 2012, Croatia operates 7 local/coastal vessels from 10,5 m to 31,35 (Bios, Hydra, Nase More, navicula, Shamal, Triton, Vila Velebita) and 1 regional vessel of 45,50 (Palagruza) registered at the European Research Vessels Infobase ([www.eurocean.org](http://www.eurocean.org)).
- In 2012, Croatia maintains about 1 large marine research equipments registered in the European large Exchangeable instruments database ([www.eurocean.org](http://www.eurocean.org)).
- Key aquaculture experimental and research facilities in Croatia include
  - o Laboratory of Aquaculture (Institute of oceanography and fisheries, Split)
  - o Fish culture unit (University of Dubrovnik, Department of Aquaculture)

# Denmark



## Overarching science strategies, plans and policies:

- National Whitepaper: “**Research2015**” description of the focus areas for strategic research. The paper was launched in 2008, an updated version “Research2020” will be published in may 2012.

<http://www.fi.dk/publikationer/2008/forsk2015-et-prioriteringsgrundlag-for-strategisk-forsk/forsk2015-net-op2.pdf>



## Research funding schemes and programmes:

- The **Danish Council for Strategic Research (DSF)** funds research projects, innovation projects, industrial projects and infrastructure. DSF consists of a board and a number of programme commissions of which the following are relevant:
  - o **Programme Commission on Health, Food and Welfare** whose aim is to provide the prerequisites for a healthy lifestyle and stimulate sustainable and competitive food production. In 2012 the programme commission allocates research funds (among other items) within ‘Bioresources, foods and other biological products’.
  - o **Programme Commission on Strategic Growth Technologies**. The Commission’s field of activity is new technologies that can create important and new opportunities to all sectors in the society. In 2012 the programme Commission on Strategic Growth Technologies allocates research funds (among other items) within biotechnology and nanotechnology.
- The **Danish Council for Independent Research (DFR)** funds specific research activities, within all scientific areas, that are based on the researchers' own initiatives and that improve the quality and internationalisation of Danish research. The Danish Council for Independent Research is comprised of a Board of Directors and five scientific research councils of which the following are relevant:
  - o **Natural Sciences (FNU)** covers all aspects of research geared towards basic scientific issues within the natural sciences, computer science and mathematics.
  - o **Technology and Production Sciences (FTP)** covers (among several others) these scientific fields: biotechnology, food sciences and use of natural resources.
- The **Business Innovation Fund (Fornyelsesfonden)** aims to promote growth, employment and export by supporting business opportunities within green growth and welfare as well as providing support for change-over to exploit new business and growth opportunities in less favoured areas of the country.
- The **Advanced Technology Foundation (Højteknologifonden)** offers companies and research institutions investments and a framework to transform ideas to results. The foundation invests in advanced Technology Projects and Platforms.
- The **Growth Foundation (Vækstfonden)** is a state investment fund, which aims to create new growth companies by providing venture capital and competence.

## Private funding mechanisms:

- The **Novo Nordisk Foundation awards** grants mainly for medical research but also considerable contributions to other scientific, humanitarian and social causes
- The **Carlsberg Foundation** provides support for basic scientific research in (among others) natural sciences.
- The **Villum Foundation** supports research activities in the natural and technical sciences. Grants are made for pioneering research, but the Foundation also supports the dissemination of scientific and technical research.

## Research priorities for marine biotechnology research:

- In 2010 the Danish Ministry of Food, Agriculture and Fisheries published a report entitled '**Havet – en uudnyttet resource' (The Sea – an unexploited resource)**. It was a knowledge synthesis on Danish opportunities in marine biotechnology and other exploitation of the marine resources. The report identified six themes where focused, interdisciplinary research and development efforts are likely to generate significant economic results within shorter and longer perspectives:
  - o Use of marine biomass (beyond traditional fisheries)
  - o Cultivation of commodities in and from the sea
  - o Health-promoting ingredients
  - o Discovery of new substances, materials and biological activities and principles
  - o Extraction of valuable biochemical substances
  - o Biofilms

## Infrastructures and coordination and support capacities / initiatives:

- The **Danish Centre for Marine Research** (<http://www.danskhavforskning.net/English.aspx>) is initiated by the Danish academic community. The overall aim of the centre is
  - o Administration of the funds to cover chartering of research ships
  - o Coordinate and facilitate rental of research equipment between institutions
  - o Facilitate international charter contracts of research vessels
- The **Scandinavian Culture Collection of Algae and Protozoa (SCCAP)** (<http://www.sccap.dk>) at the University of Copenhagen contains in particular marine nanoplankton flagellates, benthic marine brown and green algae, and a growing number of dinoflagellates. The SCCAP presently comprises more than 900 strains (c. 265 genera and 460 species) with representatives from most algal divisions. Nearly 700 are available to the public.
- The **Seaweed Network in Denmark (SND)** promote the production, application, communication and knowledge of seaweed, and also strengthen the national collaboration. SND consist of more than 200 members from industry, universities, authorities within the research, projects and product development range within the areas of utilization of the entire seaweed as food or feed, the biochemicals as nutraceuticals or other food (and feed) ingredients and residuals bioenergetically purposes as well as cultivation and breeding of seaweed.
- In 2012, Denmark operates 2 local/coastal vessels of 15m and 15,48 m (Genetica II, Ophelia); 1 global of 78,43m (Dana) and 1 oceanic vessel of 56,6 (Gunnar Thorson) registered at the European Research Vessels Infobase ([www.eurocean.org](http://www.eurocean.org)).
- Key aquaculture experimental and research facilities in Denmark include
  - o Experimental facilities at Danish Institute for fisheries research
  - o Experimental facility at SINTEF

## Major observations, trends and future prospects:

- Denmark has a long tradition for exploiting resources from the aquatic environment, which is reflected in ongoing research at universities and research institutes, and production in Danish industry. Research groups focusing on marine biotechnology are located at six universities and two technological research institutes.
- Among major industries having interest in marine biotechnology should be mentioned Novozymes, which are searching for new enzymes and exploitation of biological application of enzymes in the marine area. Further, several companies are producing ingredients from marine raw materials, of which could be mentioned CP Kelco, Danisco and Chr. Hansen. Within the pharmaceutical areas companies such as LeoPharma and GEA has expressed interest in products from the marine area. The company Hempel is a major producer of ship paints, and as such has a pronounced interest in understanding how biofilms are formed and how growth of organisms on submerged surfaces can be prevented.

- The association DanskBiotek, ([www.danskbiotek.dk](http://www.danskbiotek.dk)) works for common interest of the biotechnology interests in Denmark.
- The Danish research councils have previously supported research in marine biotechnology with funds for operating a marine biotechnology research centre. Presently research support is given to individual projects applied for in completion with other projects in the biological, biochemical or technical areas. The Danish Council for Strategic Research has expressed a wish to support European coordinated research within marine biotechnology by contributing to an ERA NET for marine biotechnology.

# Estonia



## Overarching science strategies, plans and policies:

- **Estonian biotechnology strategy 2008-2013**  
[http://www.biotech.ee/data/file/Microsoft\\_Word\\_-\\_Eesti\\_biotehnoloogia\\_strateegia\\_2008\\_-\\_2013\\_eng1.pdf](http://www.biotech.ee/data/file/Microsoft_Word_-_Eesti_biotehnoloogia_strateegia_2008_-_2013_eng1.pdf)

## Research funding schemes and programmes:

- **Estonian Biotechnology program**  
[http://www.biotech.ee/index.php?page\\_id=34&lang\\_id=et](http://www.biotech.ee/index.php?page_id=34&lang_id=et)



## Infrastructures and coordination and support capacities / initiatives:

- In 2012, Estonia operates 3 local/coastal vessels from 15m to 31,30 m (Juku, Vilma, Salme) registered at the European Research Vessels Infobase ([www.eurocean.org](http://www.eurocean.org)).

## Major initiatives:

- Estonian Biotechnology Association (EBio)  
[http://www.biotech.ee/index.php?lang\\_id=en](http://www.biotech.ee/index.php?lang_id=en)

# Finland



## Overarching science strategies, plans and policies:

- **Finish Biotechnology policy**  
[http://www.mkm.ee/failid/Research\\_on\\_the\\_Estonian\\_Biotechnology\\_Sector\\_Innovation\\_System\\_2002.pdf](http://www.mkm.ee/failid/Research_on_the_Estonian_Biotechnology_Sector_Innovation_System_2002.pdf)

## Research funding schemes and programmes:

- **SymBio** - Industrial Biotechnology: this programme has a budget of €80 million for a five years period (2006-2011) and is funded by the Government (49%), private companies (48%) and research institutes (3%). The aims of the programme are:
  - to create competitive industrial processes, new products and services using biotechnology;
  - to enhance the environmental friendliness of industrial processes;
  - to create new business opportunities in the fields of industrial production and environmental biotechnologies and
  - to boost the transfer of research results into technology and new productsBoth companies and research organisations can take part in the programme  
<http://akseli.tekes.fi/opencms/opencms/OhjelmaPortaali/ohjelmat/SymBio/en/etusivu.html>
- **BioRefine**: €137 million has been allocated to this programme from 2007-2012. It aims to develop innovative technologies, products and services based on national strengths as well as generate necessary new expertise. The programme also looks to develop biorefineries is examining the processing of biomass in general for the international market and is trying to promote the development and use of second-generation production technology in biofuels for transport.  
<http://akseli.tekes.fi/opencms/opencms/OhjelmaPortaali/ohjelmat/BioRefine/en/etusivu.html>



## Infrastructures and coordination and support capacities / initiatives:

- In 2012 Finland operates 2 local/coastal vessels of 20m and 27,7m (Geomari, Muikku) and 1 oceanic vessel of 59,8 (Aranda) registered at the European Research Vessels Infobase ([www.eurocean.org](http://www.eurocean.org)).
- Key aquaculture experimental and research facilities in Finland include
  - o Experimental seacages and fish rearing facilities (FGFRI)
- The university of Helsinki is coordinating the European **FP7 Project MAREX** (Exploring Marine Resources for Bioactive Compounds: From Discovery to Sustainable Production and Industrial Applications) which runs from 2010-2014  
<http://www.marex.fi/>

# France



## Overarching science strategies, plans and policies:

There are no specific Marine Biotechnology strategies, plans or policies in France at the national level. Overarching French Science & Technology Policy is described in the National Programming Law for Research and in the National Research Strategy (SNRI)

- **National Programming Law for Research**  
<http://www.legifrance.gouv.fr/affichTexte.do?cidTexte=JORFTEXT000000426953>
- **National Research Strategy (SNRI)**  
<http://www.enseignementsup-recherche.gouv.fr/pid24538/strategie-nationale-recherche-innovation-i.html>



In 2009, the "National strategy for the sea and the oceans" Blue Book laid out France's maritime policy. The Blue Book reaffirmed France's ambition to know in depth, protect and manage its vast maritime area; a source of economic and ecological wealth.

- **Blue book - National strategy for the sea and the oceans**  
[http://www.sgmer.gouv.fr/IMG/pdf/2009-12-08\\_-\\_Blue\\_Book\\_-\\_A\\_national\\_strategy\\_for\\_the\\_sea\\_and\\_oceans.pdf](http://www.sgmer.gouv.fr/IMG/pdf/2009-12-08_-_Blue_Book_-_A_national_strategy_for_the_sea_and_oceans.pdf)

The marine research component of the overarching Science & Technology Policy is further elaborated in the strategic policy document of the French marine science organisation Ifremer:

- **Exploring the sea to understand the earth: contribution to a national research strategy for marine sciences for 2020**  
[http://w3z.ifremer.fr/strategie/plan\\_strategique](http://w3z.ifremer.fr/strategie/plan_strategique)

## Research funding schemes and programmes:

In France, there is no specific call for marine and biotechnological research (apart from the Seas-ERA call launched in March 2012). However, marine projects can be funded under non-thematic calls for competitive research proposals launched by the **French Research Council (ANR)** which operates thematic and blue skies programmes (<http://www.agence-nationale-recherche.fr/>). About 10% of the ANR annual budget is dedicated to marine research.

- The programming document **Orientations for the ANR Programming Cycle** describes each year the main priorities that are going to be addressed through dedicated calls in line with the National Strategy for Research and Innovation (SNRI)  
<http://www.agence-nationale-recherche.fr/programmes-de-recherche/les-orientations-2012/>

Other National Research Funding Programmes which may be relevant for marine biotechnology research include:

- **ADEME** (The French Environment and Energy Management Agency) can launch calls that can be relevant for Marine sciences (climate change, micro-algal biomass for biofuels, ...)  
<http://www2.ademe.fr/servlet/getDoc?id=38480&m=3&cid=96>
- **PNEC** (the National Programme for Coastal Ecology Research) managed by Ifremer  
<http://www.insu.cnrs.fr/actions-sur-projets/pnec-programme-national-environnement-cotier>
- **LITEAU** (National Programme Coastal Management) managed by Ministry for Ecology, Energy, Sustainable Development, Territory Planning (MEEDDAT)  
[www.developpement-durable.gouv.fr/index.php3](http://www.developpement-durable.gouv.fr/index.php3)
- **LEFE** (Les Enveloppes Fluides et Environnement) managed by INSU  
[www.insu.cnrs.fr/a1713,lefeenveloppes-fluides-environnement.html](http://www.insu.cnrs.fr/a1713,lefeenveloppes-fluides-environnement.html)

- **EC2CO** (Continental and Coastal Ecosphere) managed by CNRS  
[www.cnrs.fr/prg/PIR/programmes/ec2co.htm](http://www.cnrs.fr/prg/PIR/programmes/ec2co.htm)

## Strategic documents:

In November 2012, upon demand by the secretaries of state of research and environment, the Alliance for the Environment (AllEnvi, a group of French research agencies) published an inventory and challenges of research and innovation in marine sciences under the title The Marine Programme. The Marine Program presents an inventory of French research on marine and coastal environments, their means of study and the technological developments they sustain, and identifies key issues in terms of knowledge and public policy.

- **The Marine Program: Inventory and challenges of research and innovation in marine sciences**  
<http://www.developpement-durable.gouv.fr/Le-programme-mer-etat-des-lieux-et.html>

## Private funding mechanisms:

- **OSEO** is a public-sector institution dedicated to economic development and a key source of financing and other support for SMEs.  
<http://www.oseo.fr/international>

## Infrastructures and coordination and support capacities/initiatives:

- **ALLENVI Groupe Mer** – Working group of Association of Research Operators in Environment Programme Mer. ALLENVI published (end of 2012) strategic document “The Marine Program: Inventory and challenges of research and innovation in marine sciences” (see above)  
[http://www.allenvi.fr/?page\\_id=335](http://www.allenvi.fr/?page_id=335)
- **Biogenouest** - the life science core facility network in Western France which comprises a Marine component which is open for all interested parties extending beyond the region  
<http://www.biogenouest.org/index.php?pa=N100&la=en>
- Regional Clusters
  - o **CapBiotek** - Regional Cluster in Biotechnologies in Brittany  
<http://www.capbiotek.fr/index.php>
  - o **Atlanpole Blue Cluster** - Regional Cluster in Biotechnologies in Pays de la Loire  
<http://www.atlanpolebluecluster.eu/>
  - o **Pole Mer Bretagne** - Global economic competitiveness cluster in Brittany  
<http://www.pole-mer-bretagne.com/innovate-to-prosper.php>
  - o **Pole Mer PACA** - Global economic competitiveness cluster in Provence-Alpes-Côte d’Azur  
<http://en.polemerpaca.com/>
  - o **Europole Mer “Blue Network”** - an informal coordination structure with about 20 members with one of the focal areas (Axe 1) on marine genomics and blue chemistry (related to biotech)  
<http://www.europolemer.eu/en/what-is-europole-mer.php>
- In 2012, France operates 14 local/coastal vessels from 10m to 30m; 1 regional vessel of 36m (Antea); 1 oceanic of 56,34m (Le Suroit); and 6 global vessels from 65m to 120,5m registered at the European Research Vessels Infobase ([www.eurocean.org](http://www.eurocean.org)).
- In 2012, France maintains about 11 large marine research equipments registered in the European large Exchangeable instruments database ([www.eurocean.org](http://www.eurocean.org)).
- Key aquaculture and marine experimental and research facilities in France include
  - o **Ifremer Station expérimentale d’Aquaculture**  
[www.ifremer.fr](http://www.ifremer.fr)
  - o **Ifremer Laboratoire ARN**  
<http://wwwz.ifremer.fr/pfom/Organisation-et-personnel/ARN>
  - o **Station Biologique Roscoff**  
<http://www.sb-roscoff.fr/roscoff-marine-station>

- **Observatoire Oceanologique de Banyuls sur mer**  
<http://www.obs-banyuls.fr/en/index.php>
- **Observatoire Océanologique de Villefranche sur mer**  
<http://www.obs-vlfr.fr/>
- **Institut Universitaire Européen de la Mer**  
<http://www.iuem.univ-brest.fr/>
- **Centre d'Océanologie de Marseille**  
<http://www.com.univ-mrs.fr/>

## Major initiatives:

- R&D and Infrastructures projects funded in the frame of “Investissements d’avenir” ANR
  - **IDEALG** – Consortium of 18 different partners from the academic sector (CNRS, IFREMER, UEB, UBO, UBS, ENSCR, University of Nantes, INRA, AgroCampus), the industrial sector (C-WEED, Bezhin Rosko, Aleor, France Haliotis, DuPont) as well as a technical centre specialized in seaweeds (CEVA) in order to foster biotechnology applications within the seaweed field. Budget of € 10 Millions for 10 years  
<http://www.idealg.ueb.eu/>  
Contact: Philippe Potin ([potin@sb-roscoff.fr](mailto:potin@sb-roscoff.fr)) & Monique Ras ([monique.ras@sb-roscoff.fr](mailto:monique.ras@sb-roscoff.fr))
  - **OCEANOMICS** – Project providing scientific prolongation of the Tara-Oceans expedition with a budget of €8 Millions for ten years coordinated by Station Biologique de Roscoff  
<http://oceans.taraexpeditions.org/>  
Contact: Colombar de Vargas ([vargas@sb-roscoff.fr](mailto:vargas@sb-roscoff.fr))
  - **GREENSTARS** – Institute of Excellence Energy on biofuels  
Contact : Jean-Philippe Steyer ([Jean-Philippe.Steyer@supagro.inra.fr](mailto:Jean-Philippe.Steyer@supagro.inra.fr))
  - **EMBRC-Fr** - French component of the European European Marine Biological Resource Centre (EMBRC), an ESFRI Roadmap Research Infrastructure with a budget of €16 Millions over 10 years  
<http://www.embrc.eu/>  
Contact : Ian Probert ([probert@sb-roscoff.fr](mailto:probert@sb-roscoff.fr)) & Anne-Emmanuelle Kervella ([akervella@sb-roscoff.fr](mailto:akervella@sb-roscoff.fr))
  - **LABEX Mer, Ocean in Change** – Laboratory of Excellence in marine research with eight academic partners from west of France (Brest, Lorein, Nantes,  
<http://www.labexmer.eu>  
Contact: Yves-Marie Paulet ([paulet@univ-brest.fr](mailto:paulet@univ-brest.fr))
- **FRB Fondation pour la Recherche sur la Biodiversité** – Foundation for Biodiversity Research  
<http://www.fondationbiodiversite.fr/>
- **Company for the acceleration of the technology transfer (SATT) Ouest Valorisation** was officially created on 20 July 2012 with a regional remit covering the areas Brittany and Pays de la Loire. It is endowed with €66.5mn over 10 years to improve the results of public research through licenses, industrial partnerships, new business start-ups, or by facilitating the mobility of the researchers. It brings together research centers and higher education bodies (French acronym: PRES) from the European University of Brittany (27%) and the Nantes Angers Le Mans university (21%), CNRS (15%), Inserm (3%), IRD (1%) and the State via Caisse des Dépôts (33%) with a head office in Rennes and two secondary establishments in Brest and Nantes. Marine Biotechnology will be one of the 4-5 focal areas of the SATT (Website under construction).
- France has a wide range of marine resource and biotechnology companies ranging from small SME’s to major multinationals. Some notable examples of companies with know marine biotechnology research activities, include major players such as SANOFI (pharmaceuticals), Laboratoire Pierre Fabre (pharmaceuticals, cosmetics, plant and innovation technology research), L’Oreal (Cosmetics, beauty product and perfumes, Lallemand (yeast bacteria and specialty ingredients) and more than 50 Innovative SMEs (from pharma to food and cosmetics) such as Hemarina.

# Germany



## Overarching science strategies, plans and policies:

There are no specific Marine Biotechnology strategies, plans or policies in Germany (yet). Up to now, marine biotechnology is supported as part of more overarching bio-economy and marine/maritime research strategies as described in different documents, including

At the federal level:

- Federal Government adopted the “**National Research Strategy BioEconomy 2030 – Our Route towards a Biobased Economy**”.  
[http://www.bmbf.de/pub/bioeconomy\\_2030.pdf](http://www.bmbf.de/pub/bioeconomy_2030.pdf)
- **High-Tech-Strategy 2020** for Germany from German Federal Government  
<http://www.hightech-strategie.de/en/index.php>
- **Technology Campaign (Innovationsstrategie)** of the Federal Ministry of Economics and Technology (BMW i)  
<http://www.bmwi.de/English/Navigation/Service/publications,did=388738.html>
- **Nationaler Masterplan Maritime Technologien (NMMT)**  
<http://www.bmwi.de/BMWi/Redaktion/PDF/Publikationen/nationaler-masterplan-maritime-technologien,property=pdf,bereich=bmwi,sprache=de,rwb=true.pdf>
- “**Nächsten Generation biotechnologischer Verfahren – Biotechnologie 2020+ \_ synthetische Biologie und zellfreie Biotechnologie**“  
<http://www.biotechnologie2020plus.de/BIO2020/Navigation/DE/Vision/strategieprozess.html>



At the regional level:

- “**Sea or Future**” initiative of state Schleswig-Holstein  
[http://www.schleswig-holstein.de/MWAVT/DE/Technologie/LandesinitiativeZukunftMeer/Ziele/Ziele\\_node.html](http://www.schleswig-holstein.de/MWAVT/DE/Technologie/LandesinitiativeZukunftMeer/Ziele/Ziele_node.html)
- A specific and new a regional development strategy **Masterplan Marine Biotechnology Schleswig-Holstein** is being developed and should be launched by the end of 2012.

## Research funding schemes and programmes:

Marine Biotechnology research activities may be supported under various programmes including:

- **Next-Generation Maritime Technologies** a programme of the Federal Ministry of Economics and Technology (BMW i) <http://www.ptj.de/index.php?index=624>
- **Framework Programme Biotechnology** a programme of the Federal Ministry of Education and Research (BMBF) <http://www.ptj.de/index.php?index=588>
- **Framework Programme Research for Sustainable Development (FONA)** a programme of the Federal Ministry of Education and Research (BMBF) managed by Jülich (PJT) <http://www.fona.de>
- **Innovationsinitiative industrielle Biotechnologie** a programme of the Federal Ministry of Education and Research (BMBF) <http://www.ptj.de/innovationsinibio>
- **Basistechnologien für eine nächste Generation biotechnologischer Verfahren** a programme of the Federal Ministry of Education and Research (BMBF) <http://www.ptj.de/biobasis>
- **e:Bio – Innovationswettbewerb Systembiologie** a programme of the Federal Ministry of Education and Research (BMBF) <http://www.ptj.de/e-bio>

- **Renewable Energy** a programme of the Federal Ministry for the Environment, Nature Conservation and Nuclear Safety (BMU) as part of the Federal Government's 6th Energy Research Programme  
<http://www.ptj.de/index.php?index=636>
- **Marine Research** a programme of the Federal Ministry of Education and Research (BMBF)  
<http://www.ptj.de/index.php?index=626>
- **Polar Research** a programme of the Federal Ministry of Education and Research (BMBF)  
<http://www.ptj.de/index.php?index=627>
- **Research for Sustainable Development** a programme of the Federal Ministry of Education and Research (BMBF)  
<http://www.ptj.de/index.php?index=633>
- **"BioRegio-Wettbewerb"** (1997 bis 2005)  
<http://www.itas.fzk.de/tatup/051/dohs05a.htm>
- **"BioFuture"** (Start 1998)  
<http://www.ptj.de/biofuture/>
- **"KMU-innovativ: Biotechnologie – BioChance"**  
<http://www.bmbf.de/foerderungen/10759.php>
- **BioChancePLUS** (2006-2011)  
[http://www.ptj.de/lw\\_resource/datapool/items/item\\_2673/biochanceplusbekanntmachung2006.pdf](http://www.ptj.de/lw_resource/datapool/items/item_2673/biochanceplusbekanntmachung2006.pdf)
- **"Biotechnologie - Chancen nutzen und gestalten"** (2001-2010)  
<http://www.bmbf.de/foerderungen/12715.php>
- **"GO-Bio" im Rahmenprogramm "Biotechnologie - Chancen nutzen und gestalten"**  
<http://www.bmbf.de/foerderungen/12715.php>

### Private funding mechanisms:

- **Volkswagen Foundation** <http://www.volkswagenstiftung.de/index.html?L=1>
- **Fritz Thyssen Stiftung** [http://www.fritz-thyssen-stiftung.de/home/?no\\_cache=1&L=1&cHash=117adf62f5979fb5992654769d2e7644](http://www.fritz-thyssen-stiftung.de/home/?no_cache=1&L=1&cHash=117adf62f5979fb5992654769d2e7644)

### Research priorities for marine biotechnology research:

- Aquaculture;
- Bio-based industries;
- Industrial biotechnology;
- Human health.

### Strategic documents:

- **Masterplan Marine Biotechnology Schleswig-Holstein** – a regional development strategy (under development)
- **Nationaler Maritimer Masterplan** <http://www.bmwi.de/BMWi/Redaktion/PDF/Publikationen/nationaler-masterplan-maritime-technologien,property=pdf,bereich=bmwi,sprache=de,rwb=true.pdf>

### Infrastructures and coordination and support capacities / initiatives:

- In 2012, Germany operates 12 local/coastal vessels from 12,5m to 32,5 m; 8 regional vessels from 38,58m to 54,59m; 3 oceanic from 60,7m to 64,5m and 4 global vessels from 73m to 118m registered at the European Research Vessels Infobase ([www.eurocean.org](http://www.eurocean.org)).
- In 2012, Germany maintains about 13 large marine research equipments registered in the European large Exchangeable instruments database ([www.eurocean.org](http://www.eurocean.org)).

- Key aquaculture experimental and research facilities in Germany include
  - o MAREE (Leibniz Gemeinschaft)
- **BIO Deutschland:** BIO Deutschland has set itself the objective of supporting and promoting the development of an innovative economic sector based on modern biosciences. <http://www.biodeutschland.org/>
- **Norgenta North German Life Science Agency GmbH:** Norgenta is the project and service company of Hamburg and Schleswig-Holstein that supports life science activities in North Germany. <http://www.life-science-nord.net/lisn-international/norgenta-gmbh/>
- **BioCon Valley:** BioCon Valley is the initiative for Life Science and health economy of Mecklenburg-Vorpommern, Germany. [http://www.ls.bcv.org/hosting/bcv/website\\_en.nsf/urlnames/bcv\\_index\\_EN?OpenDocument&mnu=bcv\\_index&submnu=](http://www.ls.bcv.org/hosting/bcv/website_en.nsf/urlnames/bcv_index_EN?OpenDocument&mnu=bcv_index&submnu=)
- **Fraunhofer Research Institution for Marine Biotechnology:** This Fraunhofer institution in Lübeck is the first one especially for Marine Biotechnology within the Fraunhofer-Gesellschaft. <http://www.emb.fraunhofer.de/en.html>
- **Cyro-Brehm:** The „German cell bank for wildlife“ is a biomaterial bank specialized on the archival cryogenic storage of propagatable cell cultures from wildlife. [http://www.emb.fraunhofer.de/en/Uebersichtsindex/cellbank\\_cryo-brehm.html](http://www.emb.fraunhofer.de/en/Uebersichtsindex/cellbank_cryo-brehm.html)
- **GEOMAR I Helmholtz Centre for Ocean Research Kiel:** GEOMAR is one of the world’s leading institutes in the field of marine sciences. <http://www.geomar.de/en/>

### Major initiatives:

- Cluster of Excellence "The Future Ocean" <http://www.futureocean.org/en/index.php>

### Major observations, trends and future prospects

In Germany there is a strong focus on Biotechnology, but very little is exclusively targeting marine biotechnology. This may change with the first specific regional development strategy for Marine Biotechnology: the **Masterplan Marine Biotechnology Schleswig-Holstein** (Nov 2012).

# Greece



## Overarching science strategies, plans and policies:

There are no specific Marine Biotechnology strategies, plans or policies in Greece. General orientation of scientific research is provided by an overarching Strategy for Research, Technology and Innovation. The marine and biotechnology research components are not further elaborated in a policy or strategy.

- **Strategic Plan for Development of Research Technology & Innovation** in the context of the National Strategic Reference Framework of the General Secretariat for Research & Technology (GRST)  
[www.gsrt.gr/default.asp?V\\_ITEM\\_ID=4699](http://www.gsrt.gr/default.asp?V_ITEM_ID=4699)



## Research funding schemes and programmes:

The General Secretariat for Research & Technology (GRST) is the main actor in innovation-policy implementation through funding schemes and legal instruments. The marine and biotechnology research components are not further elaborated in a policy or strategy nor supported by dedicated programmes. Instead they are supported through a national policy directed generic instrument.

## Strategic documents:

An outdated but interesting inventory and analysis of national public policies that stimulate research in biotechnology, its exploitation and commercialisation by industry in Europe in the period 2002–2005 can be found at [http://ec.europa.eu/research/biosociety/pdf/biopolis\\_greece\\_en.pdf](http://ec.europa.eu/research/biosociety/pdf/biopolis_greece_en.pdf)

## Infrastructures and coordination and support capacities / initiatives:

- In 2012, Greece operates 2 local/coastal vessels of 26,1 and 33m; 1 regional vessel of 50m (Pitheas); 2 oceanic of 61,5 and 63m registered at the European Research Vessels Infobase ([www.eurocean.org](http://www.eurocean.org)).
- In 2012, Greece maintains about 5 large marine research equipments registered in the European large Exchangeable instruments database ([www.eurocean.org](http://www.eurocean.org)).
- Key aquaculture experimental and research facilities in Greece include
  - o Faros Field Station (HCMR, Institute of Aquaculture)
- School of Pharmacology (University of Athens) - Vassilis roussis – also involved in marine projects
- Institute of Molecular Biology and Biotechnology (IMBB), Krete  
Dr. Dimitri Kasetzopoulos  
<http://www.imbb.forth.gr/>

## Major Initiatives:

- Greek participation in FP7 project Seabiotech
- HCMR participation in FP7 project MicroB3
- Korres company working on cosmetics including from marine origin.

# Iceland



## Overarching science strategies, plans and policies:

At this time, in 2012, Iceland does not have a dedicated Marine Biotechnology policy, strategy or plan. Iceland's Science & Technology Policy for the period 2010–2012 develops the science and technology research policy component of the government's policy for the economy and community as laid out in the National strategic document "Iceland 2020". The marine research component of this Policy is further developed in The Ocean – Iceland's Policy which contains a reference to marine biotechnology research as a key focal area.

Iceland does not have a specific bio-policy but there is a policy on the green economy, which is partly relevant for biotechnology research issues.



- **Iceland 2020**  
<http://eng.forsaetisraduneyti.is/media/2020/iceland2020.pdf>
- **Science and Technology Policy 2010-2012** from the **Science and Technology Policy Council**  
[www.vt.is/english/](http://www.vt.is/english/)
- **The Ocean – Iceland's Policy**  
[http://eng.utanrikisraduneyti.is/media/Efstabaugi/The\\_Ocean\\_Icelands\\_Policy.pdf](http://eng.utanrikisraduneyti.is/media/Efstabaugi/The_Ocean_Icelands_Policy.pdf)
- Iceland's **Green Economy Policy**  
[http://www.althingi.is/pdf/Green\\_economy.pdf](http://www.althingi.is/pdf/Green_economy.pdf)

## Research funding schemes and programmes:

The National Marine Research Strategy is implemented through the Marine Research Institute which is managed by the Ministry of Fisheries and Agriculture. A database of funded projects will be developed in the future.

Other National Research Funding Programmes which have a significant marine research element include:

- The Ministry of Industries and Innovation:
  - o **AVS** - a Research fund for Marine and Fisheries with focus on applied research for value added marine products  
[www.avs.is](http://www.avs.is)
  - o **Verkefnasjóður sjávarútvegsins** for applied R&D&I research  
[www.sjavarutvegsraduneyti.is](http://www.sjavarutvegsraduneyti.is)
  - o **Impra** – regional funds  
[www.nmi.is](http://www.nmi.is)
- The Ministry of Fisheries ([www.sjavarutvegsraduneyti.is](http://www.sjavarutvegsraduneyti.is)) merged in 2012 with the Ministry of Industry, Energy and Tourism and part of the Ministry of Economic Affairs to form the The Ministry of Industries and Innovation (MII). It covers all sectors of ordinary business and economic activity.  
<http://eng.atvinnuvegaraduneyti.is>
- The Icelandic Centre for Research, **Rannís**, also administers funding for basic/academic research as well as for technology development and applied research R&D&I.  
[www.rannis.is](http://www.rannis.is)

## Research priorities for marine biotechnology research:

- Value addition of underutilised materials
  - o Processing by-products

- New raw materials, such as seaweed
- Bioprospecting and bioactive ingredients
- Marine micro organisms and extremophiles
- Establishment of industrial biotechnology

### Strategic documents:

- English versions of strategic documents regarding biotechnology in Iceland are being developed. Most are still only available in Icelandic. An English draft of the Icelandic Biotech Sector Assessment is available but out of date. A report from 2007 on Biotechnology research policy and effort in Iceland that came out of an FP6 project is available but needs to be updated.  
[http://ec.europa.eu/research/biosociety/pdf/biopolis\\_iceland\\_en.pdf](http://ec.europa.eu/research/biosociety/pdf/biopolis_iceland_en.pdf)

### Infrastructures and coordination and support capacities / initiatives:

- **Iceland food and biotech R&D (Matis ltd)** is an independent research institute which strives toward innovation in the food industry, biotechnology and food security. Matis (<http://www.matis.is/english/about/>) provides consultancy and services to companies in fisheries and agriculture as well as governmental agencies. Currently cooperating in a number of international projects, such as:
  - SeaBiotech - FP7-KBBE start-up October 2012
  - Macumba – FP7-KBBE
  - Taste - SME project
  - MicroB3 – FP7
  - Bluegenics FP7-KBBE
- **Association of Biotech companies** defined by the Federations of Icelandic Industries  
<http://www.si.is/english>
- **University of Iceland** – Food Science and Nutrition, Center for System Biology researchers in Nature Biology  
[http://english.hi.is/frettir/center\\_for\\_systems\\_biology\\_researchers\\_in\\_nature\\_biotechnology](http://english.hi.is/frettir/center_for_systems_biology_researchers_in_nature_biotechnology)
- **University of Akureyri** – Biotechnology  
<http://english.unak.is/business-and-science/page/naturalresource>
- In 2012, Iceland operates 1 oceanic of 56m (Bjarni Saemundsson) and 1 global vessel from 69,9m (Arni Fridriksson) registered at the European Research Vessels Infobase ([www.eurocean.org](http://www.eurocean.org)).
- In 2012, France maintains about 1 large marine research equipments registered in the European large Exchangeable instruments database ([www.eurocean.org](http://www.eurocean.org)).
- Key aquaculture experimental and research facilities in Iceland include
  - Experimental facilities (Holar University college)
  - Rearing facilities (marine research institute)

### Major initiatives:

National programme is under construction. A draft in English (Icelandic Biotech Sector Assessment) is available but needs to be updated.

# Ireland



## Overarching science strategies, plans and policies:

- Ireland's national research agenda is set-out in the **Strategy for Science, Technology and Innovation**, published in 2006. [http://www.forfas.ie/media/asc060618\\_sti\\_strategy.pdf](http://www.forfas.ie/media/asc060618_sti_strategy.pdf)
- The major influence on Ireland's marine biotechnology strategy is *Sea Change – A Marine Knowledge, Research and Innovation Strategy for Ireland 2007- 2013*. Originally published in 2007, Sea Change remains influential in defining the strategic direction of Irish marine research. <http://www.marine.ie/home/research/SeaChange>
- Other related policy and national strategies include,
  - o **Food Harvest 2020** is a plan for Ireland's food sector. This Department of Agriculture, Food and the Marine strategy sets the vision for Ireland's food sector, including marine foods and establishes performance targets. <http://www.agriculture.gov.ie/media/migration/agri-foodindustry/foodharvest2020/2020FoodHarvestExeSummary240810.pdf>
  - o **Food Research Ireland** is the strategic research agenda which supports the goals of Food harvest 2020, including a dedicated strategic research agenda for marine origin food materials. <http://www.agriculture.gov.ie/media/migration/research/FoodResearchIreland.pdf>
  - o The report from the **Research Prioritisation Steering Group**, defines national priority research areas. Marine biotechnology research is relevant to research themes in Food for Health, Sustainable Food Production and Processing, Therapeutics, Processing Technologies and Novel Materials <http://www.forfas.ie/publications/featuredpublications/title,8958,en.php>



## Research funding schemes and programmes:

- No dedicated funding stream to support marine biotechnology research exists in Ireland. Different agencies provide funds for varying levels of research activity from basic to applied, all of which are awarded on the basis of open competition.
- **Science Foundation Ireland** implements a range of funding initiatives to support research at various levels. Possibilities exist for researchers in marine biotechnology related areas to apply for funds from SFI. [http://www.sfi.ie/funding/funding-calls/open-calls/assets/templates/default\\_tpl/images/favicon.ico](http://www.sfi.ie/funding/funding-calls/open-calls/assets/templates/default_tpl/images/favicon.ico)
- Specifically oriented to food research, including marine foods related research is the **Food Industry Research Measure (FIRM)** implemented by the Department of Agriculture, Food and the Marine. <http://www.agriculture.gov.ie/research/foodinstitutionalresearchmeasurefirm>
- **Enterprise Ireland** provides in-company research and development support for firms in most industry sectors. Significant emphasis on encouraging collaboration between industry and the higher education institutes is a feature of EI funding programmes. <http://www.enterprise-ireland.com/en/funding-supports/>
- The Marine Institute through its management of a national marine research funding programme established under a **National Development Plan** provided dedicated marine research support. [http://www.marine.ie/home/funding/MarineNDP2007\\_2013](http://www.marine.ie/home/funding/MarineNDP2007_2013)
- The **Irish Research Council** operates research funding initiatives which support early stage researchers at Masters, Doctoral and Postdoctoral levels to engage in exploratory research. <http://www.ircset.ie/>
- The **Higher Education Authority** manages an array of programmes designed to enhance the research capabilities, capacity and infrastructure of Ireland's higher education institutions. <http://www.hea.ie/en/research>
- A database of funded projects is available at <http://www.marine.ie/home/research/ProjectsDatabase/CurrentProjects/>

## Research priorities for marine biotechnology research:

Objectives set within Sea Change provide insights to marine biotechnology related research priorities.

- Create a strong, interdisciplinary capability in the utilisation of marine biodiversity, using novel high-throughput techniques, for the development of drugs, therapies and biomaterials.
- Develop core research capabilities and teams in taxonomy, natural products chemistry, chemogenomics and bioinformatics.
- Develop capabilities for the isolation and identification of novel chemical compounds or proteins for use by the medical device industry (e.g. adhesives and biofilms).
- Create science-based capability to support development of opportunities in functional foods based on marine raw materials, and develop strong synergies with research and development programmes in the seafood, food and health sectors.
- Develop opportunities for participation in internationally funded programmes.
- Create a strong, interdisciplinary research capability in the identification and utilisation of marine biodiversity as a source of materials for use in functional foods.
- Develop capabilities to process marine based materials for use by the functional food sector.
- Create a new research capability in marine functional foods linking indigenous and multi-national food and pharmaceutical industries with researchers at state and third level research institutions.
- Develop a screening programme for potential seaweed products (including nutritional and biochemical analysis) across the range of candidate species.

## Strategic documents:

Links to the main strategic documents are given above.

## Infrastructures and coordination and support capacities / initiatives:

The **Marine Institute** is responsible for coordination and the provision of support, including policy advice, for marine biotechnology related research.

In respect of research infrastructure, the Marine Institute manages a fleet of research vessels (<http://www.marine.ie/home/Research+Vessels.htm>). Additionally, Irish universities and institutes of technologies as well as public research institutes maintain an array of research equipment, some of which is relevant to marine biotechnology. Institutions with significant marine biotechnology related research capabilities include University College, Dublin; the National University of Ireland, Galway; University College, Cork; Limerick University; Tralee Institute of Technology; Waterford Institute of Technology; Cork Institute of Technology; Limerick Institute of Technology and Letterkenny Institute of Technology. Links to each of these institutions are at <http://www.hea.ie/en/AboutHEA#Universities>. Teagasc Ireland's agriculture and food development authority, leads the NutraMara functional foods programme and maintains an extensive research infrastructure. <http://www.teagasc.ie/>

- In 2012, Ireland operates 2 local/coastal vessels from 15m to 31,4 m (R.V. Keary, Celtic Voyager) and 1 global vessel of 65,5mm (Celtic Explorer) registered at the European Research Vessels Infobase ([www.eurocean.org](http://www.eurocean.org)).
- In 2012, Ireland maintains about 3 large marine research equipments registered in the European large Exchangeable instruments database ([www.eurocean.org](http://www.eurocean.org)).
- Key aquaculture experimental and research facilities in Ireland include
  - o Freshwater hatchery (Marine Institute)
  - o Martin Ryan Institute Carna (National University of Ireland)
  - o Daithi O'Murchu Marine Research Station
  - o Aquaculture and Fisheries Development centre (University College Cork, department zoology, ecology and plant science)

## Major Initiatives:

Major initiatives which incorporate, or have links to marine biotechnology based research include

- **NutraMara** – a marine functional foods research programme  
<http://www.marine.ie/home/research/ProjectsDatabase/CurrentProjects/MFFRI.htm>
- **The Beaufort Marine Biodiscovery Project**  
<http://www.marine.ie/home/research/ProjectsDatabase/CurrentProjects/Marine+Biodiscovery.htm>
- **The Beaufort *Fish Population Genetics* project**  
<http://www.marine.ie/home/research/ProjectsDatabase/CurrentProjects/Fish+Population+Genetics.htm>
- **Food for Health Ireland** <http://www.fhi.ie/>

## Trends and observations

### Strategy on Marine Biotechnology:

Ireland has a national strategy on marine biotechnology, as an element of an overall marine research strategy (Sea Change), focusing on biodiscovery and functional foods/neutraceuticals. A recent broader national research prioritization exercise includes marine functional foods as part of a 'Food for Health' priority and opportunities marine biodiscovery research within the 'Therapeutics' priority. Links between marine biotechnology and other priority areas also exist.

### Programs on Marine biotechnology:

There is no distinct (i.e. 'ring-fenced') funding program for marine biotechnology, but marine biotechnology can be funded as part of the funding programmes of a number of funding agencies, ranging from the basic science (Science Foundation Ireland), to specific marine programmes (Marine Institute) and industry-focused programmes (Enterprise Ireland).

### Funding:

The Marine Institute operates a national marine research funding programme. From a total annual budget of €8-10M for this programme, spending on marine biotechnology research (Marine Biodiscovery and Marine Functional Foods) accounts for approximately €1.5M/annum. Additional investments from other national funding agencies (e.g. Department of Agriculture, Food and marine; Science Foundation Ireland) amount to approximately €0.5M/annum.

Irish researchers are very active in FP7 funded marine biotechnology projects, including marine biofuels.

# Italy



## Overarching science strategies, plans and policies:

Italy does not have a dedicated Marine Biotechnology strategy, plan or policy. Overarching Italian Science and Technology Policy for the period 2011-2013 is described in Programma Nazionale della Ricerca. The marine research component of this Strategy is further developed in the Italian Research for the Sea Programme managed by Ministry of Education, University and Research.

- **Italian National Research Programme 2011-2013**  
[http://www.miur.it/Documenti/ricerca/pnr\\_2011\\_2013/PNR\\_2011-2013\\_23\\_MAR\\_2011\\_web.pdf](http://www.miur.it/Documenti/ricerca/pnr_2011_2013/PNR_2011-2013_23_MAR_2011_web.pdf)
- **RITMARE** is a national programme which promote marine research, including Biotechnologies  
[http://www.mit.gov.it/mit/mop\\_all.php?p\\_id=06444](http://www.mit.gov.it/mit/mop_all.php?p_id=06444)



## Strategic documents:

- **BioItaly** report , a document which report a detailed analyses of Biotechnologies in Italy, sectors, funding, trend (09/05/2012 will be published the updated version)  
[http://www.ey.com/Publication/vwLUAssets/BioItaly-report\\_2011/\\$FILE/BioItaly\\_2011.pdf](http://www.ey.com/Publication/vwLUAssets/BioItaly-report_2011/$FILE/BioItaly_2011.pdf)
- **Guideline for the development of biotechnologies** in Italy  
<http://www.osservatoriobiotec.it/Store/LineeGuidaCNBBinglese.pdf>
- **Industrial Biotechnology** in Italy, initiative and policies  
[http://www.bio-economy.net/bioeconomy/member\\_states/italy/files/report\\_italy\\_final01.pdf](http://www.bio-economy.net/bioeconomy/member_states/italy/files/report_italy_final01.pdf)

## Research funding schemes and programmes:

There are a range of relevant funding schemes and programmes which may provide financial support for marine biotechnology research, including:

- **Funding scheme**  
<http://www.ditt.de/atlas/it/node/2/view>
- **National Research programmes**  
(<http://www.istruzione.it/web/ricerca/home>)
- **PON National Operative Programme** from the Ministry of Education Universities and Research, Ministry of Economy Development to promote research–industry collaboration at national level  
<http://www.ponrec.it>
- **POR REGIONAL OPERATIVE PROGRAMME** to promote research–industry collaboration at regional level  
<http://www.sviluppoeconomico.gov.it/>
- **PRIN NATIONAL INTEREST RESEARCH PROGRAMME**  
[www.miur.it](http://www.miur.it)
- **FIRB** to promote Fundamental Research  
[www.miur.it](http://www.miur.it)
- **FAR** to promote Industrial Research  
[www.miur.it](http://www.miur.it)
- **FNI** to support Entreprises innovation  
<http://www.sviluppoeconomico.gov.it/>

## Research priorities for marine biotechnology research:

- Human, animal and environment health;
- Industrial Biotechnologies (Bio-processes);
- Bio-prospecting.

## Infrastructures and coordination and support capacities / initiatives:

- **National Committee for Biosafety, Biotechnology and Life Sciences (CNBBSV)**  
<http://www.governo.it/biotecnologie/organizzazione.html>
- **Cluster Applied Biotechnologies** [www.sardegnaicercche.it](http://www.sardegnaicercche.it)
- **National Centre for Biological resources** <http://www.cnr.it/>
- Useful links for Italian research infrastructure and support initiatives for biotechnology research :  
<http://www.biotechitaly.com/web/Rubriche.aspx?rubrica=Links>
- In 2012, Italy operates 12 local/coastal vessels from 10m to 42,40 m; 2 regional vessels of 35,3m and 44,8m (Universitatis, Dallaporta); 1 oceanic of 61,3m (Urania); and 2 global vessels of 72,63 and 130m (Italica, OGS-Explora) registered at the European Research Vessels Infobase ([www.eurocean.org](http://www.eurocean.org)).
- In 2012, Italy maintains about 3 large marine research equipments registered in the European large Exchangeable instruments database ([www.eurocean.org](http://www.eurocean.org)).
- Key aquaculture experimental and research facilities in Italy include
  - o Rearing installations (Istituto Sperimentale Talassografico)
  - o Marine Aquaculture and fisheries research centre (Universita del Salento)

# Latvia



## Overarching science strategies, plans and policies:

There are no specific marine biotechnology strategies, plans or policies.

## Research funding schemes and programmes:

- **Competence centre program**, Investment and Development Agency of Latvia  
[http://en.latbiotech.lv/files/LBA%20zinass%20Nr1\\_EN.pdf](http://en.latbiotech.lv/files/LBA%20zinass%20Nr1_EN.pdf)
- **Environment, Bioenergetics and Biotechnology Competence centre**  
[http://en.latbiotech.lv/index.php?option=com\\_content&view=article&id=120&catid=43&Itemid=132](http://en.latbiotech.lv/index.php?option=com_content&view=article&id=120&catid=43&Itemid=132)



## Research priorities:

Blue biotech as such does not appear to be a priority at this stage.

# Lithuania



## Overarching science strategies, plans and policies:

- Lithuanian biotechnology policy  
[http://www.bio-economy.net/bioeconomy/member\\_states/lithuania/files/report\\_lithuania\\_final01.pdf](http://www.bio-economy.net/bioeconomy/member_states/lithuania/files/report_lithuania_final01.pdf)



## Research funding schemes and programmes:

- **National Industrial Biotechnology Development Programme** for 2007-2010  
[http://www.bio-economy.net/bioeconomy/member\\_states/lithuania/files/report\\_lithuania\\_final01.pdf](http://www.bio-economy.net/bioeconomy/member_states/lithuania/files/report_lithuania_final01.pdf)
- Strengthening and sustaining the European perspectives of Molecular Biotechnology in Lithuania (**MoBiLi**)  
<http://mobili.ibt.lt/>

## Infrastructures and coordination and support capacities / initiatives:

- In 2012, Lithuania operates 2 local/coastal vessels from 21m to 23,06 m (Gintaras, Darius); 1 oceanic of 55,6m (Vejas) registered at the European Research Vessels Infobase ([www.eurocean.org](http://www.eurocean.org)).
- **Association “Baltic valley”**  
<http://balticvalley.lt/en/>

# Malta



## Overarching science strategies, plans and policies:

There is currently no specific Marine Biotechnology strategy or policy in Malta. Overarching Maltese Science & Technology Policy is described in a National Strategy for Research and Innovation for the period 2007-2010 (Building and Sustaining the Research and Innovation Enabling Framework). Currently a National Strategy for Research and Innovation for the period 2011-2020 is being developed.



- **National Strategic Plan for Research and Innovation:** Building and Sustaining the R&I Enabling Framework Malta Council for Science and Technology (MCST) <http://www.mcst.gov.mt/>

## Research funding schemes and programmes:

The biotech/marine component of the National Research Strategy is implemented through the National R&I Funding Programme which is managed by the Malta Council for Science & Technology (MCST). A database of funded projects is available at [www.mcst.gov.mt](http://www.mcst.gov.mt)

## Infrastructures and coordination and support capacities / initiatives:

- In 2012, Malta operates 1 local/coastal vessel of 15 m (Madonna ta) registered at the European Research Vessels Infobase ([www.eurocean.org](http://www.eurocean.org)).

# The Netherlands



## Overarching science strategies, plans and policies:

There is currently no dedicated strategy or policy for Marine Biotechnology research in the Netherlands. The current research and innovation policy for the Netherlands is incorporated in the Ministry of Economics, Agriculture and Innovation document 'To the top: Towards a new enterprise policy', published in 2011. The special report 'Quality in diversity: Strategic Agenda Higher Education, Research and Science' was published in July 2011.

- **To the top: Towards a new enterprise policy**  
<http://www.government.nl/documents-and-publications/parliamentary-documents/2011/02/04/to-the-top-towards-a-new-enterprise-policy.html>
- **Quality in diversity: Strategic Agenda Higher Education, Research and Science**  
<http://www.government.nl/documents-and-publications/reports/2012/08/30/quality-in-diversity.html>
- **NIOZ Science Plan** Royal Netherlands Institute for Sea Research (NIOZ)  
[www.nioz.nl/public/nioz\\_reports/scienceplan\\_08-12.pdf](http://www.nioz.nl/public/nioz_reports/scienceplan_08-12.pdf)



## Research funding schemes and programmes:

- The national Marine Research Strategy is implemented through the **Dutch National Programme Sea and Coastal Research** from the Netherlands Organisation for Scientific Research (NWO), Division Earth and Life Sciences (ALW). A database of funded projects from NWO is available at  
[http://www.nwo.nl/projecten.nsf/pages/NWOP\\_6KRLVE\\_Eng](http://www.nwo.nl/projecten.nsf/pages/NWOP_6KRLVE_Eng)  
[www.nwo.nl/nwohome.nsf/pages/NWOA\\_795JFX\\_Eng](http://www.nwo.nl/nwohome.nsf/pages/NWOA_795JFX_Eng)
- Other National Research Funding Programmes which have a significant marine research element include:
  - o **Deltares Healthy Water and Subsoil systems programme**  
<http://kennisonline.deltares.nl/thema-s/gezonde-water-en-bodemsystemen>
  - o **MARIN Maritime Innovation Programme**  
[www.nedmip.nl](http://www.nedmip.nl)
- Important biotechnology research programmes
  - o **IBOS - Integration of Biosynthesis and Organic Synthesis.** This programme from NWOACTS runs from 2003 to 2010 with a budget of € 13,6 million (€ 2,27 million from NWO General Board € and 2,27 million from NWO Chemical Sciences), Ministry of Economic Affairs (€ 4,54 million), chemical and life sciences industry (€ 4,54 million). It aims at a change of strategy in synthetic chemistry by integrating state of the art organic chemistry and modern biochemistry and biotechnology. This will enable a new and sustainable future for more efficient industrial synthesis of ever more complex products, hand in hand with a drastic reduction of waste products.  
[http://www.nwo.nl/nwohome.nsf/pages/NWOA\\_6NSGQQ\\_Eng](http://www.nwo.nl/nwohome.nsf/pages/NWOA_6NSGQQ_Eng)
  - o **B-Basic - Bio-based Sustainable Industrial Chemistry.** The B-Basic programme from NWOACTS runs from 2004 to 2010 with a total budget of € 50 million (basic subsidy of the Ministry of Economic Affairs (€ 25 million), industrial B-Basic partners (€ 12 million) and participating universities and research institutes (€ 13 million). Research focuses on 4 multidisciplinary themes: bulk chemicals, fine chemicals, performance materials and novel feed stocks. In addition, B-Basic contains a Life Science & Technology Training Centre and a clear focus on innovation via workshops and an annual Innovation Trophy. B-Basic aims to provide the chemical industry with an advanced set of tools and concepts by approaching Bio-based Sustainable Industrial Chemistry in a fully integrated manner, combining functional genomics, intensified bioprocess technology and feedstock scenarios. B-Basic is a consortium of Delft University of Technology, the University of Groningen, Leiden University,

Wageningen University and Research Centre, TNO, Agrotechnology & Food Sciences Group, DSM, AkzoNobel, Shell Global Solutions, Paques and Schering-Plough.

<http://www.b-basic.nl/>

- **STW Open Technology Programme** is open to proposals from any field of applied research and aims to enhance the utilisation of research results. Research proposals can be submitted on an on-going basis.  
<http://www.stw.nl>
- **Kluyver Centre for Genomics of Industrial Fermentation.** This Programme initiated by the Netherlands Genomics Initiative has started in 2002. Since 2008 a second 5 years subsidy round has began. The annual turnover of the Kluyver Centre is €10 million with up to one third from industry and two third from governmental sources and knowledge institutes. The research covers five programmes: yeast for chemicals, fuels and beverages, Filamentous fungi for protein and peptides; lactic acid bacteria for fermented foods and food ingredients; systems biology of industrial micro-organisms and industrial genomics for society. The Kluyver Centre aims to enable breakthrough innovations in industrial biotechnology that are required for addressing sustainability, quality of life and the economy. To this end, it applies existing and novel genomics technology for high-quality, precompetitive and focused research on three key groups of industrial micro-organisms: yeast, fungi, and lactic acid bacteria. The Kluyver Centre is a consortium comprised of Delft University of Technology, the universities of Groningen, Leiden and Utrecht, Wageningen University, VU University Amsterdam, NIZO food research and TI Food and Nutrition. Current industrial partners are: Applikon Biotechnology, CSKFood Enrichment, Danone, DSM, Friesland Foods, Heineken, Nestlé, Purac, and Tate & Lyle.  
<http://www.kluyvercentre.nl/>
- **Innovational Research Incentives Scheme.** The aim of the Innovational Research Incentives is to promote innovation in the academic research field. Industrial Biotechnology research ideas can flourish within this funding.  
[http://www.nwo.nl/subsidiewijzer.nsf/pages/NWOA\\_4YJDQ3\\_Eng](http://www.nwo.nl/subsidiewijzer.nsf/pages/NWOA_4YJDQ3_Eng)
- **CatchBio - Catalysis for Sustainable Chemicals from Biomass** initiates a research programme of 8 years (it started in 2007) in the field of catalytic biomass conversion. It aims to process the various components present in biomass (cellulose, hemi-cellulose, lignin, proteins and oils) in useful fuels, chemicals and pharmaceuticals. Also the socio-economical and ethical aspects will be investigated. CatchBio is a collaborative programme of Universities and Industry with a total budget of € 29million of which € 15 million is a subsidy provided by the Ministry of Economic Affairs.  
<http://www.catchbio.com>
- **Horizon** - The Horizon programme is set up as a breeding ground for talented researchers active in genomics and/or bioinformatics. It aims to promote and coordinate outstanding and visionary fundamental research by offering researchers the freedom to realize their ideas and concepts beyond existing disciplines. The research supported by the Horizon programme is future-oriented. Researchers are given the opportunity to respond rapidly to new hypotheses or technologies. In addition, the Horizon programme seeks to achieve valorisation of the results obtained in the research projects. Project leaders are therefore expected to adopt an active attitude towards valorisation.  
<http://www.genomics.nl/Talent/Horizon.aspx>

## Research priorities:

Current science and technology policy in the Netherlands identifies nine 'top sectors' for research and innovation, several of which are relevant for Marine Biotechnology Research:

- Life Sciences;
- Water;
- Agro-food;
- Energy;

- Chemicals;
- Creative Industry;
- Horticulture and propagating stock;
- High-tech materials and systems;
- Logistics.

There are no specific marine biotechnology research priorities defined by the Dutch government at this stage.

### Strategic documents:

- National science policy and the science system in the Netherlands: An organisational overview  
<http://www.government.nl/issues/science/national-science-policy>
- Overview of the state of art of the Dutch Lifesciences and health biotechnology research  
[http://www.lifescienceshealth.com/downloads.html?no\\_cache=1&tx\\_drblob\\_pi1%5BdownloadUid%5D=25](http://www.lifescienceshealth.com/downloads.html?no_cache=1&tx_drblob_pi1%5BdownloadUid%5D=25)
- The Report Industrial Biotechnology In The Netherlands contains a good description policy and regulations  
[http://www.bio-economy.net/bioeconomy/member\\_states/netherlands/files/report\\_netherlands\\_final01.pdf](http://www.bio-economy.net/bioeconomy/member_states/netherlands/files/report_netherlands_final01.pdf)

### Infrastructures and coordination and support capacities / initiatives:

- In 2012, The Netherlands operates 8 local/coastal vessels from 15m to 34,9 m; 1 regional vessels of 41,5m (Delta); 1 oceanic of 63m (Zirfaea); and 3 global vessels from 66m to 83,02m registered at the European Research Vessels Infobase ([www.eurocean.org](http://www.eurocean.org)).
- In 2012, The Netherlands maintains about 1 large marine research equipments registered in the European large Exchangeable instruments database ([www.eurocean.org](http://www.eurocean.org)).
- Key aquaculture experimental and research facilities in The Netherlands include
  - o Aquarium facilities (Royal Netherlands Intitute for Sea Research)
  - o Aquarium facilities (Wageningen IMARES)
- Most laboratories, bench and pilot-scale facilities available in the universities and institutes are more or less open-to-all facilities; those available in private enterprises are mostly closed facilities.
- Applied and strategic research by **IMARES Wageningen UR**  
[www.imares.wur.nl/UK/](http://www.imares.wur.nl/UK/)
- Fundamental research in estuarine water and coastal seas at world class level by **CEME**  
<http://www.nioo.knaw.nl/en/content/centre-estuarineand-marine-ecology>

# Norway



## Overarching science strategies, plans and policies:

- National Whitepaper: “**Climate for research**” describes the overall Norwegian government’s research strategy.  
<http://www.regjeringen.no/pages/2178785/PDFS/STM200820090030000DDDPDFS.pdf>
- National Whitepaper: “**Marine Bioprospecting- a source of new and sustainable wealth growth**” describes the Norwegian government’s strategy for marine bioprospecting.  
[http://www.regjeringen.no/upload/FKD/Vedlegg/Diverse/2009/Marin\\_bioprospektering\\_080909\\_lavoppl.pdf](http://www.regjeringen.no/upload/FKD/Vedlegg/Diverse/2009/Marin_bioprospektering_080909_lavoppl.pdf)
- National Whitepaper: “**National strategy for biotechnology**” describes the Norwegian government’s strategy on biotechnology.  
<http://www.regjeringen.no/upload/KD/Vedlegg/Forskning/Bioteknologistrategi.pdf>
- National White paper: “**Strategy for an Environmentally Sustainable Norwegian Aquaculture Industry**” describes the Norwegian government’s strategy on aquaculture.  
<http://www.regjeringen.no/upload/FKD/Vedlegg/Diverse/2009/strategy%20for%20an%20sustainable%20aquaculture.pdf>
- National White paper: “**Nordområdestategien**” describes the Norwegian government’s strategy for research in the high north.  
<http://www.regjeringen.no/upload/FKD/Vedlegg/Diverse/2009/strategy%20for%20an%20sustainable%20aquaculture.pdf>



## Research funding schemes and programmes:

- **The Research Council of Norway (RCN)** funds research projects, innovation projects, industrial projects and infrastructure. Relevant research programmes includes:
  - o **BIOTEK2021:** A research financing program that finance applied academic research and industrial development of biotechnology.  
<http://www.forskningsradet.no/servlet/Satellite?c=Page&pagename=biotek2021%2FHovedsidemal&cid=1253970728155&langvariant=en>
  - o **Aquaculture - An industry in growth:** A research financing program that finance applied academic research and industrial development on aquaculture and fisheries  
<http://www.forskningsradet.no/servlet/Satellite?c=Page&pagename=havbruk%2FHovedsidemal&cid=1226994216892>
  - o **The ocean and the coast:** A research financing program that finance academic research and industrial development on eco systems and the marine environment  
<http://www.forskningsradet.no/servlet/Satellite?c=Page&cid=1226994156395&pagename=havkyst%2FHovedsidemal>
  - o **Sustainable Innovation in Food and Bio-based Industries:** A research financing program that finance applied academic research and industrial development of bio-based industries.  
<http://www.forskningsradet.no/servlet/Satellite?c=Page&pagename=bioner%2FHovedsidemal&cid=1253971968584&langvariant=en>
  - o **Polar research:** A research financing program that finance research on sustainable management and development of industries in the high north  
<http://www.forskningsradet.no/servlet/Satellite?c=Page&pagename=polarforskning%2FHovedsidemal&cid=1231229969369&langvariant=en>
- **Innovation Norway** funds innovation projects with industry and infrastructure. Relevant programmes include:

- Public R&D contracts and Private R&D contracts, where SMBs can be funded with up to 35% in a collaboration project with either a public or private customer.  
<http://www.innovasjon Norge.no/Finansiering/IFUOFU/>
- Entrepreneurial grant, where start-ups can be funded in an initial period of the company.  
<http://www.innovasjon Norge.no/Finansiering/Etablerertilskudd1/>
- **SIVA** funds infrastructures, such as laboratories and necessary housing for innovation centres.  
<http://www.siva.no/internett/cms.nsf/pages/english?open>
- Regional research foundations funds research projects, innovation projects, industrial projects and infrastructure.  
<http://www.regionaleforskningsfond.no/servlet/Satellite?c=Page&pagenam=rff-hovedside/Hovedsidemal&cid=1253954088866>
- A collaboration effort exists between Innovation Norway, The research council of Norway, SIVA and equivalent research councils in the United Kingdom to fund innovation and applied research in marine biotechnology.  
<https://connect.innovateuk.org/web/biosciencesktn/articles/-/blogs/6374683;jsessionid=E2F58BACA08C2F4ECA1F541C658C55B7.MekushUdbew4>

### Research priorities for marine biotechnology research:

- Bioprospecting / Biodiscovery, Aquaculture, Human and animal health
- Fisheries
- Polar research
- Industrial biotechnology
- Bio-based industries



### Strategic documents:

- **Strategy plan for Marine Bioprospecting:** A strategy document formed by the RCN, Innovation Norway and SIVA on how to implement the national strategy for Marine Bioprospecting.  
<http://www.forskningsradet.no/servlet/Satellite?c=Page&cid=1253953666626&pagenam=fuge%2FHovedsidemal>
- **The Arctic and Northern Areas Initiative (Forskning.nord.to):** The Research Council of Norway's research strategy for the high north  
<http://www.forskningsradet.no/servlet/Satellite?c=Nyhet&cid=1253968952749&lang=no&pagenam=nord%2FHovedsidemal>
- A new program plan (Biotek2021) for biotechnology is under development.

### Infrastructures and coordination and support capacities / initiatives:

- In 2012, Norway operates 9 local/coastal vessels from 12,2m to 31,25 m; 1 regional vessels of 47,24m (Hakon Mosby); 4 oceanic from 56,80m to 64,40; and 3 global vessels from 66,65m to 102,8m registered at the European Research Vessels Infobase ([www.eurocean.org](http://www.eurocean.org)).
- In 2012, Norway maintains about 11 large marine research equipments registered in the European large Exchangeable instruments database ([www.eurocean.org](http://www.eurocean.org)).
- Key aquaculture experimental and research facilities in Norway include
  - Breeding facilities (Aqua Gen AS)
  - Skretting, Marine Harvest (Center for Aquaculture Competence AS)
  - Trial farms (Ewos Innovation AS)
  - Commercial sea based facilities (Fjord Forsøksstasjon Helgeland AS)
  - Grow out sea based facilities (GIFAS - Gildeskål Forskningsstasjon)
  - Cod Breeding Centre Nofima Marin
  - Grow out sea based facilities (NIVA)

- SEALAB( SINTEF)
  - Aquaculture research station (Havbruksstasjonen)
  - Grow out unit (Val Akva)
  - Grow out sea based facilities (VESO Vikan Akvavet)
  - Cod Farm and Miljølaks (Villa AS)
  - IMR - Flødevigen Research Station (Institute of Marine Research )
  - IMR - Matre Research Station (Institute of Marine Research)
  - CodTech laboratory (NTNU)
  - IMR - Austevoll Research Station (Institute of Marine Research)
- **Biotech North:** BioTech North is the network organisation for the development of biotechnology in the Tromsø region in North Norway.  
<http://biotechnorth.no/biotech-north-2/>
  - **Biotech Forum:** Norwegian Bioindustry Association (NBA) was established autumn 2001 by representatives for Norwegian biotechnological industries and the Confederation of Norwegian Business and Industry (NHO). The Association is an independent member organization with purpose to promote development of Norwegian biotechnological trade and research.  
[http://www.biotekforum.no/About\\_us/](http://www.biotekforum.no/About_us/)
  - **10 biotechnology platforms:** These technology platforms have been built up during the course of the FUGE programme. They offer service in different high tech niches to academic researchers and industry.  
<http://www.forskningsradet.no/servlet/Satellite?c=Page&cid=1226993578290&pagename=fuge%2FHovedsidemal>
  - **Mabcent-SFI:** Center for research based innovation on bioprospecting in Tromsø where academic research groups and SMBs collaborate on defined research topics for innovation. <http://www0.nfh.uit.no/mabcent/>
  - **MarBank:** A national marine biobank organising the collection, and structuring of the marine biodiversity for research and industrial development.  
[http://www.imr.no/barentshavet/tokt/toktdagbok\\_2006/dagbok/marbank](http://www.imr.no/barentshavet/tokt/toktdagbok_2006/dagbok/marbank)  
[http://www.noruega.org.pt/PageFiles/575028/7%20Kjersti%20L%20Gabrielsen\\_Marbank%20-%20A%20national%20collection%20of%20Arctic%20Marine%20Organisms.pdf](http://www.noruega.org.pt/PageFiles/575028/7%20Kjersti%20L%20Gabrielsen_Marbank%20-%20A%20national%20collection%20of%20Arctic%20Marine%20Organisms.pdf)

## Major Initiatives:

- **FUGE:** The first targeted programme at The Research Council of Norway aimed at functional genomics. The program was in function from 2002 to 2011 and have financed research projects for about 1,7 billion kroner of which about 20 % are within marine biotechnology. The responsibility for fulfilling the national strategy for marine bioprospecting was part of the program. This is now continued within the BIOTEK2021 programme.  
<http://www.forskningsradet.no/servlet/Satellite?c=Page&pagename=fuge%2FHovedsidemal&cid=1226993493126>

# Poland



## Overarching science strategies, plans and policies:

There are no specific Marine Biotechnology strategies, plans or policies in Poland. Relevant Polish research strategies are described in different documents, including

- The **National Research Programme** describes the overall Polish government's research strategy.  
[http://www.ncbir.pl/gfx/ncbir/pl/defaultopisy/23/1/1/krajowy\\_program\\_badan.pdf](http://www.ncbir.pl/gfx/ncbir/pl/defaultopisy/23/1/1/krajowy_program_badan.pdf)
- The **National Scientific Research and Development Programme** describes Polish government's strategy on research and development and defines priority research areas.  
[http://www.bip.nauka.gov.pl/\\_gAllery/54/32/5432/Krajowy\\_Program\\_Badan\\_Naukowych\\_i\\_Prac\\_Rozwojowych.pdf](http://www.bip.nauka.gov.pl/_gAllery/54/32/5432/Krajowy_Program_Badan_Naukowych_i_Prac_Rozwojowych.pdf)
- The **Applied Research Programme** covers the Polish government's strategy on applied research.  
[http://www.ncbir.pl/gfx/ncbir/pl/defaultopisy/525/1/1/program\\_badan\\_stosowanych\\_opis.pdf](http://www.ncbir.pl/gfx/ncbir/pl/defaultopisy/525/1/1/program_badan_stosowanych_opis.pdf)
- The "**Basis for the Maritime Policy of the Republic of Poland until 2020**" describes the overall Polish government's maritime policy.  
[http://www.cbss.org/component/option,com\\_attachments/id,564/task,download/](http://www.cbss.org/component/option,com_attachments/id,564/task,download/)
- The **Strategy on Development of Polish Maritime Economy** for the years 2007-2015 (project)  
<http://www.mea.szczecin.pl/klaster/Strategia%20Rozwoju%202007-15.pdf>
- The Polish Ministry of Science and Higher Education's document titled "**Biotechnology**" describes the priorities of strategy on biotechnology and defines biotechnology itself as one of the most important fields of science for Polish economy.  
<http://www.nauka.gov.pl/nauka/polityka-naukowa-panstwa/biotechnologia/biotechnologia/>
- In March 2008, the Ministry of Science and Higher Education adopted the **Action plan: towards the development of industrial biotechnology in Poland**. This action plan addresses mainly two types of activities: research and development activities (R&D) as well as system activities (policy).  
[http://www.bio-economy.net/bioeconomy/member\\_states/poland/files/workshop\\_files/draft\\_summary\\_poland.pdf](http://www.bio-economy.net/bioeconomy/member_states/poland/files/workshop_files/draft_summary_poland.pdf)



## Research funding schemes and programmes:

- The **Ministry of Science and Higher Education** is the main institution financing research and development projects except for military research.  
<http://www.nauka.gov.pl/home/>
- The **National Centre for Research and Development (NCRD)** manages and executes strategic research and development programmes, funds applied research and innovation projects and supports commercialization or other forms of transfer of scientific research results.  
<http://www.ncbir.pl/en/>
- The **National Science Centre (NSC)** supports basic research by funding research projects carried out by Polish scientists and research teams, both on the domestic and international level, as well as doctoral fellowships and post-doctoral internships. NCNs annual budget is around € 230M, with about € 0,2 M being spent on marine biotechnology.  
<http://ncn.gov.pl/?language=en>
- The Ministry of Science and Higher Education adopted the "**Action plan: towards the development of industrial biotechnology in Poland**". This action plan addresses mainly two types of activities: research and development activities (R&D) as well as system activities (policy). The main R&D activities are:

- Unique and improved biocatalysts, metabolites and microorganisms of new generation as essential tools for bioprocesses
- Production of biodegradable biomaterials and polymers
- Integrated biorefineries – bioprocesses for production of new generation of liquid and gaseous biofuels and recovery of high value added components from by-products and wastes

[http://www.bio-economy.net/bioeconomy/member\\_states/poland/files/workshop\\_files/draft\\_summary\\_poland.pdf](http://www.bio-economy.net/bioeconomy/member_states/poland/files/workshop_files/draft_summary_poland.pdf)

## Research priorities:

General research priorities from strategic plans in biotechnology and marine research include:

- Fisheries and aquaculture research
- Industrial biotechnology
- Bio-based industries
- Securing human and animal health
- Biodiscovery and sustainable exploitation of the Baltic Sea resources
- Green energy
- Climate change research
- Pollution monitoring, prevention and remediation
- Preservation of Baltic Sea ecosystem

In December 2005, a conference on the “Perspectives and trends in development of biotechnology in Poland until 2013” was organised by the Polish Academy of science. One of the main foci was placed on the development of industrial biotechnology. As a result of this conference, the following trends for the development of industrial biotechnology were placed on the agenda to develop through 2013:

- Microbial genomics and bioinformatics
- Metabolic engineering and modelling
- Biocatalyst function and optimisation
- Biocatalyst process design
- Innovative fermentation science and engineering
- Bioproduct isolation and purification
- Novel enzymes and microorganisms

[www.biotechnologia.com.pl/upload2/Scan\\_Balt\\_atlas\\_biot.pdf](http://www.biotechnologia.com.pl/upload2/Scan_Balt_atlas_biot.pdf)

## Strategic documents:

There are no strategic documents in the field of marine biotechnology or marine bioprospecting.

## Infrastructures and coordination and support capacities / initiatives:

- **The Polish Biotechnology Platform** is one of the 28 technological platforms in Poland. It carries out research programmes in the field of biotechnology, which are strategic from the point of view of Polish government and EU. <http://www.platformabio.pl/en.html>
- **The Sea Research Committee** supports research in the field of oceanology and performs the function of the National Committee for cooperation with Scientific Committee on Oceanic Research. <http://www.ioopan.gda.pl/kbm/pl/>

- **The Department of Genetics and Marine Biotechnology of Institute of Oceanology** of Polish Academy of Sciences performs researches on biochemistry and genetics of marine organisms.  
<http://www.iopan.gda.pl/genetyka.html>
- **The Institute of Oceanography** of the University of Gdańsk conducts scientific research in the coastal zone of the shelf seas and implements national and international projects in the field of oceanography.  
<http://www.ocean.ug.edu.pl/pages/english-version/about-the-institute.php>
- **The Centre of Excellence for Baltic Development, Education and Research (BALTDER)** focuses on research in the field of marine ecology, biology, chemistry and physical oceanography.  
[http://www.kpk.gov.pl/centra\\_doskonalosci/coe/midi/data/476.html](http://www.kpk.gov.pl/centra_doskonalosci/coe/midi/data/476.html)
- **The Maritime Institute** is a Polish maritime research and development entity.  
<http://www.im.gda.pl/>
- **National Marine Fisheries Research Institute** is the Poland's oldest marine science center.  
<http://www.sfi.gdynia.pl/>
- **Pomeranian Science and Technology Park** provides excellent conditions for development of high technology-based ideas, mainly in biotechnology, environment protection, computer science, electronics and telecommunication and industrial design.  
<http://ppnt.pl/en.html>
- **Gdansk Science and Technology Park** is a facet for cooperation between science and business and promotes entrepreneurship, activity, development and creativity. It takes part in the "Submariner" project.  
<http://www.gpnt.pl/en.html>
- **Centre of Excellence "Environmental Biotechnology Research Centre" DEMETER** is one of the leading Polish research centres in the field of environmental biotechnology with wide contacts in whole Europe with research centres involved in environmental engineering.  
<http://kbs.ise.polsl.pl/etomite/index.php?id=97>
- **Centre of Excellence BIOMOBIL** is the academic department in Gdansk which performs biotechnology research.  
[http://www.biotech.ug.gda.pl/index\\_eng.php](http://www.biotech.ug.gda.pl/index_eng.php)
- **Department of Environmental Biotechnology** develops advanced technologies based on biological systems to improve efficiency and reduce or utilise waste to benefit a wide range of industries and the environment.  
[http://www.uwm.edu.pl/kbos/index\\_en.php?id=1](http://www.uwm.edu.pl/kbos/index_en.php?id=1)
- **The West Pomeranian Maritime Cluster**  
<http://klastermorski.com/misja-i-cele.html>
- In 2012, Poland operates 3 local/coastal vessels from 12,17m to 32,5 m; 2 regional vessels of 41m and 48,93m (Baltica, Oceania); 1 oceanic of 60,3m (Nawigator XXI) registered at the European Research Vessels Infobase ([www.eurocean.org](http://www.eurocean.org)).
- In 2012, Poland maintains about 2 large marine research equipments registered in the European large Exchangeable instruments database ([www.eurocean.org](http://www.eurocean.org)).

## Major initiatives:

The **Polish Technology Platform for Biotechnology** has been established in January 2005 in the framework of the European Technology Platform for Sustainable Chemistry (SusChem). It is coordinated by the Technical University of Lodz and the Centre of Excellence of Industrial Biotechnology. It gathers 18 industrial partners, 5 advanced technology centres, 7 centers of excellence, 4 research institutes, the Polish Federation of Biotechnology and the National Contact Points for EU Research Programmes of the EU. The main objectives of the platform are:

- o to build a platform between science and industry in scope of development of new biotechnologies
- o to integrate key economic and research partners interested in technologies based on bioprocesses
- o to build a strategy for developing modern biotechnology in Poland
- o to elaborate implementation methods of new biotechnologies in industrial processes, health care, environment and agriculture
- o to take optimum advantage of Structural Funds
- o to participate actively in European Research Programmes
- o to promote biotech processes and products
- o to cooperate in creating policies and law facilitating the development of biotechnology

<http://www.zinatne.lv/NBCC/files/File/Polish%20Technology%20Platform%20for%20Biotechnology%20NBCC%20PM%2008%2004%202006%20final.PPT>

### **Observations, trends and future prospects:**

Biotechnology is considered by the Polish Ministry of Science and Higher Education as one of the most important fields of science, which the Polish economy may benefit from a lot. There have been numerous investments in infrastructure for biotechnology research centres, which indicates how important role will play the biotechnology in the Polish economy in the nearest future. It surely concerns marine biotechnology as well. Although an overall strategy for marine biotechnology or bioprospecting has not been developed yet, it will be surely developed in the future, because the Polish government makes the effort to develop comprehensive strategies for all sectors of economy and research.

# Portugal



## Overarching science strategies, plans and policies:

Portugal does not have a specific Marine Biotechnology research policy or strategy. There is a national strategy for the Sea and for food, but there is no specific strategy on biotechnology.

- **National Strategy for the Sea**

[http://www.cienciaviva.pt/img/upload/Estrategia\\_Nacional\\_Mar\(2\).pdf](http://www.cienciaviva.pt/img/upload/Estrategia_Nacional_Mar(2).pdf)

## Research funding schemes and programmes:

The funding of the Portuguese research system is mainly conducted under the authority of the **Ministry of Science, Technology and Higher Education** (<http://www.mctes.pt/>), namely through its **Foundation for Science and Technology or Fundação para a Ciência e Tecnologia (FCT)**.

- FCT is funding research via a non-thematic research programme which funds all research areas through competitive calls for proposals. The total funding budget for FCT is about €472 per year, with about €0,5-1 M being spent on marine biotechnology. FCT has signed with ANR (France) a collaboration protocol, with emphasis on Oceanology cooperation. However, this protocol has not been implemented yet.  
<http://www.fct.pt/index.phtml.en>



Other Research Funding Programmes which have a significant Marine Research element include:

- Azores Marine Research Specific Programme managed by Direcção Regional da Ciência, Tecnologia e Comunicações  
<http://www.azores.gov.pt/Portal/en/principal?lang=en&area=ct>
- ON2 - North Portugal Regional Operational Programme 2007/2013 with two strategic priorities with special relevance to S&T: "Competitiveness, Innovation and Knowledge" and "Economic Valorisation of Specific Resources" with a specific objective related with Economic development of new uses for the sea and a significant investment in marine S&T infrastructures managed by a political management body  
<http://www.novonorte.qren.pt/pt/menu-topo/english-version/>

## Private funding mechanisms:

- Business forum of the economy of the sea ([www.fem.pt](http://www.fem.pt)) developed a document called 'Hypercluster of the Economy of the Sea': <http://www.fem.pt/Documentos/Hypercluster%20da%20Economia%20do%20Mar.pdf>

## Infrastructures and coordination and support capacities / initiatives:

- In 2012, Portugal operates eight local/coastal vessels ranging from 11m to 31,40m (Águas Vivas, Arquipelago, Diplodus, NRP "Andromeda", NRP "Auriga", Puntazzo, Tellina and Ziphius); one regional vessels of 47,50m (Noruega); and two global vessels of 68,20m and 68,50m (NRP "Almirante Gago Coutinho" and NRP "D. Carlos I") registered in the European Research Vessels Infobase ([www.eurocean.org](http://www.eurocean.org)).
- In 2012, Portugal maintains about 25 large marine research equipments registered in the European large Exchangeable instruments database ([www.eurocean.org](http://www.eurocean.org)).
- Key aquaculture experimental and research facilities in Portugal include
  - o Experimental Research Facilities CIIMAR Portugal Land based facilities
  - o Specialised Laboratories IPIMAR Portugal
  - o Marine aquaculture station of Ramalhete University of Algarve Portugal

- Any other research facilities of relevance to Marine Biotech?
  - o Algarve Centre of Marine Sciences, University of Algarve
  - o Centre of IMAR at Department of Oceanography and Fisheries at the University of the Azores

### **Major initiatives:**

- FCT is partner in the following European initiatives
  - o JPI Oceans  
[www.jpi-oceans.eu](http://www.jpi-oceans.eu)
  - o Seas-ERA  
[www.seas-era.eu](http://www.seas-era.eu)
  - o CSA MarineBiotech  
[www.marinebiotech.eu](http://www.marinebiotech.eu)
  - o EuroFleets  
[www.eurofleets.eu](http://www.eurofleets.eu)
  - o EurOcean  
[www.eurocean.org/](http://www.eurocean.org/)

### **Major observations, trends and future prospects:**

There is an industry forum for marine biotechnology. However, there is no specific program for funding marine biotechnology, hence marine biotechnology is fragmented and needs national cooperation.

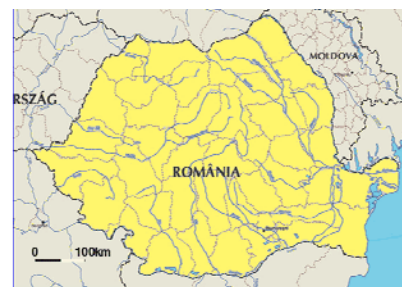
# Romania



## Overarching science strategies, plans and policies:

There is currently no national strategy or plan specifically for Marine Biotechnology research. Relevant research is considered under a much wider scoped plan and strategy:

- The **National Plan for Research, Development and Innovation (RDI) 2007-2013 (PN II)** and **National Research, Development and Innovation Strategy** from the National Authority for Scientific Research (ANCS) [www.ancs.ro](http://www.ancs.ro)



## Research funding schemes and programmes:

- The **Executive Agency for Higher Education, Research, Development and Innovation Funding (UEFISCDI)** (<http://uefiscdi.gov.ro/>) implements five out of the six programmes of the National Plan for Research, Development and Innovation 2007-2013 (PN II)
  - o Human Resources (exploratory research)
  - o Ideas (exploratory research)
  - o Partnerships in Priority Areas (applied research)
  - o Innovation (innovation and technology transfer)
  - o Capacities (R&D infrastructure)
- The R&D Programme **Partnerships in Priority Areas** does not refer explicitly to marine biotechnology; the research support is structured in nine thematic areas, similar to FP7:
  - o Information and communication technology (10%)
  - o Energy (10%)
  - o Environment (10%)
  - o Health (14%)
  - o Agriculture, food safety and security (14%)
  - o Biotechnologies (12%)
  - o Innovative materials (7%)
  - o Processes and products (15%)
  - o Space and security (8%)
  - o Socio-economic and humanistic research (10%)

## Infrastructures and coordination and support capacities / initiatives:

- In 2012, Romania operates 2 local/coastal vessels of 25,8 and 31,86m (Istros, Steaua de Mare 1); and 1 global vessels from 66m to 82,20m (Mare Nigrum) registered at the European Research Vessels Infobase ([www.eurocean.org](http://www.eurocean.org)).
- In 2012 Romania maintains about 1 large marine research equipments registered in the European large Exchangeable instruments database ([www.eurocean.org](http://www.eurocean.org)).
- Key aquaculture experimental and research facilities in Romania includes a long-line system (National Institute for Marine Research and Development Grigore Antipa).

## Trends and developments:

The national plan for RDI that ends in December 2013 comprises nine research areas, similar to the Seventh European Framework Programme (FP7). At this stage, development of a new national plan for RDI is being initiated. While the details of the new plan are not yet know, it is very likely the priorities will echo the ones elaborated under Horizon2020. It is expected that marine biotechnology research priorities will be considered but perhaps not reflected in an official document for RDI.

# Slovenia



## Overarching science strategies, plans and policies:

The Ministry of Education, Science, Culture and Sport (MESCS) and particularly the Science division as part of the Directorate for Higher education and Science, defines the expert bases for the adoption of political documents in the field of research policy and plans the required financial resources for research.

There are no specific Marine Biotechnology strategies, plans or policies being implemented in Slovenia.

The Research and Innovation Strategy of Slovenia (RISS) is the key strategic and political document of the Slovenian policy on research and innovation. It is currently being implemented in collaboration with the Ministry of Economic Development and Technology and other relevant stakeholders, who have contributed to the development of the program.

Currently the new National Industrial Policy is being prepared together with the National Development Strategy for the 2014-2020 period. The two documents already take into account Smart specialization. They are however not yet public.

Biotechnology has been a priority in the previous National Research and Development programme and will continue to hold a strategic place in both documents currently being prepared.



## Research Funding Schemes and Programmes:

The financing of research activities is mainly implemented through the Slovenian Research Agency (ARRS) and the Slovenian Technology Agency (TIA). The main instruments are research programs (long term, 5-year projects), basic and applied research projects, targeted research programs, the young researcher program, research infrastructures and international cooperation.

## Research priorities:

The RISS defines the R&D priorities for the next decade (2011 - 2020). They were established on the basis of the National Research and Development programme 2006 - 2010 and other stakeholder consultations. They are also being followed by the Slovenian Research Agency (ARRS) and the Slovenian Technology Agency when they issue calls for basic or/and applied research projects. These priorities are:

- Information and communication technologies,
- Modern (new) synthetic metal and non-metal materials and nanotechnologies,
- Complex systems and innovative technologies,
- Technologies for sustainable economy, and
- Health and life science.

The National Industrial Policy and the National Development Strategy take into account Smart specialization, but are not yet public. Priorities set in those documents can be communicated once the documents are publicised.

## Strategic documents:

No documents devoted to Marine Biotechnology. A strategic document titled International Challenges 2013 - Partnership to promote international cooperation is currently in the process of being approved by the government. The document sets the priority economic sectors for international cooperation, among them also biotechnology (others of interest include biomedicine, energy and environmental technologies, advanced material and technology, nanotechnology).

## Infrastructures and coordination and support capacities / initiatives:

- In 2012, Slovenia operates 1 local/coastal vessels of 11,98m (Sagita), with a dry and wet lab and associated field equipment, registered at the European Research Vessels Infobase ([www.eurocean.org](http://www.eurocean.org)),
- a 7m long working boat
- A salt water laboratory aquarium with lab to sea interflow capability
- Marine Biology Station Piran of the National Institute of biology (MBP, NIB) - The Marine Biology Station is currently the only research group in Slovenia devoted to maritime scientific research and professional work. Collaborating with high calibre foreign marine research centres, it represents a national focal point for development in the area of marine research. There are 35 people routinely employed at the MBS, comprising of 19 researchers, 8 young researchers and 8 technical and administrative collaborators. The research work is periodically augmented by students and trainee postgraduate and postdoctoral fellows with various disciplines. The infrastructure of the Marine Biology Station Piran includes:
  - Research laboratories (biological, chemical, microbiological etc)
  - A salt water laboratory aquarium with lab to sea interflow capability
  - Congress hall (95 seats), classrooms (40 seats), biology practice laboratory, meeting rooms (25 persons), dormitory (24 beds)
  - Library with 1500 scientific monographs and 60 specialized journals
  - A diving base with workshop
  - A 12m long research vessel, with a dry and wet lab and associated field equipment and a 7m long working boat
- Laboratory of Catalysis and Chemical Reaction Engineering of the National Institute of Chemistry, focuses on process and product modelling of reaction kinetics, transport phenomena and fluid mechanics, sensitivity analysis, optimisation, intensification, economical valorisation relating to cultivation and growth of microalgae under different conditions, that is light intensity, nutrient concentration, and process conditions such as temperature, pH, aeration, CO<sub>2</sub> content, flow conditions, etc. Infrastructures and coordination and support capacities / initiatives include:
  - Bioreactors: batch, semi-batch, continuous, etc.
  - Downstream processing: extraction, distillation, absorption, etc.
  - Analytics: temperature, pH, redox potential, nutrient concentration, cell number, chlorophyll, oxygen, lipid content, lipid fatty acid profile
  - Biodiesel, biogas, pyrolysis, gasification and combustion equipment

## Major Initiatives:

Relevant Research projects by Marine Biology Station Piran (MBP, NIB):

- Research program P1-0237 Coastal Sea Research (1.1.2009 - 31.12.2013)
- ECO/10/277396/SI2.601543 (Eco-Innovation 2010) Marine debris removal and preventing further litter entry – Marine Clean
- EU FP7-KBBE-2010-4 \_RADAR Rationally Designed Aquatic Receptors integrated in label-free biosensor platforms for remote surveillance of toxins and pollutants (2011-2013)
- EU FP7 IP PERSEUS
- Marine Strategy Framework directive (Directive2008/56/EC)
- Slovenian - Croatian bilateral (2012-2013): Enclosed marine systems as laboratory for biological phenomena
- Slovenian - Argentinean research cooperation project (2012-2014): Jellyfish blooms and the possibilities for commercial use
- Slovenian - Japanese joint project (2012-2014): Slovenian - Japan cooperative studies on problematic jellyfish blooms: mechanisms and mitigation
- EU FP6\_ECASA, 006540\_Ecosystem Approach for Sustainable Aquaculture
- CREICO, NSF, ZDA - Cooperative Research on Ecological Interactions in the Coastal Oceans program in the North Adriatic sea: Collaborative international research on gelatinous zooplankton in the Adriatic Sea, Role of bacteria in production and decomposition of colloidal organic matter in the Northern Adriatic

# Spain



## Overarching science strategies, plans and policies:

There is no specific national policy or strategy of Marine Biotechnology. Overarching science and technology policy is based on the Spanish Science Law of 1986 and described in the Spanish National Strategy for Science and Technology (ENCYT) managed by the Spanish Ministry of Science and Innovation.

- **The Spanish Science Spanish National Strategy for Science and Technology (ENCYT)** covers the main principles and general objectives governing both nationwide and regional science and technology policies, for the period 2007-2015.

<http://www.idi.mineco.gob.es/portal/site/MICINN/menuitem.7eeac5cd345b4f34f09dfd1001432ea0/?vgnnextoid=6b53dffba6770210VgnVCM1000001034e20aRCRD>



The main instrument to implement the National Strategy is the National Scientific Research, Development and Technological Innovation Plan (2008-2011/+2012) (National R&D&I Plan ) which has a four-five year duration and it is executed based on annual Work Programmes. Although academic research is a major component of the National R&D&I Plan, specific actions are also included to support technological innovation.

The Plan sets up 4 main Strategic Areas:

- Area 1: Development of Scientific and Technological Knowledge and Capacities
- Area 2: Promotion of Cooperation in RTD
- Area 3: Sectoral Development and Technological Innovation
- Area 4: Strategic Actions

In addition the Plan also sets up 6 Instrumental Action Lines to implement these Strategic Areas which are developed through different Programmes and a number of Subprogrammes. One of the Strategic Actions is focussed on Biotechnology, though no specific reference is made to marine biotechnology in it. As to the Programmes and Subprogrammes of the National R&D&I Plan, none of them make reference to marine research but the Plan is open to this research community since it follows a bottom-up approach.

Successful marine projects/initiatives are supported through different programmes and subprogrammes of the National R&D&I Plan, including the Strategic Area on Biotechnology.

- **The National Scientific Research, Development and Technological Innovation Plan (National R&D&I Plan)**  
<http://www.idi.mineco.gob.es/portal/site/MICINN/menuitem.7eeac5cd345b4f34f09dfd1001432ea0/?vgnnextoid=83b192b9036c2210VgnVCM1000001d04140aRCRD> and  
[http://erawatch.jrc.ec.europa.eu/erawatch/opencms/information/country\\_pages/es/policydocument/policydoc\\_mig\\_0008](http://erawatch.jrc.ec.europa.eu/erawatch/opencms/information/country_pages/es/policydocument/policydoc_mig_0008)

Recognising the importance of R&D&i to sustaining and boosting growth, productivity and society's wellbeing, and to bring Spain into line with the more developed countries of the European Union in terms of Research and Development, the Government drew up a new Strategy called the INGENIO 2010 Programme whilst keeping up all the existing efforts in the area of R&D&i. In the implementation of this strategy the necessary territorial coordination has been promoted so as to avoid wasting resources, increase the effectiveness of public R&D&i investment and reduce the existing territorial imbalances. The INGENIO 2010 Programme includes the Programmes CONSOLIDER, CENIT and the Plans AVANZA and EUROINGENIO.

- **INGENIO 2010 Programme**  
<http://www.ingenio2010.es/>

## Research funding schemes and programmes:

- The National R&D&I Plan is structured in Action Lines, Programmes and sub-programmes. In addition it has got 5 Strategic Areas with relevance for Marine Biotechnology activities. These Strategic Actions are Health,

Biotechnology, Energy and Climate Change, Nanoscience and Nanotechnology and New Materials and New Industrial Processes.

As indicated above, there is not a specific sub-programme or priority on marine sciences within the National R&D&I Plan, nevertheless most of the programmes and subprogrammes of the National R&D&I Plan follow a bottom up approach and may fund research in marine biotechnology.

**Fundamental Research on Biotechnology**, including marine biotechnology, is mainly funded through different Programmes and sub-programmes of the National Plan for Scientific Research, Development and Technological Innovation, including the National Programme on Fundamental Research (the programme CONSOLIDER, the sub-programme of non-oriented research, and the subprogramme TRACE of oriented research of knowledge transfer to industry )

In addition **industry-led or oriented research projects on Biotechnology** may be funded through different programmes including the National Programme on Applied Research (i.e. the Sub-programme of Applied Industrial Research funded by MINETUR and Sub programme of Collaborative Projects for Applied Research, Sub-Programme of Applied Research in Technology Centres funded by MINECO), National Programme on Public-Private Cooperation (i.e. the Sub-programme in Support of Singular Strategic Projects and the Sub-Programme INNPACTO), the National Programme for Experimental Development (i.e. Sub-Programme of RTD projects, Subprogramme of industrial experimental development projects) and the Specific Programme for Private-Public Cooperation of RTDI on Apply genomics and Biotechnology. The CENIT Programme was also an important that aimed at financing industry led projects.

Moreover MINECO through the National R&D&I Plan also provides funding for research in biotechnologies, including marine biotechnology, through programmes aimed at predoctoral and graduate researchers as well as for tenured scientists (Ramón y Cajal, Juan de la Cierva Sub-Programmes), as well as funding for specific programmes to facilitate mobility of researchers. In addition the Sub-Programme Torres Quevedo aims at contracting PhD to work for industries and SMEs, technology centres and science parks.

Successful marine projects/initiatives that are supported by the different Programmes and sub-Programmes of the National R&D&I Plan are generally managed within a specific management area and by a team devoted to marine sciences. The Biotechnology Strategic Action can fund also marine biotechnology projects related with the marine environment.

The commitments to INGENIO 2010 Programme (see above) also include a number of specific support programmes which follow up a bottom up approach and are open to Marine Biotechnology such as the CENIT Programme and the CONSOLIDER Programme.

- The **CONSOLIDER Programme** aims to support outstanding research groups in all the fields of science and technology to increase the average size of research groups, raise the levels of funding available to the best lines of research, eliminate excessive fragmentation in research and promote the participation of public research centres in the European Framework Programme. It has increased cooperation between researchers with regard to projects run by leading consortiums and unique installations, mobilising a total of 2,000 million euros. About €10M funding has gone to marine and aquaculture projects (not limited to marine biotechnology) up to the end of 2011. The CONSOLIDER Programme is funded through a sub-programme of the National R&D&I Plan
- **The CENIT Programme** was funded by CDTI and aimed to finance major lines of industrial research by means of public-private collaboration using a mechanism of 50% co-financing by the private sector. This Programmed ended up in 2010.

At regional level, the different regions have their own RTD programs which are also bottom up and are therefore opened to marine research and marine biotechnology. Nevertheless in some regions, like Galicia, the Regional RTD Plan include a priority line on Marine Research and Development. In others Regions, like Cataluña or the Basque Country, the term "marine" is echoed in some of the objectives of those Plan.

In the field of aquaculture JACUMAR (The Advisory Board on Marine Cultures) which depends on the Ministry of Agriculture , Food and Environment (MAGRAMA) in agreement with Regions is responsible for setting up multiannual RTDI plans on aquaculture, which may include biotechnology issues related to this field. These projects are funded by JACUMAR. <http://www.magrama.gob.es/app/jacumar/jacumar.aspx>

A database which may contain relevant funded projects is available at [www.ciencias-marinas.uvigo.es/proyectosredmar.html](http://www.ciencias-marinas.uvigo.es/proyectosredmar.html), but it does not cover all relevant projects and may not be fully up to date. The MarineERA projects database <http://marinera.seas-era.eu/national/partners.html> also contains recent information on marine research projects.

## Research priorities:

### Strategic Action for Biotechnology

[http://erawatch.jrc.ec.europa.eu/erawatch/opencms/information/country\\_pages/es/supportmeasure/support\\_mig\\_0045](http://erawatch.jrc.ec.europa.eu/erawatch/opencms/information/country_pages/es/supportmeasure/support_mig_0045)

## Strategic documents:

A good overview of the Spanish science policy landscape in English, including downloadable strategic documents is available from the MINECO website at

<http://www.idi.mineco.gob.es/portal/site/MICINN/menuitem.29451c2ac1391f1febebed1001432ea0/?vgnnextoid=4637438822a10210VgnVCM1000001034e20aRCRD>

## Infrastructures and coordination and support capacities / initiatives:

- Spain has a National Programme for Science and Technology Infrastructures to implement priorities of its National R&D&I Plan. The Programme for Science and Technology Infrastructures which aim is to improve the existing RTD infrastructures, their maintenance and optimize their use. The Programme also foresees the design, building, maintenance, operation and upgrade of ICTS (**Unique Scientific and Technological Infrastructures**) and GIC (Large Scientific Infrastructures) with a national and EU dimension. Contribute to the development of the Regions to promote the territorial cohesion.  
<http://www.idi.mineco.gob.es/portal/site/MICINN/menuitem.8ce192e94ba842bea3bc811001432ea0/?vgnnextoid=872470761ea22210VgnVCM1000001d04140aRCRD&vgnnextchannel=3c4fa7e4e90e2210VgnVCM1000001d04140aRCRD>
- In 2012, Spain operates 9 local/coastal vessels from 12m to 30,46 m; 6 regional vessels from 36,5m to 53m; and 4 global vessels from 66,7m to 82,5m registered at the European Research Vessels Infobase ([www.eurocean.org](http://www.eurocean.org)).
- In 2012, Spain maintains about 7 large marine research equipments registered in the European large Exchangeable instruments database ([www.eurocean.org](http://www.eurocean.org)).
- Marine research activities are also supported by the Secretary of State for Research through two Research Performing Organisations, Spanish National Research Council (CSIC) and Spanish Oceanographic Institute (IEO), that generate more than 50% of the scientific output in the marine sciences in the country.  
<http://www.csic.es/web/guest/presentacion> and [http://www.ieo.es/version\\_eng/indexingles.htm](http://www.ieo.es/version_eng/indexingles.htm)
- Within the framework of the INGENIO 2010 Programme, the ICTS (**Unique Scientific and Technological Infrastructures**) are configured as instruments for scientific and technological development. Currently there are 7 Marine ICTS in Spain, including the 3 Research Vessels (RV Cornide de Saavedra, RV Sarmiento de Gamboa, RV Hespérides, 2 Antarctic Basis and 2 ICTS still in the construction phase (PLOCAN and SOCIB). In addition there are 3 which still are in their design phase (OOCMur, UTO and MAREAS). The network of ICTS is coordinated by IEO <http://www.redictsmarinas.ieo.es/redICTS/principal.html?lang=en>
- Key aquaculture experimental and research facilities in Spain include
  - o 2 Experimental Research Facilities (IFAPA)
  - o Aquaculture Pilot Plant (Centro tecnologico Gallego de Acuicultura CETGA)
  - o 5 Experimental Research Facilities and Specialised Laboratories (Instituto Español de Oceanografía IEO)
  - o An inland infrastructure for bluefin tuna aquaculture research is being built by IEO. It consists of 4 large capacity inland tanks (7000 m<sup>3</sup>) for experimental research on bluefin tuna. The project started at the end of 2011 and it is under development.
  - o Experimental Research Facilities and Specialised Laboratories (Consejo Superior de Investigaciones Científicas CSIC)
  - o Experimental Research Facilities (Instituto Canario de Ciencias Marinas ICCM)
  - o Experimental Sea based facility (Instituto Gallego de Formación en Acuicultura. Xunta de Galicia IGFA)
  - o Experimental Facilities (Instituto Murciano de Investigación y Desarrollo Agrario y Alimentario IMIDA)
  - o Experimental Research Facilities (Instituto de Investigación y Tecnología Agraria-IRTA)
  - o Experimental Research Facilities (Centro de Investigaciones Marinas -CIMA)

## Major initiatives:

- The **Marine Biotechnology Centre of the ULPGC (CBM)** is a research centre of the ULPGC and comprises the **Applied Algae (GAA)** and the **Biological Oceanography (GOB)** research groups, which work closely with researchers in other groups in Spain and abroad. This cooperation between the two research groups is currently focused on developing new lines of work that apply the knowledge and techniques developed in eco-physiological and biotechnical studies to marine producers and vegetation.
- The Spanish Bank of Algae (BEA-Banco Español de Algas) is a service of the Marine Biotechnology Center (CBM-Centro de Biotecnología Marina) of the University of Las Palmas de Gran Canaria (ULPGC), which objectives are the isolation, identification, characterization, conservation and provisioning of microalgae and cyanobacteria.
- **Spanish Biomass Technology Platform** One the priorities of the Strategic Plan of this platform is the production of biofuel from microalgae. <http://www.bioplat.org/>.
- **PTEPA** is the Spanish Platform for Fisheries and Aquaculture Research. This platform has developed a SRA [http://ptepa.org/images/stories/PDFs/agenda\\_estrategica\\_ptepa.pdf](http://ptepa.org/images/stories/PDFs/agenda_estrategica_ptepa.pdf)
- **Genoma Spain** is a government-supported public foundation devoted to promoting technology development, knowledge transfer and innovative practices, chiefly in the biotechnology sector. <http://www.gen-es.org/en/index.cfm>

### More relevant projects:

- **AQUAGENOMICS** (2008-2013) is a project funded (€6M) under the CONSOLIDER Programme and probably the only current Spanish project dealing specifically with marine biotechnology. The project aims to improve aquaculture production through the use of biotechnological tools. It is composed of 18 project partners coordinated by Inmunología IIM CSIC. <http://www.aquagenomics.es/>
- **CENIT Acuisost** (2007–2011) is a project funded under the CENIT Programme with a budget €22M to develop and evaluate raw materials, technologies and processes in marine aquaculture comprising items such as nutrition, biosafety and commercialisation of product with added value, food security and revalorization of subproducts that improves the sustainability. It is composed of 22 Companies and 17 research groups lead by Grupo Dibaq and coordinated by Esmedagro. <http://www.dibaq.com/acuicultura/cas/acuisost.aspx>

Other partly relevant CENIT project include:

- **CENIT Nanofarma**: €15M (2006-2009) - [www.nanofarma.es](http://www.nanofarma.es)
- **CENIT Oncológica**: €17M (2009-2012) - [www.oncologica.es](http://www.oncologica.es)
- **CENIT BIOSOS**: €13,6M (2009-2012) biorefinery/algae - [www.cenit-biosos.es](http://www.cenit-biosos.es)
- **CENIT VIDA**: €19M (2010- 2013) energy and algae - [www.cenitvida.es](http://www.cenitvida.es)
- **CENIT PILBE**: €10,7M (2006-2009) biodiesel and algae - [www.repsol.com](http://www.repsol.com)

### Relevant INNPACTO FUNDED PROJECTS

- **INNPACTO Polysfera** (2010-2013) - <http://www.polysfera.es/>
- **INNPACTO ORALBEADS** (2011-2014) - <http://www.pharmamar.com/proyectos-europeos.aspx>
- **INNPACTO BOKÉTIDO** (2011-2014) - <http://www.pharmamar.com/proyectos-europeos.aspx>

### Industry:

- Spain is host to **Pharmamar**, one of the most successful companies dedicated specifically to marine biotechnology in the world (<http://www.pharmamar.com/>). Pharmamar is specialised in development of antitumor drugs of marine origin.
- AlgaEnergy is a technology-based company specialising in the field of microalgae biotechnology which, with substantial R&D programmes costing millions of Euros (both public and in-house funding), is managed by a team of entrepreneurs and scientists with solid financial backing and extensive experience within this field. <http://www.algaenergy.es>

- CEAMSA, , manufactures and supplies a comprehensive range of high quality carrageenan and pectin products to the global food industry. <http://www.ceamsa.com/>
- BioFuel Systems. A company specialized in the production of biofuel from marine microalgae. <http://www.biopetroleo.com>
- ANFACO-CECOPECA it is a large company that conducts research in a number of fields related with marine biotechnologies and their use in aquaculture and seafood processing, <http://www.anfaco.es>
- Seaweed Canarias Seaweed Canarias creates and provides integral sustainable high technology solutions through the industrial use of active principles present in algae. Seaweed Canarias has its own patents and develop highly innovative uses in fields as diverse as agriculture, cosmetics and human and animal nutrition. <http://www.seaweedcanarias.com>
- AQUASOLUTIONS BIOTECH it is a technology company based that offers a wide range of services in RTD to the aquaculture sector, they conduct RTD on genetics, molecular biology, microbiology, physiology, nutrition and zootechnology. <http://www.aquasolutionsbiotech.es/index.php>

# Sweden



## Overarching science strategies, plans and policies:

There is currently no dedicated Marine Biotechnology policy or strategy in Sweden. Overarching research priorities of the Swedish government for the period 2013-2016 are determined by the Swedish Research and Innovation Bill.

- **Swedish Government's Research and Innovation Bill**  
<http://www.government.se/sb/d/16288>
- **Swedish biotechnology policy**  
<http://www.regeringen.se/content/1/c4/11/10/08e3ecb4.pdf>



## Research funding schemes and programmes:

The Ministry for Education and Science is responsible for the overall coordination of research policy activities and for direct research funding via the Swedish Research Council. The ministry is also responsible for the design of framework conditions for the National Science and Innovation System with a focus on basic research and university education.

- **Vinnova** has a programme dedicated to industrial biotechnology. It aims to stimulate research and development and the implementation of industrial biotechnology in various sectors in order to promote more environmentally friendly processes linked to economic growth. SEK 50million was granted in the first call as project support in 2008. Mats Jarekrans is in charge of the programme.  
[www.vinnova.se/In-English/Activities/Biotechnology](http://www.vinnova.se/In-English/Activities/Biotechnology)
- VINNOVA also runs a programme named "VINNVÄXT" which in June 2008 granted SEK 13million to Processum Biorefinery Initiative for a project called "The future biorefinery" <http://www.vinnova.se/In-English/Activities/Strong-research-and-innovation-environments/VINNVAXT/>
- **Mistra7 (The Foundation for Strategic Environmental Research)** funds a programme called Greenchem – Specialty Chemicals from Renewable Resources<sup>8</sup>. The program runs from 2003 to 2010 with Lund University as the main contractor. The Mistra support is SEK 71,4 million. A group of 8 industries which represent renewable raw material providers as well as producers and users of chemicals participate in the programme.  
<http://www.greenchem.lu.se/>

## Strategic documents:

- State of art of Swedish biotech  
<http://www.iva.se/upload/Verksamhet/Projekt/Svensk%20bioteknik/Swedish%20biotechnology%20-%20web-1.pdf>
- Europabio report on Swedish industrial biotechnology  
[http://www.bio-economy.net/bioeconomy/member\\_states/sweden/files/report\\_sweden\\_final01.pdf](http://www.bio-economy.net/bioeconomy/member_states/sweden/files/report_sweden_final01.pdf)

## Infrastructures and coordination and support capacities / initiatives:

- In 2012, Sweden operates 6 local/coastal vessels from 11,8m to 24 m; 4 regional vessels from 38m to 46m; 1 oceanic of 61,17m (Argos), and 1 global vessels of 107,8m (Oden) registered at the European Research Vessels Infobase ([www.eurocean.org](http://www.eurocean.org)).
- In 2012, Sweden maintains about 2 large marine research equipments registered in the European large Exchangeable instruments database ([www.eurocean.org](http://www.eurocean.org)).
- Key aquaculture experimental and research facilities in Sweden include

- Specialised Laboratories (Swedish University of Agricultural Science)
- Salmon and trout experimental lab / Norrfors lab (department of Wildlife, fish and Environmental studies)

### **Major initiatives:**

- FP6 AQUAFUNC - **Integrated knowledge on functional genomics in sustainable aquaculture**  
Project website: <http://genomics.aquacultureeurope.org/>  
Coordinator: Dr Sundell Kristina UNIVERSITY OF GÖTEBORG— Sweden
- FP7 ASSEMBLE - **Association of European marine biological laboratories**  
Project website: <http://www.assemblemarine.org/>  
Coordinator: Margareta AHLQWIST, GÖTEBORGS UNIVERSITET - SWEDEN

## Overarching science strategies, plans and policies:

There is currently no national marine biotechnology policy or strategy in turkey. Nevertheless, Marine Biotechnology is addressed as part of the overarching long term science and technology vision (Vision 2023) and strategy (National Science, Technology and Innovation Strategy). The Strategy has fundamental strategic objectives that give support to develop cross-disciplinary and cross-sectoral research-technology and innovation which suits perfectly to marine/maritime and biotechnology research. The Strategy has also three priority themes; food, energy and water (not implicitly including marine) that might have direct and indirect links to marine research and innovation.



Furthermore a National Marine Research Strategy is being drafted by the National Hydrography and Oceanography Committee, whose members include marine stakeholders. Work on this draft document is well advanced at the time of publication of this report.

- **Vision 2023** is TÜBİTAK's long term vision for science and technology which details the priorities, important issues to consider and possible mechanisms to address them.
- The Turkish Science & Technology Strategy for the period 2011-2016 is described in the **National Science, Technology and Innovation Strategy**.  
<http://www.tubitak.gov.tr/sid/1048/pid/468/index.htm>

## Research funding schemes and programmes:

Until 2012, the Turkish national funding agency TÜBİTAK has funded all kind of research topics with a bottom-up approach. Projects are being funded according to scientific excellence based on peer review and panel evaluation. Thus, there is not any research priority or theme-specific calls/programmes under TÜBİTAK. However, the through competitive calls some marine biotechnology related projects also received funded. In 2012, TÜBİTAK also organised a few specific calls dedicated to national Turkish research priorities such as energy plants, seeds, automotive etc. These did not include marine biotechnology as such but as long as it meets the national evaluation criteria, marine biotechnology related projects can still be funded within the open calls for competitive research funding.

<http://www.tubitak.gov.tr/en/ot/10/>

## Research priorities:

There is currently no specific priority list for marine biotechnology. Projects funded as part of TUBİTAK's up up to now are more concentrated on using/exploiting/improving marine organisms for environmental purposes (ex: like remediation or energy source).

## Infrastructures and coordination and support capacities / initiatives:

- In 2012, Turkey operates 6 local/coastal vessels from 16m to 31,27 m; 3 regional vessels from 36m to 40,36m; 2 oceanic of 55,75m and 87m (MTA Sismik I, Cesme) registered at the European Research Vessels Infobase ([www.eurocean.org](http://www.eurocean.org));
- In 2012, Turkey maintains about 3 large marine research equipments registered in the European large Exchangeable instruments database ([www.eurocean.org](http://www.eurocean.org));
- Key aquaculture experimental and research facilities in Turkey include
  - o Experimental facilities (Dokuz Eylul University)
  - o Marine and freshwater hatchery ( Ministry of Agriculture and Rural affairs)

- Dokuz Eylül University, Institute of Marine Sciences and Technology, Turkey has Institutes of Marine Chemistry and Living Marine Resources that are involved in Bioprospecting and biodiscovery  
[http://web.deu.edu.tr/seislab/eng\\_denizbilimleri.html](http://web.deu.edu.tr/seislab/eng_denizbilimleri.html).
- Ege University is a partner in the EU-funded project MAREX (marine bioactives). It has a Research and Application Center for Underwater, working on mariculture; the faculties of Engineering and Fisheries have aspects of aquaculture and marine biotechnology, including study of algae and cyanobacteria in extreme environments  
<http://ege.edu.tr/index.php?lid=2&SayfaID=641&cat=details>.
- The Technical University of Istanbul was a partner in the EU-funded project COLORSPORE, which aimed to find new natural carotenoids from, among other organisms, marine *Bacillus* species.
- The Dutch company Porifarma has a sponge-growing and research facility on the Turkish coast.

### **Major observations, trends and future prospects:**

While it does not exist yet, according to informal information from the TÜBİTAK's National Funding Department, a specific call for marine biotechnology research is something that could be considered in the future.

# United Kingdom



## Overarching science strategies, plans and policies:

There is currently no national strategy for marine biotechnology. Marine Biotechnology fits into wider science and technology policy and supported via overarching marine and bioscience strategies:

- UK Science and Technology Policy for the period **2004–2014** is described in **Science and Innovation Investment Framework (2004–2014)**  
[www.hm-treasury.gov.uk/spending\\_review/spend\\_sr04/associated\\_documents/spending\\_sr04\\_science.cfm](http://www.hm-treasury.gov.uk/spending_review/spend_sr04/associated_documents/spending_sr04_science.cfm)
- The marine research component of this Policy/Strategy is further developed in **UK Marine Science Strategy (2010-2025)** led by the UK Marine Science Co-ordination Committee:  
<http://www.defra.gov.uk/environment/marine/documents/science/mscc/mscc-strategy.pdf>
- A five year strategy for the biosciences was launched in 2010: **The Age of Bioscience: BBSRC's Strategic Plan 2010-2015**  
<http://www.bbsrc.ac.uk/publications/planning/strategy/strategic-plan-index.aspx>



## Research funding schemes and programmes:

There are no dedicated funding schemes or programmes on marine biotechnology in the UK at this time. Nevertheless, marine biotechnology is included in several focus areas of the numerous UK funding agencies.

At the research end of the innovation chain, there are 7 research councils working together as Research Councils UK (RCUK). These include the Science and Technology Facilities Council or STFC. These Research Councils have a strong role to play in different aspects of marine biotechnology research. Four of the UK Research Councils are particularly relevant to marine biotechnology:

- **Biotechnology and Biological Sciences Research Council (BBSRC);**  
[www.bbsrc.ac.uk/](http://www.bbsrc.ac.uk/)
- **Natural Environment Research Council (NERC);**  
[www.nerc.ac.uk](http://www.nerc.ac.uk)
- **Engineering and Physical Sciences Research Council (EPSRC)**  
[www.epsrc.ac.uk](http://www.epsrc.ac.uk)
- **Medical Research Council (MRC)**  
[www.mrc.ac.uk](http://www.mrc.ac.uk)

NERC is the main UK agency for funding and managing research, training and knowledge exchange in the environmental sciences. As such NERC is the lead UK research council for marine environmental biosciences (e.g. ecology, diversity, etc.) and marine bioenergy.

The BBSRC is the lead council for biotechnology as it covers all aspects of non-medical life sciences with three strategic themes; Food Security including aquaculture; Basic Science underpinning Health including nutrition, ageing, immune systems, tissue engineering, regenerative sciences etc; Industrial Biotechnology including bioenergy. The BBSRC budget is about € 500M pa, with € 0,5-1M pa being spent on marine biotechnology.

Other relevant organisations include:

- The **Technology Strategy Board (TSB)** is the UK's technology innovation agency in the UK. Areas relevant to marine biotechnology include Energy, Food, Healthcare, Biosciences, Industrial biotechnology and High-Value Manufacturing. The TSB's budget is about € 366M pa, with about € 0,2-0,5 M being spent on marine

biotechnology.

<https://connect.innovateuk.org>

- The **Biosciences Knowledge Transfer Network (KTN)**'s main role is to accelerate the rate of bioscience technology exchange into and within the UK by (i) promoting rapid knowledge flow; (ii) providing networking opportunities; (iii) helping build relationships; (iv) focussing resources; (iv) building innovation capacity; and (v) assisting industry to deliver new technology-enabled products and processes. The KTN offers a funding scheme called SPARK awards, which is intended to initiate new business and academic collaborations by providing the academic with £5000 to conduct research of value to the business. Marine biotechnology (non-medical) related projects are within scope of this competition. TSB supports the Industrial Biotechnology Special Interest Group <https://connect.innovateuk.org/web/industrial-biotechnology/overview> which is co-managed by Biosciences KTN. NERC and TSB support the Algal Bioenergy Special Interest Group which is managed by Biosciences KTN.  
<https://connect.innovateuk.org/web/biosciencesktn/>
- The **Carbon Trust** is an organisation supporting the move from an oil economy towards a sustainable, low carbon economy. From 2008 onwards it has supported projects in algal bioenergy and hence is relevant in terms of these aspects of marine biotechnology. Due to re-prioritisation, it is unlikely that the Algae Bioenergy Challenge will be subject of much focus of the Carbon Trust in the future.
- The **Department of Energy and Climate Change (DECC)** has a role in translating the outcomes of marine bioresource use for carbon capture and energy generation into its own criteria and has sub-contracted responsibility in scoping algal potential, for example, to the **National Non-Food Crop Centre (NNFCC)**.  
<http://www.decc.gov.uk/>

## Strategic documents:

- A report to government was submitted in May 2009 by the Industrial Biotechnology Innovation and Growth Team setting out its vision for IB by 2025. The report included 21 recommendations on how the UK can be strongly positioned to gain maximum benefits from the new strategic market of renewable chemicals, and low carbon manufacturing. Marine biotechnology, and particularly, marine-derived resources, were viewed in this report, as having a critical role to play in driving a bio-based economy. The subsequent government response to this report published in June 2009 accepted all the recommendations. One of the recommendations accepted by government was the formation of an Industrial Biotechnology Leadership Forum, with company engagement and knowledge exchange firmly embedded in the Forum's activities. Biosciences KTN is part of the IBLF delivery team whose activities include engaging with marine biotechnology companies in the UK.
  - o The May 2009 report can be found here:  
[https://connect.innovateuk.org/c/document\\_library/get\\_file?p\\_l\\_id=1023438&folderId=1031597&name=DLE-10022.pdf](https://connect.innovateuk.org/c/document_library/get_file?p_l_id=1023438&folderId=1031597&name=DLE-10022.pdf)
  - o The June 2009 government response report can be found here:  
[https://connect.innovateuk.org/c/document\\_library/get\\_file?p\\_l\\_id=1023438&folderId=1031597&name=DLE-10021.pdf](https://connect.innovateuk.org/c/document_library/get_file?p_l_id=1023438&folderId=1031597&name=DLE-10021.pdf)
- The UK Marine Policy Statement was published in March 2011 and applies to all UK waters. It is the framework for preparing Marine Plans, ensuring consistency across the UK, and provides direction for new marine licensing and other authorisation systems in each UK Administration. It will set out the general environmental, social and economic considerations that need to be taken into account in marine planning. The statement can be found at:  
<http://archive.defra.gov.uk/environment/marine/documents/interim2/marine-policy-statement.pdf>
- The first UK National Ecosystem Assessment was published in June 2011. It is the first analysis of the UK's natural environment in terms of the benefits it provides to society and continuing economic prosperity. The assessment provides values for a range of services we gain from nature to help us to fully understand the worth of the natural environment and how the benefits to individuals and society as a whole can be better protected and preserved for future generations. The report includes two specific chapters relevant to the marine environment and is available at:  
<http://uknea.unep-wcmc.org>

## Infrastructures and coordination and support capacities / initiatives:

- In 2012, UK operates 19 local/coastal vessels from 10,5m to 32,1m; 3 regional vessels from 48,6m to 52,5m; 2 oceanic of 56,55m and 63,9m (HMS Roebuck, Colonel Templer); and 15 global vessels from 68,6m to 131,1m registered at the European Research Vessels Infobase ([www.eurocean.org](http://www.eurocean.org)).
- In 2012, UK maintains about 17 large marine research equipments registered in the European large Exchangeable instruments database ([www.eurocean.org](http://www.eurocean.org));
- Key aquaculture experimental and research facilities in UK include
  - o Specialised laboratories at Centre for Environment, Fisheries & Aquaculture Science (CEFAS)  
<http://www.cefasc.defra.gov.uk>
  - o Rearing facilities from the Fisheries Research Services (now Marine Scotland after merger with the Scottish Fisheries Protection Agency and the Scottish Government Marine Directorate)  
<http://www.scotland.gov.uk/About/People/Directorates/marinescotland>
  - o Marine hatchery from NAFC Marine Centre with both land based and sea based facilities  
<http://www.nafc.ac.uk>
  - o Specialised laboratories at the Scottish Association for Marine Science (SAMS)  
<http://www.sams.ac.uk>
  - o Specialised laboratories and Institute of Aquaculture External facilities at the University of Stirling  
<http://www.aqua.stir.ac.uk/>
- Key marine biotechnology experimental and research facilities in UK include
  - o Specialised laboratories at the SAMS, Marine Biological Association, Plymouth University, Plymouth Marine Laboratory, Heriot-Watt University, Glasgow University, Bangor University, Southampton University, University of Stirling, Swansea University and the University of Aberdeen
  - o There are also important culture collections, in particular the Culture Collection of Algae and Protozoa (CCAP - [www.ccap.ac.uk](http://www.ccap.ac.uk)), Culture Collection of the Marine Biological Association and NCIMB (Aberdeen).
  - o There are around 25 companies in the UK whose sole activity is Marine Biotechnology R&D and include Aquapharm, Glycomar, Algenuity, Algaecytes, Marine Biopolymers and the Hebridean Seaweed Company to name a few.

## Major initiatives:

- IB SIG, the Industrial Biotechnology Special Interest Group, is supported by TSB and managed by Biosciences KTN and Chemistry Innovation KTN  
<https://connect.innovateuk.org/web/industrial-biotechnology/overview>
- AB SIG, the Algal Bioenergy Special Interest Group, is supported by TSB and NERC and managed by the Biosciences KTN  
<https://connect.innovateuk.org/web/algal-biotechnology-special-interest-group/overview>
- The Algal Knowledge Transfer Centre, Swansea University  
<http://www.swansea.ac.uk/business-and-industry/collaboration-with-industry/algal/>
- The European Center for Marine Biotechnology aims to be the business incubator of choice for new and emerging marine biotechnology companies in the UK. By establishing a growing cluster of activity and international networks it strives to be the premier site for innovative growth and development within this emerging sector.  
<http://www.samsrsl.co.uk/facilities/european-center-for-marine-biotechnology>

# Ukraine



## Overarching science strategies, plans and policies:

There is no dedicated Marine Biotechnology Strategy or Policy in Ukraine at this stage (end of 2012). Ukraine Science and Technology Policy for the years 2010-2020 falls under the Cabinet of Ministers of Ukraine and is described in the Law of Ukraine On priority directions of development of science and technique". The marine research component of this Policy/Strategy is further developed in Part 5.6 "Science & Technology and Innovative Policy» and Part 3.1.6. "Realization of state policy in the sphere of protection and expedient exploitation of water resources".



- **Law of Ukraine On priority directions of development of science and technique**  
<http://zakon1.rada.gov.ua/?nreg=2623-14>

Other National Policy Documents which have a significant Marine Research element include:

- Programme of Economic Reforms for 2010-2014
- Law of Ukraine On scientific and technical activity
- Law of Ukraine On protection of natural environment
- Law of Ukraine On approval of Nation-wide Programme of Protection and Recovery of Natural Environment of Azov and Black Seas
- Water Code of Ukraine
- Decree of the Cabinet of Ministers of Ukraine «On approval of Concept of State Programme of research in Antarctica for 2011-2020

## Infrastructures and coordination and support capacities / initiatives:

- In 2012, Ukraine operates 1 global vessels of 68,9m (Professor Vodyanitskiy) registered at the European Research Vessels Infobase ([www.eurocean.org](http://www.eurocean.org)).

# Annex 1. Information sources and acknowledgements

The information in this document has been compiled by the European Marine Board as part of the CSA MarineBiotech Project activities (2011-2013) and is based on available online information sources and contributions from project partners and external experts and stakeholders. Names of country and regional experts contributing to the mapping exercise are available upon request from the European Marine Board Secretariat (mail to [jbcalewaert@esf.org](mailto:jbcalewaert@esf.org)).

The document does not aim nor claim to be complete or final, but should be considered as a first attempt to gain a high level overview of some of the main policies, strategies, programmes and major efforts relevant for marine biotechnology research and development. It will be elaborated, updated and improved on the [www.marinebiotech.eu](http://www.marinebiotech.eu) portal as more information becomes available, including further inputs from experts and stakeholders during the lifetime of the MarineBiotech ERA-NET (if awarded).

## Specific noteworthy sources of information and used materials:

- FP7 Seas-ERA D1.1.1 Synthesis report on existing (sub)national (marine) science and technology strategies available at [www.seas-era.eu](http://www.seas-era.eu)
- Scoping paper of the EU Collaborative Working Group on Marine Biotechnology (CWG-MB)
- Flags- [http://www.nationsonline.org/oneworld/flags\\_of\\_europe.htm](http://www.nationsonline.org/oneworld/flags_of_europe.htm)
- Maps - [http://europa.eu/about-eu/countries/index\\_en.htm](http://europa.eu/about-eu/countries/index_en.htm)
- Seas and Regions maps
  - o [http://ec.europa.eu/maritimeaffairs/atlas/maritime\\_atlas/#theme=themeGeography.subthemeBathymetry&extent=-33.6\\_21\\_63.9\\_84](http://ec.europa.eu/maritimeaffairs/atlas/maritime_atlas/#theme=themeGeography.subthemeBathymetry&extent=-33.6_21_63.9_84)
  - o [http://ec.europa.eu/regional\\_policy/atlas2007/transnational/index\\_en.htm](http://ec.europa.eu/regional_policy/atlas2007/transnational/index_en.htm)

# **Annex 2. Summaries of relevant FP6 Projects**

# AQUABREEDING

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## **Towards enhanced and sustainable use of genetics and breeding in the European aquaculture industry**

**Call number:** FP6-2005-SSP-5A

**Contract number:** 044424

**Contract type:** Specific Support Action

**Starting Date:** 01/12/2006

**Duration (months):** 24

**Project website:** <http://www.aquabreeding.eu>

**Total Project Cost:** 236.614,00

**EC Contribution:** 236.614,00

**Actionline:** The modernisation and sustainability of fisheries policies

**Coordinator:** Mr Chavanne Hervé ISTITUTO SPERIMENTALE ITALIANO 'LAZZARO SPALLANZANI' — Italy

The European aquaculture industry is a dynamic production sector characterized by a large variety of cultivated species and various rearing environments. The industry, although heterogeneous in size and type, is willing to collaborate with research organisations to tackle the problems inherent to any young production system but also to invest in strategic areas. Genetic improvement represents a crucial area for any industry whose activities depend on the trade of improved 'seeds' in both the plant and animal production sectors. When we consider the commitments made by the aquaculture sector in the area of genetic improvement, the industry can be divided into two halves. On one side pioneering companies have developed sophisticated selection programs and are now investing in the application of new technologies to their breeding systems. On the other side are the small producers which have either set up sporadic breeding activities or have not invested at all in breeding and are still using unselected broodstock. The project tackles this imbalance through the following objectives:

- 1) definition of the research priorities of the industry already involved in aquaculture breeding,
- 2) promotion of knowledge dissemination to support a major involvement of the entire industry in breeding activities,
- 3) creation of the conditions for a progressive integration of the European aquaculture industry into the FABRE Technology Platform.

The output of this project will consist of the definition of a strategic research agenda for the aquaculture sector in relation to breeding techniques and the provision of a vision paper defining the needs of the industry within the remit of the Technology Platform on Animal Breeding. The project also intends to increase the awareness within the entire industry of the benefits of implementing breeding activities and the use of genomic tools in the production of aquaculture species and by doing this assist in addressing the imbalance described above.

# AQUAFUNC

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## **Integrated knowledge on functional genomics in sustainable aquaculture**

**Call number:** FP6-2004-SSP-4

**Contract number:** 22685

**Contract type:** Specific Support Action

**Starting Date:** 01/11/2005

**Duration (months):** 24

**Project website:** <http://genomics.aquacultureeurope.org/>

**Total Project Cost:** 177.469,00

**EC Contribution:** 177.120,00

**Actionline:** The modernisation and sustainability of fisheries policies

**Coordinator:** Dr Sundell Kristina UNIVERSITY OF GOTEBORG— Sweden

A number of projects, using molecular technologies and a functional genomics approach to improve sustainability of European aquaculture, have been funded within the EU 5th and 6<sup>th</sup> frame work program. An integration of the outcome of these projects would undoubtedly contribute to build a large common knowledge base in this area. A synthesis of the different data sets can be expected to have a leverage effect, creating a more significant output than the sum of the individual projects. Integration and communication of the different projects outcome would also reduce possible overlap both currently and in the future. Bringing together large number of research groups/projects in a common forum should generate a critical mass and improve European and International visibility in this important area of production. The overall aim of the present project is to integrate the outcome of the projects within Framework Program 5 and 6 that concern genome mapping and functional genomics in aquaculture, in order to generate a common scientific basis of a functional genomics approach to aquaculture. This will be achieved through a series of instruments including work group meetings, analyse and combining of results in joint scientific publications as well as the creation of a common Internet site containing both public and restricted, accessible for registered scientific members, areas.

# BIODIVERSA

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## An ERA-Net in Biodiversity Research

**Call number:** ERA-NET/1/CA-SSA

**Contract number:** 517836

**Contract type:** Coordination action

**Starting Date:** 01/05/2005

**Duration (months):** 48

**Project website:** <http://www.eurobiodiversa.org>

**Total Project Cost:** 2.837.440,00

**EC Contribution:** 2.837.440,00

**Actionline:** Networking of national or regional programmes or parts of programmes; actors: public authorities, research agencies, open call for proposals (ERA-NETs)

**Coordinator :** Ms Deschamps Anne-Marie INSTITUT NATIONAL DE LA RECHERCHE AGRONOMIQUE — France

BIODIVERSA is an ERA Net involving 15 countries and 19 major research funding agencies in Europe with significant research funding in the field of terrestrial, freshwater and marine biodiversity. Most ERA-Net members are represented on other fora which discuss and recommend requirements for European biodiversity research: including the Convention for Biological Diversity (CBD-SBSTTA), Diversitas, the European Platform for Biodiversity Research Strategy (EPBRS) and the European Science Foundation (ESF). Recommendations from these fora are often made without a formal mechanism to ensure connection with the strategies, priorities and budgets of national research funding agencies. The aim of BIODIVERSA is to contribute to setting up such a mechanism, and its objective for the period 2004- 2008 is to achieve an efficient trans-national research cooperation in the field of biodiversity research funding. With the aim of contributing to the implementation of the EU Biodiversity Strategy, BiodivERsA will allow the funding agencies to collate existing activities, compare future strategies and recommendations of consultative bodies, and systematically explore opportunities for future collaboration. BIODIVERSA will also contribute to better coherence and increased synergies between the national programmes of cooperation with developing countries in the field of biodiversity research funding. In order to achieve this, BIODIVERSA will proceed through seven stages: (i) inventory, description and classification of biodiversity research programmes and research funding programmes of ERA-Net members; (ii) information gathering and linkage of ERA-Net members funding programmes with developing countries; (iii) identification of best practices to be compared, shared and implemented among the participants; (iv) identification of the existing opportunities for cooperation; (v) identification of administrative, legal and technical barriers to cooperation.

# ERATS

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## Ecological risk-assessment of transgenic fish

**Call number:** FP6-2002-MOBILITY-6

**Contract number:** 8141

**Contract type:** Marie Curie

**Starting Date:** 01/05/2006

**Duration (months):** 36

**Project website:** <http://vivaldi.zool.gu.se/Ekologi/Projects/Laxfiskgruppen/Transgenics/riskassr.htm>

**EC Contribution:** 178.683,00

**Actionline:** Marie Curie Outgoing International Fellowships (OIF)

**Coordinator:** Dr Grevby Cecilila Dr Johnsson Jörgen UNIVERSITY OF GOTEBORG— Canada

Recent advances in gene technology have been applied to create fast-growing transgenic fish, which are of great commercial interest to shorten production cycles and increase food production. However, there is growing concern over the impact escaped growth hormone (GH) transgenic fish may have on the natural environment. To predict these risks it is crucial to obtain data on the relative fitness of transgenic and non-transgenic fish under nature-like conditions. Empirical data on this is, however, lacking at present. Since transgenic fish cannot be released to the wild, studies on these fish must be carried out in specially contained laboratory facilities under simulated natural conditions. The main objective of the current proposal is to carry out such work with the goal to obtain knowledge of the potential ecological risks associated with commercial production of transgenic fish. In addition, these transgenic fish will be used both to increase our understanding of how hormones interact with the organism and its environment to regulate behaviour, and to examine evolutionary questions of why growth in nature often is below that physiologically possible. By comparing the performance of transgenic and nontransgenic fish at different life-stages and under various environmental settings, an assessment of the relative success of transgenic fish under natural conditions can be made. This information will form the base for policy decisions associated with commercial production of transgenic fish which may pose critical risks to natural populations of fish and other aquatic species in their ecosystems.

# FISH & CHIPS

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## **Towards DNA chip technology as a standard analytical tool for the identification of marine organisms in biodiversity and ecosystem science**

**Call number:** FP6-2002-GLOBAL-1

**Contract number:** 505491

**Contract type:** Specific Targeted Research Project

**Starting Date:** 01/01/2004

**Duration (months):** 39

**Project website:** <http://www.fish-and-chips.unibremen.de>

**Total Project Cost:** 2.245.159,00

**EC Contribution:** 1.599.872,00

**Actionline:** Cost effective, reliable and efficient technologies for enabling progress in biodiversity and ecosystem science

**Coordinator:** Prof. Blohm Dietmar, CENTRE FOR APPLIED GENSENSORIK AT THE UNIVERSITY OF BREMEN

Sustainable development is a fundamental goal of the European Union and loss of biodiversity is emphasised as one of the main threats to it. However, biodiversity and ecosystems of European Seas are under human impact, such as pollution, eutrophication, and overfishing.

Therefore it is necessary to monitor changes in biodiversity and ecosystem functioning. The aim of the project is the development of DNA chips for the identification of marine organisms in European Seas as a cost effective, reliable and efficient technology in biodiversity and ecosystem science. Many marine organisms, such as eggs and larvae of fishes, plankton, and benthic invertebrates, are difficult to identify by morphological characters. The classical methods are extremely time consuming and require a high degree of taxonomic expertise.

Consequently, the basic step of identifying such organisms is a major bottleneck in biodiversity and ecosystem science. Therefore, the project seeks to demonstrate that DNA chips can be a new powerful and innovative tool for the identification of marine organisms. Three DNA chips for the identification of fishes, phytoplankton, and invertebrates of European Seas will be developed. These chips will facilitate research on dispersal of ichthyoplankton, monitoring of phytoplankton, and identification of bioindicators as well as prey in gut contents analysis. To achieve this goal a combined biological and technical approach has been initiated:

The biological material will be sampled by marine biologists. The next step is the sequencing of suitable molecular markers for probe design. The technical part consists mainly in constructing gene probe libraries and determining their specificity. This will be done by biotech research centres in connection with SMEs engaged in bioinformatics and DNA chip technology. Therefore the project has the potential to bring Europe's marine biotechnology to the forefront of this field.

# HERMES

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## Hotspot Ecosystem Research on the Margins of European Seas

**Call number:** FP6-2003-Global-2

**Contract number:** 511234

**Contract type:** Integrated Project

**Starting Date:** 01/04/2005

**Duration (months):** 48

**Project website:** <http://www.eu-hermes.net/>

**Total Project Cost:** 21.828.715,00

**EC Contribution:** 14.999.974,00

**Actionline:** Integrated research on ecosystems lying in the deeper ocean section

**Coordinator:** Prof. Weaver Philip NATIONAL OCEANOGRAPHIC CENTRE— United Kingdom

HERMES is designed to gain new insights into the biodiversity, structure, function and dynamics of ecosystems along Europe's deep-ocean margin. It represents the first major attempt to understand European deep-water ecosystems and their environment in an integrated way by bringing together expertise in biodiversity, geology, sedimentology, physical oceanography, microbiology and biogeochemistry, so that the generic relationship between biodiversity and ecosystem functioning can be understood. Study sites will extend from the

Arctic to the Black Sea and include open slopes, where landslides and deep-ocean circulation affect ecosystem development, and biodiversity hotspots, such as cold seeps, cold-water coral mounds, canyons and anoxic environments, where the geosphere and hydrosphere influence the biosphere through escape of fluids, presence of gas hydrates and deep-water currents. These important systems require urgent study because of their possible biological fragility, unique genetic resources, global relevance to carbon cycling and possible susceptibility

to global change and man-made disturbances. Past changes, including catastrophic events, will be assessed using sediment archives. We will make estimates of the flow rates of methane from the geosphere and calculate how much is utilised by benthic communities, leaving the residual contribution to reach the atmosphere as a greenhouse gas. HERMES will enable forecasting of biodiversity change in relation to natural and man-made environmental changes by developing the first comprehensive pan-European margin Geographic Information System. This will provide a framework for integrating science, environmental modelling and socioeconomic indicators in ecosystem management. The results will underpin the development of a comprehensive European Ocean and Seas Integrated Governance Policy enabling risk assessment, management, conservation and rehabilitation options for margin ecosystems.

# MARBEF

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## Marine biodiversity and ecosystem functioning

**Call number:** FP6-2002-GLOBAL-1

**Contract number:** 505446

**Contract type:** Network of Excellence

**Starting Date:** 01/02/2004

**Duration (months):** 60

**Project website:** <http://www.marbef.org>

**Total Project Cost:** 8.707.000,00

**EC Contribution:** 8.707.000,00

**Actionline:** Network to structure and integrate European research on marine biodiversity and ecosystems

**Coordinator:** Mr Heip Carlo, NEDERLANDS INSTITUUT VOOR ECOLOGIE- The Netherlands

Knowledge on marine biodiversity in Europe is fragmented within and between disciplines. The approach to understanding the effects of increased anthropogenic pressure on marine biodiversity has hitherto been ad hoc and local. In particular, to understand how marine ecosystems will adapt to climate change, we need addressing especially the longterm and large-scale changes in marine biodiversity. This requires an entirely new research framework. The creation of the network of excellence MARBEF (Marine Biodiversity and Ecosystem Functioning) aims at integrating research efforts by forming a dedicated group of marine scientists and institutes and creating a virtual European institute with a longterm research programme and dedicated links with industry and the public at large. This involves besides coordination of research the training, exchange and outreach activities in several relevant fields of science, including marine ecology and biogeochemistry, fisheries biology, taxonomy and socioeconomic sciences. Better integration of research is also required to support the legal obligations of the EU and its Member States and associated states for the Convention for Biological Diversity, the OSPAR and Barcelona conventions as well as several EU directives (Bird Directive, Habitat Directive, Water Framework Directive). Society needs this information because a large and growing number of industries depend on the sustainable use and exploitation of marine biodiversity. This includes tourism, fisheries and aquaculture but also new industries that explore and commercialise marine genetic and chemical products.

# MARINE GENOMICS

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## Implementation of high-throughput genomic approaches to investigate the functioning of marine ecosystems and the biology of marine organisms

**Call number:** FP6-2002-GLOBAL-1

**Contract number:** 505403

**Contract type:** Network of Excellence

**Starting Date:** 01/03/2004

**Duration (months):** 48

**Project website:** <http://www.marine-genomics-europe.org>

**Total Project Cost:** 10.000.001,00

**EC Contribution:** 10.000.000,00

**Actionline:** Developing genomics approaches

**Coordinator:** Mr Stephan Ronan FIST S.A. — FRANCE INNOVATION SCIENTIFIQUE ET TRANSFERT

— France

The overall aim of this project is to set up and develop a European Network of Excellence, referred to as 'Marine Genomics Europe', for the implementation of high-throughput genomic approaches in the biology of marine organisms. 'Marine Genomics Europe' will promote, develop, and spread throughout the European Union a broad range of genomic approaches, to investigate a wide range of questions related to the functioning of marine ecosystems and to the biology of marine organisms. With this aim in view, we propose to group and network experts in genomics, proteomics, and bioinformatics from several centres of excellence in genomics in Europe with marine biologists who can make use of highthroughput genomics data. This will involve the dedication and the development of common research infrastructures, both in genomics and in marine biology. Joining together these distinct scientific communities will establish Europe's lead in marine genomics. The J.E.R. of 'Marine Genomics Europe' is broken down into comparative, functional and environmental genomics, three sections which structure more traditional streamlines, leading to various microbial, algal, evolution development and diversity, and fish and shellfish nodes. This research can be applied to the management of marine resources (prediction of global changes in marine populations, conservation of biodiversity, fisheries management and improvement of aquacultured species) and to gene mining for health and biotechnology.

The Integration effort of Marine Genomics Europe is based on the following strategies:

(i) jointly develop enabling technologies; (ii) sharing existing technical platforms; (iii) collectively gaining access to major Genomic centres; (iv) regrouping under a common Bioinformatics Centre; and (v), create and develop a Knowledge and Communication System. Spreading activities will include workshops and courses implemented by a Training & Education Council.

# SPONGES

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## Sustainable production, Physiology, Oceanography, Natural products, Genetics and Economics of Sponges

**Call number:** FP6-2003-SME-1

**Contract number:** 17800

**Contract type:** SMEs-Co-operative research projects

**Starting Date:** 01/11/2005

**Duration (months):** 24

**Project website:** <http://www.sponges.nl>

**Total Project Cost:** 1.999.790,00

**EC Contribution:** 1.441.901,00

**Actionline:** Co-operative Research (all areas of science and technology)

**Coordinator:** Prof. Müller Werner E.G. INSTITUT FÜR PHYSIOLOGISCHE CHEMIE, ABTEILUNG ANGEWANDTE MOLEKULARBIOLOGIE, JOHANNES GUTENBERG UNIVERSITÄT — Germany

Many marine sponges contain natural compounds that have potential interest to society. Limited possibilities to supply these compounds from natural resources often delays or even stops further development of a product after its initial discovery. In the SPONGES project, systems and processes for the cultivation of marine sponges and subsequent recovery of their natural products will be developed in order to create a stable and sustainable supply and reduce pressures on natural resources. Sponges are regarded as extremely difficult to culture, most likely as a result of our limited knowledge on the biology of these animals. The SPONGES consortium represents a combination of expertise that is unique in the world and the project is one of the most comprehensive research efforts ever to tackle the persisting challenge of growing sponges in tanks. The main objectives of SPONGES are: 1) sponge culture to obtain sponge natural products. Culture methods to be developed within SPONGES include techniques on three different levels of technological complexity: (i) sea based culture; (ii) land-based culture in tanks using natural seawater; (iii) closed land-based culture systems. These are the most challenging techniques to develop in terms of technological complexity, but also the most desired techniques with respect to control of production processes. Hence, a major part of the research efforts within SPONGES will be dedicated to the establishment of these systems, which include both the cultivation of functional sponges in enclosures and the cultivation of sponge primmorphs

(cellular aggregates obtained from dissociated cells) in bioreactors; 2) understanding sponges physiology, ecology and genetics. An upgrade of our fundamental understanding of sponges is needed to improve our abilities to farm these animals.

In SPONGES, ecological and physiological aspects are studied. The knowledge obtained will be converted into system engineering and process optimization. In addition, the genetic background of growth and secondary metabolism of sponges are studied in order to rationalize strategies to improve culture techniques; 3) process design and economic perspectives. In order to achieve the main goal — commercial sponge cultivation — the optimized basic procedures need to be up-scaled and validated. Market analyses will be executed and business plans will be presented for each individual technique developed as well as for the integrated sponge culture technology.

The project will strongly improve the competitive position of Europe in marine biotechnology and is expected to generate new products for the market.

# **Annex 3. Summaries of relevant FP7 Projects**

# APROPOS

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## **BioWASTE - Novel biotechnological approaches for transforming industrial and/or municipal biowaste into bioproducts – SICA**

**Call number:** FP7-KBBE-2011-5

**Contract number:** 289170

**Contract type:** Small or medium-scale focused research project

**Starting Date:** 01/01/2012

**Duration (months):** 36

**Project website:** [www.euapropos.eu](http://www.euapropos.eu)

**EC Contribution:** 2.874.468 euro

**Coordinator:** Kervinen Riitta; TEKNOLOGIAN TUTKIMUSKESKUS VTT (FI)

The focus of APROPOS is to develop novel eco-efficient bio-mechanical processing solutions to enrich intermediate fractions from industrial high protein and oil-containing process residues originating from agriculture and fisheries. Enzyme-aided modification steps are developed for the intermediate fractions to obtain value-added nutritive and bio-active components, chemical as well as functional bio-materials suitable for exploitation in food, skin care, wound healing, bio-pesticide and soil improvement product applications. Mentioned residues are voluminous in Europe and globally significant.

Zero waste concepts to be developed aim at avoidance of unnecessary purification of the components, establishment of local and distributed processing units in connection with the primary production and new business opportunities essentially for SMEs in Europe and beyond. An emphasis is directed to East Africa and India to support their needs to process local residues to components directed to nourish infants and fight against pests, respectively, in rural areas of both regions. The success of technological developments will be assessed in terms of economical feasibility, raw material efficiency and environmental impacts. The assessment will also include study on how the developed residue producer-end use value chain will affect the existing value chain from the residue producer to feed or energy. The multidisciplinary research group and cross-industrial

SME group together cover the whole value chain from residue producers and processors to various end-users. The expertises of the partners include crop and fish processing, process hardware manufacture, mechanical, chemical and biotechnical biomaterial processing, biomaterial up-grading and analytics, enzyme technology, end-product applications, assessment of eco-efficiency and value chains, technology transfer and commercialization. Feasibility of the developed processes is verified by demonstrations.

# ASSEMBLE

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## Association of European marine biological laboratories

**Call number:** FP7- CAPACITIES -INFRA-2008

**Contract number:** 227799

**Contract type:**

**Starting Date:** 01/03/2009

**Duration (months):** 48

**Project website:** <http://www.assemblemarine.org/>

**EC Contribution:** 8.7 million euro

**Coordinator:** Margareta AHLQWIST, GOETEBORGS UNIVERSITET - SWEDEN

ASSEMBLE is a research infrastructure initiative, funded within the European Union's 7th framework programme for Research and Technological Development, comprising a network of marine research stations. The joint research activities of ASSEMBLE are designed to improve the quality of provision of marine organisms with an emphasis on models for marine genomics. This includes multi-cellular organisms, unicellular eukaryotic organisms and cell lines as well as genetic and molecular resources. The research projects in ASSEMBLE will focus on:

- Improving the provision of whole, multi-cellular organisms, including such activities as tank development, flow control, filtration and containment, feeding, breeding, and distribution of marine plants and animals;
- Improving the provision of unicellular eukaryotic organisms and cell lines, including such activities as development of new cell lines, development of techniques for cryopreservation.
- Improving the provision of genetic and molecular resources, including such activities as the development of mutant lines, and the curation and arraying of libraries prior to their archiving into a common genomic resource centre (MPI-MG, Berlin).

# AQUATERRE

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## **BIOMASS SUPPLY AND IMPACT - Identification of optimal terrestrial and aquatic biomass and waste for Bioproducts**

**Call number:** FP7 – KBBE – 2007 - 1

**Contract number:** 212654

**Contract type:** Coordination and Support Action

**Starting Date:** 01/04/2008

**Duration (months):** 24

**Project website:** n/a

**EC Contribution:** 775.003 euro

**Coordinator:** Beck Steinar Rafn; HASKOLINN A AKUREYRI (IS)

AquaTerrE will promote the cooperation between research centres, business and other stakeholders in Europe devoted to the research, development and application of biomass and biofuel production and valorisation. It will aim integration and unification of efforts and the exchange of knowledge and expertise between partners, to promote the creation of a network for improving biomass and waste reutilisation. Mainly, AquaTerrE aims to make an inventory of existing biomass feedstocks in Europe and quantify the potential and identify of the best ones. In addition, to study the best possibilities for implementing different biomass sources in different environments to improve their utilisation. Pursuing this target, literature and data survey and current research review will be carried out.

Furthermore, the scope of AquaTerrE consists also in mapping European biomass feedstocks using different tools as Geographical Information Systems (GIS). Additionally, AquaTerrE expert members will identify economic and environmental impacts schemes to define the optimum Life Cycle Assessment (LCA). LCA is a standardized and structured method for calculating the environmental load of a product, process or activity throughout all its phases. The implementation of a new bio-product/bio-fuel in the market requires the analysis of economical, social and environmental aspects, with the objective of attaining enough information for the decision making progress. The contribution of a LCA study to this project can be framed in the identification of best sources of biomass feedstock as well as other agricultural waste for the sustainable obtaining of bio-fuels and other added value products.

# BAMMBO

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## Sustainable culture of marine microorganisms, algae and/or invertebrates for high added value products

**Call number:** FP7-KBBE-2010-4

**Contract number:** 265896

**Contract type:** Small or medium-scale focused research project

**Starting Date:** 01/03/2011

**Duration (months):** 36

**Project website:** [www.bammbo.eu](http://www.bammbo.eu)

**EC Contribution:** 2.992.421 euro

**Coordinator:** Walsh Daniel; LIMERICK INSTITUTE OF TECHNOLOGY (IE)

Innovation is the most important engine of growth and jobs in knowledge-based bioeconomies.

The scope of BAMMBO (Biologically Active Molecules of Marine Based Origin) is ambitious. This is intentional. BAMMBO will provide innovative solutions to overcome existing bottle-necks associated with culturing marine organisms in order to sustainably produce high yields of value-added products for the pharmaceutical, cosmetic and industrial sectors. BAMMBO will screen and identify target marine organisms (e.g. bacteria, fungi, sponges, microalgae, macroalgae and yeasts) from diverse global locations for potential as sustainable producers of high-added value molecules (HVAB's).

Our project will apply analytical methods for the extraction, purification and enrichment of targeted bioactive compounds. A detailed life cycle analysis of the production pathways developed in the project will be undertaken to fully evaluate the sustainability of production of biologically active products from marine organisms. BAMMBO will exploit knowledge and technologies developed during the project and effectively manage their transfer to relevant stakeholders in industry and the research community, as well as to policy-makers. We have brought together a multidisciplinary consortium of specialist. Research and SME partners representing 8 countries including partners from ICPC countries Russia and Brazil, and from EU member states at Mediterranean, Adriatic and Atlantic coasts. In adhering to the European Strategy for Marine and Maritime Research this three year project will encourage capacity-building, integration and synergies across relevant marine sectors. Innovative technologies developed in the project will be demonstrated with the involvement of industry partners, and the results will be of interest not only to companies directly involved in the marine sector, but to other large scale industry players such as pharmaceutical companies with interest in added-value bioactive compounds.

# BIOCLEAN

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## Biotechnological solutions for the degradation of synthetic polymeric materials (The Ocean of Tomorrow)

**Call number:** FP7-KBBE-2012-6-singlestageF

**Contract number:** 312100

**Contract type:** Small or medium-scale focused research project

**Starting Date:** 01/09/2012

**Duration (months):** 36

**Project website:** n/a

**EC Contribution:** 2.995.988 euro

**Coordinator:** Fava Fabio; ALMA MATER STUDIORUM UNIVERSITA DI BOLOGNA (IT)

In BIOCLEAN project, novel and robust microorganisms (aerobic and anaerobic bacteria, and fungi) able to extensively degrade polyethylene (PE), polypropylene (PP), polystyrol (PS) and polyvinyl chloride (PVC) polymers and plastics will be isolated from actual site aged plastic wastes obtained from several European marine and terrestrial sites, composting facilities and landfills, and obtained via tailored screenings from existing European collections of microbes. Robust enzymes able to fragment the target plastics with the production of valuable chemicals and building blocks will be obtained from the selected microbes and enzyme collections. Untreated and physically/chemically pre-treated PE, PS, PP and PVC polymers and plastics will be employed in such isolation/ screening activities, and an integrated methodology, relying on advanced analytical methods (determining plastics physicochemical changes and breakdown products resulting from biological attack), and tailored enzymatic, microbiological and ecotoxicological methods, will be adopted for the characterization of actual industrial relevance of the obtained microbes and enzymes. Physical and chemical pretreatments improving biodegradability of target plastics will be identified and transferred on the pilot scale. The most promising microbial cultures and enzymes will be exploited in the development of pilot scale, slurry or solid-phase bioprocesses for the bioremediation and controlled depolymerization, respectively, of target pretreated plastics and in the set up of tailored bioaugmentation protocols for enhancing plastic waste biodegradation in marine water systems, composting and anaerobic digester facilities. The processes developed will be assessed for their economical and environmental sustainability. Field scale validation of the most promising bioaugmentation protocols in a composting and a marine site and attempts to develop a plastic pollution reduction strategy for the Aegean Sea have been planned too.

# BLUEGENICS

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## Innovative marine biodiscovery pipelines for novel industrial products

**Call number:** FP7-KBBE-2012-6-singlestage

**Contract number:** 311848

**Contract type:** Small or medium-scale focused research project

**Starting Date:** 01/08/2012

**Duration (months):** 48

**Project website:** n/a

**EC Contribution:** 5.999.869 euro

**Coordinator:** Muller Werner E.G.; UNIVERSITATSMEDIZIN DER JOHANNES GUTENBERGUNIVERSITAET MAINZ (DE)

Marine organisms, in particular sponges and their associated microorganisms, are an inexhaustible source of novel bioactive (lead) compounds for biomedical application. Industrial exploitation of this natural resource using traditional approaches is, however, hampered, with a few exceptions, by unsolvable supply problems - despite of numerous efforts in the past. Therefore, there is, very likely, only one way: to start from the genes encoding the bioproducts, or their biosynthetic pathways, to sustainably obtain the active molecules in sufficient amounts. The aim of the presented industry-driven integrating project is to combine the knowledge in marine genomics, chemogenetics and advanced chemistry to produce recombinantly prepared novel secondary metabolite (lead) compounds and analogous from them, as well as pharmacologically active peptides, and to bring them up to the pre-clinical, and hopefully also to the clinical studies. This ambitious approach is based on breakthrough discoveries and the results of previous successful EU projects of members of the applying consortium, including European leaders (or worldwide leaders) in marine (sponge) genomics, metagenomics (polyketide synthase clusters), combinatorial biosynthesis and marine natural product chemistry/ structure elucidation. This multidisciplinary project, driven by high-tech genomics-based SMEs with dedicated interest in bringing marine-biotechnology-derived products to the market, will also involve the discovery and sustainable production of bioactive molecules from hitherto unexploited extreme environments, such as hydrothermal vents and deepsea sources, and the expression/scale-up of unique enzymes/proteins of biomedical and biotechnological interest. The molecular-biology-based strategies developed in this project for a sustainable exploitation of aquatic molecular biodiversity will further strengthen the international position and effectiveness of European (SME-based) blue biotechnology industry.

# CHIBIO

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## **BioWASTE - Novel biotechnological approaches for transforming industrial and/or municipal biowaste into bioproducts – SICA**

**Call number:** FP7-KBBE-2011-5

**Contract number:** 289284

**Contract type:** Small or medium-scale focused research project

**Starting Date:** 01/11/2011

**Duration (months):** 36

**Project website:** [www.chibiofp7.fraunhofer.de](http://www.chibiofp7.fraunhofer.de)

**EC Contribution:** 2.904.425 euro

**Coordinator:** Schulte Christoph; FRAUNHOFER-GESELLSCHAFT ZUR FOERDERUNG DER ANGEWANDTEN FORSCHUNG E.V (DE)

The fishing industry in the EU and elsewhere produces an increasing mass of negative value crustacean shell waste (>6 MTPA), whose current disposal in landfills results in significant costs and risks to human health as well as to the environment. While in Asia small amounts of shrimp waste are processed to chitosan, the high CaCO<sub>3</sub> content of EU crab shell waste has prevented cost effective conversion to value adding products. The project will develop an integrated biorefinery platform transforming the chemical constituents of EU, African and Asian crustacean shell waste into “drop-in” and novel chemical intermediates to produce high value, high performance bio-based polymers at high atom efficiencies. The innovative process comprises pretreatment steps to facilitate downstream enzymatic depolymerisation and conversion of sugars into chemical building blocks utilizing enzymatic and whole-cell biocatalysis routes. Biocatalyst development requires application of genomics techniques in combination with green-chemical and process-engineering know-how. Sustainable purification technologies will enable integration of monomers into current industrial polymerization processes. Biowaste streams will be valorised for the production of bioenergy to improve process efficiency and greenhouse gas footprint. The environmental impact of the process chain will be evaluated by a cradle-to-product life cycle analysis. Process scale-up will be linked with modelling and optimization studies to demonstrate economic viability. The consortium of 5 academic, 4 SME and 2 large industrial partners has the technical and management expertise to rapidly transfer laboratory scale results into novel industrial product lines at an accelerated pace. Key consortium members are from 5 different EU and 2 associated ICP states, which allows for strategic technology transfer from high- to low-tech driven countries, fostering the development of sustainable economies in the EU and beyond.

# ELIXIR

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## European Life-Science Infrastructure for Biological Information

**Call number:** FP7- CAPACITIES -INFRA-2007

**Contract number:** 211601

**Contract type:**

**Starting Date:** 01/11/2007

**Duration (months):** 38

**Project website:** <http://www.elixir-europe.org>

**EC Contribution:** 4.5 million euro

**Coordinator:** Janet THORNTON, EUROPAISCHES LABORATORIUM FUER MOLEKULARBIOLOGIE – EMBL - GERMANY

ELIXIR is a research infrastructure initiative, funded within the European Union's 7th framework programme for Research and Technological Development with the aim to develop the plan for a sustainable infrastructure for biological information in Europe. This plan focuses on generating stable funding for Europe's most important publicly accessible databases of molecular biological information, and the development of a compute infrastructure that can cope with the biological data deluge. ELIXIR is one of 44 research infrastructures recommended by the European Strategy Forum for Research Infrastructures as being of key strategic importance to Europe's future. ELIXIR holds a special place among these because it will provide infrastructure for the other biological, medical and environmental research infrastructures being developed. ELIXIR will provide: data resources; bio-computer centres; an infrastructure for integration of biological data, software tools and services throughout and beyond Europe; support for other European infrastructures in biomedical and environmental research; and services for the research community, including training and standards development.

# EMBRC

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## European Marine Biological Resource Centre

**Call number:** FP7- CAPACITIES -INFRA

**Contract number:**

**Contract type:**

**Starting Date:**

**Duration (months):** 38

**Project website:** <http://www.embrc.eu/>

**EC Contribution:**

### **Coordinator:**

The European Strategy Forum for Research Infrastructures selected end 2008 the European Marine Biological Resource Centre (EMBRC), to become the newest large-scale infrastructure for marine science. This infrastructure will enable scientists to use the most up-to-date techniques to study the composition, functioning and diversity of marine organisms, providing important benefits for life sciences and biomedicine and bringing new insights to the way organisms evolve and adapt to a changing environment. This initiative builds on the synergy developed between partner marine institutes during the Sixth Framework Programme of the European Commission, where networks of excellence in marine biology, such as Marine Genomics Europe, have had a major impact on advancing marine research. The action plan to realise the EMBRC infrastructure will begin with practical steps to obtain governmental commitment from member states and initiate the construction of this new European entity. Importantly the partners will collaborate on the legal and practical issues and liaise with their national representatives and research councils to make this proposal a reality. In the longer term, the ambition is to develop EMBRC as a major global player providing European researchers with a world class infrastructure to explore the world's valuable marine biological resources.

# GIAVAP

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## Modification of marine or freshwater algae to better suit industrial applications

**Call number:** FP7-KBBE-2010-4

**Contract number:** 266401

**Contract type:** Small or medium-scale focused research project

**Starting Date:** 01/01/2011

**Duration (months):** 36

**Project website:** [www.giavap.eu](http://www.giavap.eu)

**EC Contribution:** 5.596.607 euro

**Coordinator:** Boussiba Sammy; BEN-GURION UNIVERSITY OF THE NEGEV (IL)

Microalgae are a highly promising resource for the sustainable production of a wide variety of biomaterials for a wide range of applications. Microalgae can transform solar energy at high efficiency directly into valuable biological products using marginal water resources, waste nutrients and exhaust CO<sub>2</sub> without the needs for high value cropland. A wide variety of eukaryotic microalgae of high evolutionary diversity produce naturally valuable products like polyunsaturated fatty acids, carotenoids, medically active carbohydrates etc. Nevertheless only a few commercially viable algal products have entered the market. Algal cultivation and induction of high value product accumulation is a complex problem, algae grow in diluted solutions and require large areas and water volumes, causing high cultivation and harvesting costs and posing contamination problems and variable productivities due to climate variability. Genetic modifications to make microalgae better suit industrial applications are possible over a wide range of target mechanisms: stress tolerance, product accumulation pathways, cellular chlorophyll contents, novel metabolic pathways, resistance to pathogens and competition, etc. Due to the wide variability of algal strains under consideration, available techniques for genetic manipulations have to be adapted or developed for all algal strains of interest. Our consortium will adapt genetic engineering techniques to various algal strains of economic interest focusing on carotenoid and PUFA production and the overexpression of peptides of commercial value. In parallel we will develop cultivation technologies, harvesting and extraction methods for lipids, carotenoids and proteins using existing model algae strains that will then be adapted to suitable improved strains. Furthermore products will be tested for energy, pharmaceutical, nutritional or medical applications for economic evaluation of the production processes and their economic exploitation.

# KILL●SPILL

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## Innovative biotechnologies for tackling oil spill disasters (The Ocean of Tomorrow)

**Call number:** FP7-KBBE-2012-6-singlestage

**Contract number:** 312139

**Contract type:** Small or medium-scale focused research project

**Starting Date:** 01/01/2013

**Duration (months):** 48

**Project website:** n/a

**EC Contribution:** 8.996.599 euro

**Coordinator:** Kalogerakis Nicolas; TECHNICAL UNIVERSITY OF CRETE (EL)

Kill●Spill delivers innovative (bio)technologies, which can be integrated to the real sequences of state-of-the-art actions used currently to cleanup oil spills. The catalogue of Kill●Spill products & technologies is based on a review of technology & knowledge gaps in approaches of oil spill disasters and brings appropriate tools for 1st response, follow-up, and longer-term actions, specifically tailored to the versatility of oil spills. Kill●Spill develops chemicals & biochemicals to be used for 1st response actions to disperse/emulsify oil and materials enabling the containment and sorption of oil, preparing the field for the follow-up actions. Kill●Spill develops (Bio)technologies aiming at intensified biodegradation processes by bioaugmentation/biostimulation as follow-up and longer term actions in aerobic/slight anoxic compartments. Kill●Spill develops (bio) technologies adapted for the remediation of anoxic/anaerobic fresh & chronically polluted sediments. Kill●Spill compiles knowledge on dispersion/sorption and biodegradation processes to produce multifunctional products, which are suited for follow-up and longer term actions. The multifunctional products address the necessity for integrated bioremediation (bioavailability, metabolic requirements, etc.) and are efficient along the whole redox gradient from surface water to sediments. The products/technologies are field-tested in open sea oil spills and large mesocosms to unravel the champions products & technologies. The (bio)tools are benchmarked with existing solutions using cutting-edge analytics, biosensors, and omics and checked for eco-efficiency to merit green label. Kill●Spill consortium is multidisciplinary and gathers 38 partners from 11 EU and EU-associated countries and USA; 22 research & academic institutions, 14 SMEs, 1 large company, and 1 association of oil spill companies work together with the support of a high level advisory board to cover the whole chain of oil spill (bio)remediation.

# LIPOYEASTS

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## LIPID ENZYMES - Development of enzymes for lipid modification and activation

**Call number:** FP7-KBBE-2007-1

**Contract number:** 213068

**Contract type:** Small or medium-scale focused research project

**Starting Date:** 01/08/2008

**Duration (months):** 36

**Project website:** [www.lipoyeasts.ugent.be](http://www.lipoyeasts.ugent.be)

**EC Contribution:** 911.111 euro

**Coordinator:** Sabirova Julia; UNIVERSITEIT GENT (BE)

This proposal aims at developing a versatile fermentation platform for the conversion of lipid feed stocks into diverse added-value products. It is proposed to develop the oleaginous yeast *Yarrowia lipolytica* into a microbial factory by directing its versatile lipid metabolism towards the production of industrially valuable compounds like wax esters (WE), polyhydroxyalkanoates (PHA's), free hydroxyl fatty acids (HFA's) and isoprenoid-derived compounds (carotenoids, polyenic carotenoid ester). Conversion of lipid intermediates into these products will be achieved by introducing heterologous enzyme functions isolated from marine hydrocarbonoclastic bacteria into *Yarrowia*. To achieve these goals we have assembled a team with a broad set of complementary expertise in microbial physiology, metabolic engineering, yeast lipid metabolism, metagenomics, biochemical and protein engineering. Already available for this project are a number of genetically engineered *Yarrowia* strains as well as a collection of genes encoding enzymes for the production of WE's, 3-HFA's, PHA's and carotenoids. The following complementary research focus areas are proposed: (1) Engineering of metabolic precursor pools in *Yarrowia lipolytica* for the production of added-value products from lipids (INRA, UGe). (2) Conversion of metabolic precursor pools in *Yarrowia* to added-value products by overexpressing heterologous biosynthetic enzymes (UGe, INRA, UoM). (3) Discovery and characterization of novel aliphatic enzyme activities by metagenomic screening of marine hydrocarbonoclastic and other oiland fat-metabolizing microbial communities (TUBS, UoN). The project is further complemented by: (i) the activity of a professional valorization company (Ascenion) providing IP protection and commercialization services; (ii) by proactive efforts to expand the project's targetproducts' application potential (Avecom).

# MACUMBA

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## Improved cultivation efficiency of marine microorganisms

**Call number:** FP7-KBBE-2012-6-singlestage

**Contract number:** 311975

**Contract type:** Small or medium-scale focused research project

**Starting Date:** 01/08/2012

**Duration (months):** 48

**Project website:** n/a

**EC Contribution:** 8.999.948 euro

**Coordinator:** Van Der Linden Marcel; STICHTING KONINKLIJK NEDERLANDS INSTITUUT VOOR ZEEONDERZOEK (NIOZ) (NL)

Marine microorganisms form an almost untapped resource of biotechnological potential. However, its use is hindered by the low success rate of isolation of novel microorganisms and often by poor growth efficiency. Hence, the vast majority of marine microorganisms has not been cultivated and is often considered as 'unculturable'. MaCuMBA aims at improving the isolation rate and growth efficiency of marine microorganisms from conventional and extreme habitats, by applying innovative methods, and the use of automated high throughput procedures. The approaches include the co-cultivation of interdependent microorganisms, as well as gradient cultures and other methods mimicking the natural environment, and the exploitation of cell-to-cell communication.

Signaling molecules produced by microorganisms may be necessary for stimulating growth of the same or other species, or may prevent their growth. Signaling molecules also represent an interesting and marketable product. MaCuMBA will make use of high throughput platforms such as Cocagne, using gel microdroplet technology, or MicroDish in which many thousands of cultures are grown simultaneously. Various single-cell isolation methods, such as optical tweezers, will aid the isolation of specific target cells.

Isolated microorganisms as well as their genomes will be screened for a wide range of bioactive products and other properties of biotechnological interest, such as genetic transformability. Growth efficiency and expression of 'silent' genes of selected strains will be increased also by using the clues obtained from genomic information. MaCuMBA is targeted to SMEs and industry and they make a significant part of the consortium, ensuring that the project focuses on the interests of these partners. Moreover, MaCuMBA has adopted a comprehensive and professional exploitation, dissemination, implementation, and education strategy, ensuring that MaCuMBA's results and products will be directed to end-users and stakeholders.

# MAGICPAH

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## Molecular approaches to bioremediation of polyaromatic hydrocarbon compounds

**Call number:** FP7-KBBE-2009-3

**Contract number:** 245226

**Contract type:** Small or medium-scale focused research project

**Starting Date:** 01/04/2010

**Duration (months):** 48

**Project website:** [www.magicpah.org](http://www.magicpah.org)

**EC Contribution:** 2.997.137 euro

**Coordinator:** Pieper Dietmar H.; HELMHOLTZ-ZENTRUM FUER INFektionsFORSCHUNG GMBH (DE)

MAGICPAH aims to explore, understand and exploit the catalytic activities of microbial communities involved in the degradation of persistent PAHs. It will integrate (meta-) genomic studies with in-situ activity assessment based on stable isotope probing particularly in complex matrices of different terrestrial and marine environments. PAH degradation under various conditions of bioavailability will be assessed as to improve rational exploitation of the catalytic properties of bacteria for the treatment and prevention of PAH pollution. We will generate a knowledge base not only on the microbial catabolome for biodegradation of PAHs in various impacted environmental settings based on genome gazing, retrieval and characterization of specific enzymes but also on systems related bioavailability of contaminant mixtures. MAGICPAH takes into account the tremendous undiscovered metagenomic resources by the direct retrieval from genome/metagenome libraries and consequent characterization of enzymes through activity screens. These screens will include a high-end functional small-molecule fluorescence screening platform and will allow us to directly access novel metabolic reactions followed by their rational exploitation for biocatalysis and the re-construction of biodegradation networks. Results from (meta-) genomic approaches will be correlated with microbial in situ activity assessments, specifically dedicated to identifying key players and key reactions involved in anaerobic PAH metabolism. Key processes for PAH metabolism particularly in marine and composting environments and the kinetics of aerobic degradation of PAH under different conditions of bioavailability will be assessed in model systems, the rational manipulation of which will allow us to deduce correlations between system performance and genomic blueprint. The results will be used to improve treatments of PAH-contaminated sites.

# MAMBA

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## Marine metagenomics for new biotechnological applications

**Call number:** FP7-COOPERATION- KBBE-2008-3

**Contract number:** 226977

**Contract type:** Small or medium-scale focused research project

**Starting Date:** 01/07/2009

**Duration (months):** 48

**Project website:** <http://mamba.bangor.ac.uk>

**EC Contribution:** 2.88 million euro

**Coordinator:** Golyshin Peter; BANGOR UNIVERSITY COLLEGE ROAD UNITED KINGDOM

The Project aims at the mining of individual enzymes and metabolic pathways from extremophilic marine organisms and the metagenomes from microbial communities from peculiar marine environments and consequent funneling the new enzymatic reactions and processes towards the new biotechnological applications. Project builds up on the scientific and technological excellence of individual academic and industrial partners, and beyond that, on application of the state-of-the-art technologies for archiving, molecular screening for the activities (using a unique Surface Plasmon Resonance screening platform), protein structure elucidation, enzyme engineering and directed evolution and establishing new biotechnological processes (biocatalysis, synthesis of fine chemicals, etc.).

Marine sampling hotspots to produce the metagenomic resources for their further exploration will cover the whole diversity of marine microbial life at its limits (hypersaline, low and high temperature, high pressure and low water activity conditions, etc.). Individual enzymes interacting with the substrates will be identified, and in case they are new, hyper-expressed and crystallized and their structures will be elucidated. Consequently, the most promising candidates will be scored against the chiral substrates of relevance for biocatalysis and their ability to perform in water-free systems will be evaluated, the directed evolution will be implemented to improve the performance, and specificity of the enzymes. A comprehensive bioinformatic survey throughout the whole tree of cellular life will reveal and suggest the new candidates homologous to the discovered new proteins, from other organisms to be cloned and assayed. The implementation of the set of new enzymes in the biotechnological processes for fine chemical synthesis and drug discovery will be conducted in a strong alliance with competent industrial partners.

# MAREX

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## Novel marine bioactive compounds for European industries

**Call number:** FP7-KBBE-2009-3

**Contract number:** 245137

**Contract type:** Small or medium-scale focused research project

**Starting Date:** 01/08/2010

**Duration (months):** 48

**Project website:** [www.marex.fi](http://www.marex.fi)

**EC Contribution:** 5.999.974 euro

**Coordinator:** Vuorela Heikki; HELSINGIN YLIOPISTO (FI)

Biodiversity in the seas is only partly explored, although marine organisms are excellent sources for many industrial products. Through close co-operation between industrial and academic partners, the MAREX project will collect, isolate and classify marine organisms, such as micro- and macroalgae, cyanobacteria, sea anemones, tunicates and fish from the Atlantic, Pacific and Indian Oceans as well as from the Mediterranean, Baltic and Arabian Seas. Extracts and purified compounds of these organisms will be studied for several therapeutically and industrially significant biological activities, including anticancer, anti-inflammatory, antiviral and anticoagulant activities by applying a wide variety of screening tools, as well as for ion channel/receptor modulation and plant growth regulation. Chromatographic isolation of bioactive compounds will be followed by structural determination. Sustainable cultivation methods for promising organisms, and biotechnological processes for selected compounds will be developed, as well as biosensors for monitoring the target compounds. The work will entail sustainable organic synthesis of selected active compounds and new derivatives, and development of selected hits to lead compounds. The project will expand marine compound libraries.

MAREX innovations will be targeted for industrial product development in order to improve the growth and productivity of European marine biotechnology. MAREX aims at a better understanding of environmentally conscious sourcing of marine biotechnology products and increased public awareness of marine biodiversity and potential. Finally, MAREX is expected to offer novel marine-based lead compounds for European industries and strengthen their product portfolios related to pharmaceutical, nutraceutical, cosmetic, agrochemical, food processing, material and biosensor applications.

# MARINEBIOTECH

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## Marine biotechnology ERA-NET preparatory action

**Call number:** FP7-KBBE-2011-5

**Contract number:** 289311

**Contract type:** Coordination and Support Action

**Starting Date:** 01/10/2011

**Duration (months):** 18

**Project website:** [www.marinebiotech.eu](http://www.marinebiotech.eu)

**EC Contribution:** 999.870 euro

**Coordinator:** Bergseth Steinar; NORGES FORSKNINGSRAD (NO)

Marine biotechnology has the potential to provide a major contribution towards addressing some of the most pressing societal challenges including environmental degradation, human health and delivering sustainable supplies of food and energy.

The main goal of the CSA will be to prepare the foundation for a potential ERA-NET in the area of Marine Biotechnology which will require: a) Gaining better understanding of the Marine Biotechnology landscape in Europe and beyond. To this end the consortium envisages carrying out an analysis of the current landscape (research effort, infrastructures, stakeholders, strategies and programmes, gaps and barriers to cooperation). b) Mobilisation of key stakeholders: extending the partnership of funding agencies and European Stakeholders. To this end the consortium envisages pro-active engagement with relevant and potentially interested funding agencies and stakeholders through development of appropriate fora, the organisation of information sessions, workshops and other project activities. c) Sketching the contours of future cooperation between funding agencies in the area of Marine Biotechnology. To this end the consortium envisages workshops involving the extended network of funding agencies and representative governmental organisations to set the stage for the set-up of appropriate cooperation tools to develop joint programmes and pool resources for collaborative research on a European scale. d) Managing information relevant to marine biotechnology research, technology development and innovation, and making this available via a dedicated web-site (including Wiki pages), newsletters, reports and briefing documents.

# MARINEFUNGI

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## Sustainable culture of marine microorganisms, algae and/or invertebrates for high added value products

**Call number:** FP7-KBBE-2010-4

**Contract number:** 265926

**Contract type:** Small or medium-scale focused research project

**Starting Date:** 01/05/2011

**Duration (months):** 36

**Project website:** [www.marinefungi.eu](http://www.marinefungi.eu)

**EC Contribution:** 2.999.898 euro

**Coordinator:** Labes Antje; HELMHOLTZ ZENTRUM FUR OZEANFORSCHUNG KIEL (DE)

The aim of MARINE FUNGI is the demonstration of sustainable exploitation of marine natural resources providing appropriate culture conditions for the underutilised group of marine fungi, thus enabling efficient production of marine natural products in the laboratory and also in large scale cultures, avoiding harm to the natural environment. The focus of MARINE FUNGI are new anti-cancer compounds. The project will carry out the characterisation of these compounds to the stage of in vivo proof of concept ready to enter further drug development in order to valorise the results of the project. MARINE FUNGI covers two approaches to gain effective producer strains: a) Candidate strains originating from one partner's strain collection will be characterised and optimised using molecular methods. b) New fungi will be isolated from unique habitats, i.e. tropical coral reefs, endemic macroalgae and sponges from the Mediterranean. Culture conditions for these new isolates will be optimised for the production of new anti-cancer metabolites. MARINE FUNGI will develop a process concept for these compounds providing the technological basis for a sustainable use of marine microbial products as result of "Blue Biotech". The project will explore the potential of marine fungi as excellent sources for useful new natural compounds. This will be accomplished by the formation of a new strongly interacting research network comprising the scientific and technological actors, including 3 SMEs and 2 ICPC partners, necessary to move along the added-value chain from the marine habitat to the drug candidate and process concept. The generated and existing knowledge will be disseminated widely for the valorisation of the project results.

# MEM-S

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## Nanobiotechnology: functionalised membranes

**Call number:** FP7-KBBE-2009-3

**Contract number:** 244967

**Contract type:** Small or medium-scale focused research project

**Starting Date:** 01/01/2010

**Duration (months):** 36

**Project website:** [www.eu-mem-s.de](http://www.eu-mem-s.de)

**EC Contribution:** 2.816.819 euro

**Coordinator:** Muller Werner E.G.; UNIVERSITÄTSMEDIZIN DER JOHANNES GUTENBERGUNIVERSITÄT MAINZ (DE)

There is strong interest in the development of novel functionalized membranes which can be used as microsieves, as a component of integrated analytical systems, in food processing, drug discovery and diagnostic applications. This project is based on a combination of three break-through technologies, developed by the applicants in the past, with high impact for nano(bio)technological application: (i) the S-layer technology allowing the construction of nanoporous protein lattices, (ii) the biocatalytic formation of inorganic materials by silicatein, a group of unique enzymes capable to catalyze the formation of porous silica from soluble precursors, and (iii) the sol-gel technique for encapsulation (immobilization) of biomolecules serving as biocatalyst or as a component of sensors. The goal of this project is to design and fabricate - based on molecular biology inspired approaches - nano-porous bio-inorganic membranes with novel functionalities for industrial application. These membranes will be formed by S-layer proteins, which are able to assemble to highly ordered structures of defined poresize, and recombinant silicateins or silicatein fusion proteins. The hydrated silica glass layer formed by silicatein will be used to encase biocatalysts (enzymes) or antibodies against small molecules as sample prep- or sensor components of integrated systems. The innovative type of the functionalized membranes developed in this project thus exploits two principles: (i) protein self-assembly and - and this has not been done before - (ii) enzymatic (silicatein-mediated) deposition of inorganic material used for reinforcement of the membranes as well as for encasing biomolecules, providing the membranes with new functionalities. The new technique will be exploited by three research-based SMEs and the enduser involved in the project, in microfluidics based sample processing and micro-array development, in industrial nanosieves, as well as in sensors in drinking water systems.

# METAEXPLORE

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## **ACTIVITY MINING IN METAGENOMES – Exploring molecular microbial diversity in aquatic environment or the soil**

**Call number:** FP7-KBBE-2007-2A

**Contract number:** 222625-2

**Contract type:** Small or medium-scale focused research project

**Starting Date:** 01/05/2009

**Duration (months):** 60

**Project website:** [www.rug.nl/metaexplore](http://www.rug.nl/metaexplore)

**EC Contribution:** 5.999.991 euro

**Coordinator:** van Elsas Jan Dirk; RIJKSUNIVERSITEIT GRONINGEN (NL)

This proposal will (further) develop and apply metagenomics tools to access the enzymatic potential borne in the cryptic biota of selected natural habitats, in particular target soil-related and aquatic ones. In the light of the environmental relevance of chitins and lignins (as natural compounds recalcitrant to degradation) and halogenated aliphatic and aromatic compounds (anthropogenic recalcitrant compounds), the enzymatic activities that we will target are functions able to degrade these compounds. A database of gene functions will be established and maintained. Next to its great relevance to environmental biotechnology including bioremediation, a spin-off of the work will be the discovery of novel biocatalytic functions of industrial relevance. We will in particular address the catabolic potential that is encoded by the mobilome, the collective pool of mobile genetic elements in the microbiota. We will further apply high-throughput (454-based) sequencing to rapidly unravel the metabolic complement in this mobile gene pool. The project brings together a suite of 15 contractors across Europe, encompassing 21 laboratories spread over 11 countries and including 4 SMEs. Most of the partners are renowned laboratories which have vast experience in metagenomics of environmental samples, biotechnology, enzymology, bioinformatics, the mobilome, waste management and bioremediation and enzyme production.

# MG4U

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## Learning from research projects: specific dissemination action to potential users in marine genomics

**Call number:** FP7-KBBE-2010-4

**Contract number:** 266055

**Contract type:** Coordination and Support Action

**Starting Date:** 01/01/2011

**Duration (months):** 30

**Project website:** [www.mg4u.eu](http://www.mg4u.eu)

**EC Contribution:** 997.826 euro

**Coordinator:** Kloareg Bernard; CENTRE NATIONAL DE LA RECHERCHE SCIENTIFIQUE (FR)

Marine waters provide resources and services estimated at 60% of the total economic value of the biosphere. The application of cutting-edge genomic approaches has generated significant new understanding the marine environment. Rapid progress will continue given the fast rate of technological development in this field. Methods and information are sufficiently mature for direct application to achieve a more competitive European economy, and the generation of knowledge economies in the marine sector. Applications include improving the efficiency of characterisation and mining of marine diversity for biotechnology products and processes that will contribute to the welfare of mankind in a sustainable and environmentally compatible manner. Marine genomics knowledge has enormous potential to assist organisations involved in governance and sustainable management of the marine environment and its resources. However, the direct utility of marine genomics in developing commercial advantage, and in general problem solving is not understood by many decision makers in government and industry.

A large amount of valuable marine genomics knowledge is inaccessible to users or exists in non-user-friendly contexts. Marine Genomics 4 Users (MG4U) responds to the specific call "Learning from research projects: specific dissemination to potential users in marine genomics" designed to address this critical bottleneck. The call was generated since it is crucial that putative end-users are aware of both the potential of genomics approaches and the state-of-the-art developments that have taken place in recent EU and other research programmes for genomics to be exploited effectively end users. MG4U brings together a project consortium containing both scientific excellence and knowledge management specialists to design an innovative and realisable project that can have a measurable impact on the current situation and become a best practice example of effective knowledge transfer.

# MICRO B3

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## Marine microbial diversity – new insights into marine ecosystems functioning and its biotechnological potential

**Call number:** FP7-OCEAN-2011

**Contract number:** 287589

**Contract type:** Small or medium-scale focused research project

**Starting Date:** 01/01/2012

**Duration (months):** 48

**Project website:** [www.microb3.eu](http://www.microb3.eu)

**EC Contribution:** 8.987.491 euro

**Coordinator:** Gloeckner Franck Oliver; de JACOBS UNIVERSITY BREMEN GGMBH (DE)

Micro B3 will develop innovative bioinformatic approaches and a legal framework to make large-scale data on marine viral, bacteria; archaeal and protists genomes and metagenomes accessible for marine ecosystems biology and to define new targets for biotechnological applications. Micro B3 will build upon a highly interdisciplinary consortium of 32 academic and industrial partners comprising world-leading experts in bioinformatics, computer science, biology, ecology, oceanography, bioprospecting and biotechnology, as well as legal aspects.

Micro B3 is based on a strong user- and data basis from ongoing European sampling campaigns to long-term ecological research sites. For the first time a strong link between oceanographic and molecular microbial research will be established to integrate global marine data with research on microbial biodiversity and functions. The Micro B3

Information System will provide innovative open source software for data-processing, -integration, visualisation, and -accessibility. Interoperability will be the key for seamless data transfer of sequence and contextual data to public repositories. Micro B3 will allow taking full advantage of current sequencing technologies to efficiently exploit large-scale sequence data in an environmental context. Micro B3 will create integrated knowledge to inform marine ecosystems biology and modelling. Moreover, it will facilitate detecting candidate genes to be explored by targeted laboratory experiments for biotechnology and for assigning potential functions to unknown genes. Micro B3 will develop clear IP agreements for the protection and sustainable use of pre-competitive microbial genetic resources and their exploitation in high potential commercial applications. To underline the translational character of Micro B3, outreach and training activities for diverse stakeholders are planned as well as an Ocean Sampling Day to transparently make project results accessible and gain valuable user feedback.

# MIDTAL

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## Microarrays for the detection of toxic algae

**Call number:** FP7- COPERATION - ENV.2007

**Contract number:** 201724

**Contract type:** Small or medium-scale focused research project

**Starting Date:** 01/09/2008

**Duration (months):** 45

**Project website:** <http://www.midtal.com/>

**EC Contribution:** 2.23 million euro

**Coordinator:** Parr JON, MARINE BIOLOGICAL ASSOCIATION OF THE UNITED KINGDOM - UNITED KINGDOM

Microalgae in marine and brackish waters of Europe regularly cause «harmful effects», considered from the human perspective, in that they threaten public health and cause economic damage to fisheries and tourism. Cyanobacteria cause similar problems in freshwaters. These episodes encompass a broad range of phenomena collectively referred to as «harmful algal blooms» (HABs). They include discoloration of waters by mass occurrences of microalgae (true algal blooms that may or may not be «harmful») to toxin-producing species that may be harmful even in low cell concentrations.

A broad classification of HAB distinguishes three groups of toxic organisms. For adequate management of these phenomena, monitoring of microalgae is required. However, the effectiveness of monitoring programmes is limited by the fact that it is time consuming and morphology as determined by light microscopy may be insufficient to give definitive species and toxin attribution. Once cell numbers reach a threshold level, then shellfish are selected to toxin analysis by the mouse bioassay. The mouse bioassay is continued on a daily basis until no more toxin is detected. Molecular and biochemical methods are now available that offer rapid means of both species and toxin detection. In this project we will target rapid species identification using rRNA genes as the target.

We include antibodies to specific toxins because even when cell numbers are very low, the toxins can be present and can be accumulated in the shellfish. Microarrays are the state of the art technology in molecular biology for the processing of bulk samples for detection of target RNA/DNA sequences. The purpose of MIDTAL is to support the common fisheries policy to aid the national monitoring agencies by providing new rapid tools for the identification of toxic algae and their toxins so that they can comply with ECC directive 91/1491/CEE that can be converted to cell numbers and reduce the need for the mouse bioassay.

# PERSEUS

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## Policy-oriented marine Environmental Research in the Southern European Seas

**Call number:** FP7-OCEAN-2011

**Contract number:** 287600

**Contract type:** Small or medium-scale focused research project

**Starting Date:** 01/01/2012

**Duration (months):** 48

**Project website:** [www.perseus-net.eu](http://www.perseus-net.eu)

**EC Contribution:** 12.973.123,40 euro

**Coordinator:** Papathanassiou Evangelos; HELLENIC CENTRE FOR MARINE RESEARCH (EL)

The overall scientific objectives of PERSEUS are to identify the interacting patterns of natural and human-derived pressures on the Mediterranean and Black Seas, assess their impact on marine ecosystems and, using the objectives and principles of the Marine Strategy Framework Directive as a vehicle, to design an effective and innovative research governance framework based on sound scientific knowledge. Well-coordinated scientific research and socio-economic analysis will be applied at a wide-ranging scale, from basin to coastal. The new knowledge will advance our understanding on the selection and application of the appropriate descriptors and indicators of the MSFD. New tools will be developed in order to evaluate the current environmental status, by way of combining monitoring and modelling capabilities and existing observational systems will be upgraded and extended. Moreover, PERSEUS will develop a concept of an innovative, small research vessel, aiming to serve as a scientific survey tool, in very shallow areas, where the currently available research vessels are inadequate. In view of reaching Good Environmental Status (GES), a scenario-based framework of adaptive policies and management schemes will be developed. Scenarios of a suitable time frame and spatial scope will be used to explore interactions between projected anthropogenic and natural pressures. A feasible and realistic adaptation policy framework will be defined and ranked in relation to vulnerable marine sectors/groups/regions in order to design management schemes for marine governance. Finally, the project will promote the principles and objectives outlined in the MSFD across the SES. Leading research Institutes and SMEs from EU Member States, Associated States, Associated Candidate countries, non-EU Mediterranean and Black Sea countries, will join forces in a coordinated manner, in order to address common environmental pressures, and ultimately, take action in the challenge of achieving GES.

# PHARMASEA

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## Innovative marine biodiscovery pipelines for novel industrial products

**Call number:** FP7-KBBE-2012-6-singlestage

**Contract number:** 312184

**Contract type:** Small or medium-scale focused research project

**Starting Date:** 01/010/2012

**Duration (months):** 48

**Project website:** n/a

**EC Contribution:** 9.465.907 euro

**Coordinator:** Esguerra Camila ([camila.esguerra@pharm.kuleuven.be](mailto:camila.esguerra@pharm.kuleuven.be)), Katholieke Universiteit, Leuven, BE

The PharmaSea project focuses on obstacles in marine biodiscovery research, development and commercialization and brings together a broad interdisciplinary team of academic and industry researchers and specialists to address and overcome these. The partners are ideally placed to demonstrate how to widen the bottlenecks and increase the flow of ideas and products derived from the marine microbiome towards a greater number of successes in a larger number of application areas. Despite the tremendous potential of marine biodiscovery, exploitation, particularly at a commercial scale, has been hampered by a number of constraints. These relate to access (physical and legal), genetics of the organisms, compound isolation, structure elucidation, early reliable validation of biological activity and best mechanisms of flow-through into exploitation. PharmaSea will solve these chronic bottlenecks by developing essential actions beyond the state of the art and linking them with best practice and appropriate pragmatic approaches. The robust pipeline structure established within PharmaSea will process a wide genetic basis including marine microbial strain collections held by partners and new strain collections from extreme environments (deep, cold and hot vent habitats) to produce new products with desirable characteristics for development by the SME partners in three accessible market sectors, health (infection, inflammation, CNS diseases), personal care and nutrition. The global aim of PharmaSea is to produce two compounds at larger scale and advance them to pre-clinical evaluation. To address relevant challenges in marine biodiscovery related to policy and legal issues, PharmaSea will bring together practitioners, legal experts, policy advisors/makers and other stakeholders, focusing on the feasibility of harmonising, aligning and complementing current legal frameworks with recommendations and ready to use solutions tailored to marine biodiscovery.

# POLYMODE

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## **NOVEL ENZYMES – The search for novel enzymes and microorganisms for different bioprocesses**

**Call number:** FP7-KBBE-2007-2A

**Contract number:** 222628-2

**Contract type:** Small or medium-scale focused research project

**Starting Date:** 01/05/2009

**Duration (months):** 48

**Project website:** [www.polymode.eu](http://www.polymode.eu)

**EC Contribution:** 5.999.948 euro

**Coordinator:** Moerschbacher Bruno; WESTFAELISCHE WILHELMSUNIVERSITAET MUENSTER (DE)

The PolyModE project convenes an international, interdisciplinary, and intersectorial consortium to identify, characterise, and optimise novel polysaccharide modifying enzymes, and to develop robust fermentation strategies for their large-scale production, to exploit the potential of biopolymers for food, pharmaceutical, cosmetic, and technical applications. We have selected the six complex carbohydrates with the highest current market share or expected future market potential, namely alginate, carrageenan, chitosan, glycosaminoglycan, pectin, and xanthan gum. For each of these, the industrial partners have identified those enzymes which will answer to the most pressing needs or offer the most promising potential for improved production of polysaccharides with novel physico-chemical properties and biological functionalities. Primary targets will be alginate epimerases, carrageenan sulfatases, chitosan de-acetylases, glycosaminoglycan sulfatases, pectin de-acetylases, and xanthan gum de-acetylases. These enzymes together with secondary target enzymes, e.g. sequence specific lyases and hydrolases, will allow the generation and analysis of polymers and oligomers with novel, non-random patterns of modification. Two parallel approaches will be followed for each type of polysaccharide modifying enzyme, namely a knowledge-based genomic approach and a broad, un-biased metagenomic approach, e.g. using soil or sludge samples with a history of contact with the polysaccharide in question. A pipeline of three levels of fermentation systems will be established, ranging from lab-scale innovative expression systems with features shaped according to the specific characteristics of our target enzymes, through medium-scale, novel and unusual fermentation systems provided by a number of SME with highly specialised knowledge and expertise in developing and using such systems, to the established large-scale fermentation systems and facilities of market leaders in White Biotechnology.

# RADAR

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## Innovative aquatic biosensors

**Call number:** P7-KBBE-2010-4

**Contract number:** 265721

**Contract type:** Small or medium-scale focused research project

**Starting Date:** 01/01/2011

**Duration (months):** 48

**Project website:** [www.fp7-radar.eu](http://www.fp7-radar.eu)

**EC Contribution:** 2.926.127 euro

**Coordinator:** Follonier Stephane; CSEM CENTRE SUISSE D'ELECTRONIQUE ET DE MICROTECHNIQUE SA – RECHERCHE ET DEVELOPPEMENT (CH)

RADAR is a 7-member consortium that aims to develop a robust, sensitive, and versatile label-free, biosensor platform for spot measurements and on-line monitoring of toxins and pollutants in food production processes and in the aquatic environment. Specificity towards chemical pollutants and toxins is achieved by using recombinant receptors (namely the estrogen receptor and the aryl hydrocarbon receptor) whose amino acid sequences have been rationally designed based on genomic and functional information from aquatic organisms. Sensitivity of the biosensor is increased by the unique combination of isotachophoretic pre-concentration step, and surface nanostructuring & chemical modification. The integration of the label-free detection sensors with an on-line automated sample handling and a wireless communication system will yield a best-in-class biosensor platform for robust, specific and sensitive detection of EDCs and PAHs in difficult operating conditions. To validate the RADAR biosensor the consortium will test the biosensors in fresh and marine water, in fish farms, and in food products such as fish, fruit juices, and milk. Through their contacts in these industries, the partners will evaluate the performance of the biosensors in such environments, analyzing a representative number of samples and reporting on the stability, ruggedness and accuracy of the sensors used under laboratory and real test conditions. This project is expected to have a high economic impact, since our cost-effective sensor could find a worldwide distribution in most food production and water testing lines as supported by Agilent Technologies Inc.

# SEABIOTECH

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## **Innovative marine biodiscovery pipelines for novel industrial products**

**Call number:** FP7-KBBE-2012-6-singlestage

**Contract number:** 311932

**Contract type:** Small or medium-scale focused research project

**Starting Date:** 01/08/2012

**Duration (months):** 48

**Project website:** n/a

**EC Contribution:** 7.461.716 euro

**Coordinator:** Gregory Martin; UNIVERSITY OF STRATHCLYDE (UK)

SeaBioTech is a 48-month project designed and driven by SMEs to create innovative marine biodiscovery pipelines as a means to convert the potential of marine biotechnology into novel industrial products for the pharmaceutical (human and aquaculture), cosmetic, functional food and industrial chemistry sectors. SeaBioTech will reduce barriers to successful industrial exploitation of marine biodiversity for companies more accustomed to 'terrestrial' biotechnology. SeaBioTech directly addresses five key challenges to remove bottlenecks in the marine biodiscovery pipeline, leading to (1) improvements in the quality of marine resources available for biotechnological exploitation, (2) improvement in technical aspects of the biodiscovery pipeline to shorten time to market, and (3) developing sustainable modes of supply of raw materials for industry. The two last challenges centre on enabling activities to enhance the marine biodiscovery process: first, clarification of legal aspects to facilitate access to marine resources, their sustainable use, and their secure exploitation; second, to create an improved framework for access to marine biotechnology data and research materials. To achieve its goals, SeaBioTech brings together complementary and world-leading experts, integrating biology, genomics, natural product chemistry, bioactivity testing, industrial bioprocessing, legal aspects, market analysis and knowledge exchange. The expertise assembled within the consortium reflects the industry-defined needs, from the SME partners' initial definition of market and product opportunities to their ultimate proof-of-concept demonstration activities. SeaBioTech will have significant impact on research and technology, on innovation, on European competitiveness and on economic growth. It will provide a model to accelerate the development of European biotechnology into a world leading position.

# SPECIAL

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## Sustainable culture of marine microorganisms, algae and/or invertebrates for high added value products

**Call number:** FP7-KBBE-2010-4

**Contract number:** 266033

**Contract type:** Small or medium-scale focused research project

**Starting Date:** 01/12/2010

**Duration (months):** 36

**Project website:** [www.project-special.eu](http://www.project-special.eu)

**EC Contribution:** 2.991.682 euro

**Coordinator:** Reis Rui L.; UNIVERSIDADE DO MINHO (PT)

The SPECIAL project aims at delivering breakthrough technologies for the biotechnological production of cellular metabolites and extracellular biomaterials from marine sponges.

These include a platform technology to produce secondary metabolites from a wide range of sponge species, a novel in vitro method for the production of biosilica and recombinant technology for the production of marine collagen. Research on cellular metabolites will be based upon our recent finding that non-growing sponges continuously release large amounts of cellular material. Production of biosilica will be realized through biosintering, a novel enzymatic process that was recently discovered in siliceous sponges.

Research on sponge collagen will focus on finding the optimal conditions for expression of the related genes. Alongside this research, the project will identify and develop new products from sponges, thus fully realizing the promises of marine biotechnology.

Specifically, the project will focus on potential anticancer drugs and novel biomedical/ industrial applications of biosilica and collagen, hereby taking advantage of the unique physico-chemical properties of these extracellular sponge products. The consortium unites seven world-class research institutions covering a wide range of marine biotechnology-related disciplines and four knowledge-intensive SMEs that are active in the field of sponge culture, drug development and nanobiotechnology. The project is clearly reflecting the strategic objectives outlined in the position paper European Marine Strategy (2008); it will enhance marine biotechnology at a multi-disciplinary, European level and provide new opportunities for the European industry to exploit natural marine resources in a sustainable way. In particular the biotechnological potential of marine sponges, which has for a long time been considered as an eternal promise, will be realized through the SPECIAL project.

# SPLASH

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## Biotechnology for novel biopolymers

**Call number:** FP7-KBBE-2012-6-singlestage

**Contract number:** 311956

**Contract type:** Small or medium-scale focused research project

**Starting Date:** Under negotiation

**Duration (months):** 48

**Project website:** n/a

**EC Contribution:** 8.942.933 euro

**Coordinator:** Barbosa Maria; STICHTING DIENST LANDBOUWKUNDIG ONDERZOEK (NL)

The 4-year SPLASH project will develop a new biobased industrial platform using microalgae as a renewable raw material for the sustainable production and recovery of hydrocarbons and (exo)polysaccharides from the species *Botryococcus braunii* and further conversion to renewable polymers. The project comprises 20 partners of which 40% SME and several large corporates plus universities and research institutes. Two bioproduction platforms will be explored: (1) green alga *Botryococcus braunii* on its own and (2) the green microalga *Chlamydomonas reinhardtii*, to which the unique hydrocarbon and polysaccharides producing genes from *Botryococcus* will be transferred.

SPLASH will deliver knowledge, tools and technologies needed for the establishment of a new industry sector: Industrial Biotechnology with algae and/or algal genes for the manufacture of polyesters and polyolefins. The building blocks for these polymers will be derived from the sugars (polyesters) and hydrocarbons (polyolefins) exuded by the algae: adipic acid from galactose, 2,5-furandicarboxylic acid from glucose, rhamnose and fucose, 1,4-pentanediol from rhamnose and fucose, ethylene from 'green naphtha', propylene from 'green naphtha'. The conversion of ethylene and propylene to polyolefins is common technology, and will not be included in the project. The sugar-derived building blocks will be converted to new condensation polymers, including poly(ethylene 2,5-furandioate) (PEF) and poly(1,4-pentylene adipate-co-2,5-furandioate). End-use applications include food packaging materials and fibres for yarns, ropes and nets. The project encompasses (1) development of *Botryococcus* as an industrial production platform, (2) Systems biology analysis, (3) Development of procedures for production, in situ extraction and isolation, (4) product development.

# SUNBIOPATH

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## Sustainable use of seas and oceans - Biomass from micro- and macro-algae for industrial

**Call number:** FP7-KBBE-2009-3

**Contract number:** 245070

**Contract type:** Small or medium-scale focused research project

**Starting Date:** 01/01/2010

**Duration (months):** 36

**Project website:** [www.ulg.ac.be/genemic/sunbiopath](http://www.ulg.ac.be/genemic/sunbiopath)

**EC Contribution:** 2.998.182 euro

**Coordinator:** Remacle Claire; UNIVERSITE DE LIEGE (BE)

SUNBIOPATH - towards a better sunlight to biomass conversion efficiency in microalgae - is an integrated program of research aimed at improving biomass yields and valorization of biomass for two Chlorophycean photosynthetic microalgae, *Chlamydomonas reinhardtii* and *Dunaliella salina*. Biomass yields will be improved at the level of primary processes that occur in the chloroplasts (photochemistry and sunlight capture by the light harvesting complexes) and in the cell (biochemical pathways and signaling mechanisms that influence ATP synthesis). Optimal growth of the engineered microalgae will be determined in photobioreactors, and biomass yields will be tested using a scale up approach in photobioreactors of different sizes (up to 250 L), some of which being designed and built during SUNBIOPATH. Biomethane production will be evaluated. Compared to other biofuels, biomethane is attractive because the yield of biomass to fuel conversion is higher. Valorization of biomass will also be achieved through the production of high-value antigens in the chloroplast. Significant progress has been made in the development of chloroplast genetic engineering in microalgae such as *Chlamydomonas*, however the commercial exploitation of this technology still requires additional research. SUNBIOPATH will address the problem of maximising transgenic expression in the chloroplast and will develop a robust system for producing vaccines by developing methodologies such as inducible expression and trans-operon expression. A techno economic analysis will be made to evaluate the feasibility of using these algae for the purposes proposed (antigen production in the chloroplast and/or biomethane production) taking into account their role in CO<sub>2</sub> mitigation.

# ULIXES

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## **Approaches towards bioremediation of the Mediterranean Sea by exploring its microbial diversity – SICA (Mediterranean Partner Countries)**

**Call number:** FP7-KBBE-2010-4

**Contract number:** 266473

**Contract type:** Small or medium-scale focused research project

**Starting Date:** 01/02/2011

**Duration (months):** 36

**Project website:** n/a

**EC Contribution:** 2.993.812 euro

**Coordinator:** Daffonchio Daniele; UNIVERSITA DEGLI STUDI DI MILANO (IT)

The project ULIxes aims to unravel, categorize, catalogue, exploit and manage the microbial diversity available in the Mediterranean Sea for addressing bioremediation of polluted marine sites. The idea behind ULIxes is that the multitude of diverse environmental niches of the Mediterranean Sea contains a huge range of microorganisms and their components (e.g. catabolic enzymes) or products (e.g. biosurfactant) that can be exploited in pollutant and site-tailored bioremediation approaches. ULIxes intends to provide the proof of concept that it is possible to establish and exploit for bioremediation site-specific collections of microbial strains, mixed microbial cultures, enzymes, biosurfactants and other microbial products. These biotechnological resources will be mined by using approaches based on isolation of culturable microorganisms as well as by extensively applying advanced novel 'meta-omics' technologies recently developed by the project partners and exclusively available for ULIxes. Three pollutant classes recognized worldwide as environmental priorities will be considered: petroleum hydrocarbons, chlorinated compounds and heavy metals. A large set of polluted environmental matrices from sites located all over the Mediterranean Sea will be explored, including seashore sands, lagoon sediments, deep sea sediments polluted by heavy oil hydrocarbons at oil tanker shipwreck sites, hypersaline waters and sediments from polluted salty coastal lakes and natural deep hypersaline anoxic submarine basins and mud volcanoes where hydrocarbon seepages occur. The mined collections of microbial biotechnological products will be exploited for development of novel improved bioremediation processes whose effectiveness will be proved by ex situ and in situ field bioremediation trials. A careful dissemination action will be pursued to assure capillary information of the ULIxes results and products to stakeholders and SMEs operating in the sector of marine bioremediation.

# VECTORS

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## Vectors of changes in marine life, impact on economic sectors

**Call number:** FP7-OCEAN-2010

**Contract number:** 266445

**Contract type:** Small or medium-scale focused research project

**Starting Date:** 01/02/2011

**Duration (months):** 48

**Project website:** [www.marine-vectors.eu](http://www.marine-vectors.eu)

**EC Contribution:** 12.484.835 euro

**Coordinator:** Austen Melanie; PLYMOUTH MARINE LABORATORY (UK)

Marine life makes a substantial contribution to the economy and society of Europe. VECTORS will elucidate the drivers, pressures and vectors that cause change in marine life, the mechanisms by which they do so, the impacts that they have on ecosystem structures and functioning, and on the economics of associated marine sectors and society. VECTORS will particularly focus on causes and consequences of invasive alien species, outbreak forming species, and changes in fish distribution and productivity. New and existing knowledge and insight will be synthesised and integrated to project changes in marine life, ecosystems and economies under future scenarios for adaptation and mitigation in the light of new technologies, fishing strategies and policy needs. VECTORS will evaluate current forms and mechanisms of marine governance in relation to the vectors of change. Based on its findings, VECTORS will provide solutions and tools for relevant stakeholders and policymakers, to be available for use during the lifetime of the project. The project will address a complex array of interests comprising areas of concern for marine life, biodiversity, sectoral interests, regional seas, and academic disciplines as well as the interests of stakeholders. VECTORS will ensure that the links and interactions between all these areas of interest are explored, explained, modeled and communicated effectively to the relevant stakeholders. The VECTORS consortium is extremely experienced and genuinely multidisciplinary. It includes a mixture of natural scientists with knowledge of socio-economic aspects, and social scientists (environmental economists, policy and governance analysts and environmental law specialists) with interests in natural system functioning. VECTORS is therefore fully equipped to deliver the integrated interdisciplinary research required to achieve its objectives with maximal impact in the arenas of science, policy, management and society.

**Annex 4. Summaries of FP7 Projects with  
potential partial relevance for marine  
biotechnology research and  
development**

# AQUATRACE

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## **Providing molecular tools for assessing and monitoring the potential genetic impact of aquaculture on native populations (The Ocean of Tomorrow)**

**Call number:** FP7-KBBE-2012-6-singlestage

**Contract number:** 311920

**Contract type:** Small or medium-scale focused research project

**Starting Date:** under negotiation

**Duration (months):** 36

**Project website:** n/a

**EC Contribution:** 2.999.185 euro

**Coordinator:** Nielsen Einar Eg; DANMARKS TEKNISKE UNIVERSITET (DK)

The genetic changes associated with domestication in aquaculture pose an increasing threat to the integrity of native fish gene pools. Consequently, there is a burgeoning need for the development of molecular tools to assess and monitor the genetic impact of escaped or released farmed fish. In addition, exploration of basic links between genetic differences among farmed and wild fish and differences in important life-history traits with fitness consequences are crucial prerequisites for designing biologically informed management strategies.

The project "AquaTrace" will establish an overview of current knowledge on aquaculture breeding, genomic resources and previous research projects for the marine species seabass, seabream and turbot. The project will apply cutting-edge genomic methods for the development of high-powered, cost-efficient, forensically validated and transferable DNA based tools for identifying and tracing the impact of farmed fish in the wild. Controlled experiments with wild and farmed fish and their hybrids will be conducted with salmon and brown trout as model organisms using advanced "common garden" facilities. These experiments will elucidate the fundamental consequences of introgression by pinpointing and assessing the effects on fitness of specific genomic regions. Generated insights will form the basis of a risk assessment and management recommendations including suggestions for mitigation and associated costs. This information and the developed molecular tools will be available as open-access support to project participants and external stakeholders including the aquaculture industry. The project is expected to facilitate technology transfer to the aquaculture sector by promoting better tailored breeding practices and traceability throughout production chain. Overall this initiative will support the development of sustainable European aquaculture and provide "Good Environmental Status" in line with the Marine Strategy Framework Directive.

# ARRAINA

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## **Aquaculture feeds and fish nutrition: paving the way to the development of efficient and tailored sustainable feeds for European farmed fish**

**Call number:** FP7-KBBE-2011-5

**Contract number:** 288925

**Contract type:** Small or medium-scale focused research project

**Starting Date:** 01/01/2012

**Duration (months):** 60

**Project website:** [www.arraina.eu](http://www.arraina.eu)

**EC Contribution:** 5.999.803 euro

**Coordinator:** Kaushik Sadasivam; INSTITUT NATIONAL DE LA RECHERCHE AGRONOMIQUE (FR)

Sustainable development of European fish farming is dependent on the availability, environmental sustainability of feeds relying less and less on capture fisheries derived fishmeal and fish oil. The European aquaculture industry has made a determined shift towards the use of feeds based on alternative ingredients which continue to ensure the health and welfare of fish and the nutritional value of farmed seafood. However, the long term effects of such interventions and over the full life cycle of the major species farmed in Europe need to be determined. To answer this challenge, ARRAINA will define and provide complete data on the quantitative nutrient requirements of the five major fish species and develop sustainable alternative aquaculture feeds tailored to the requirements of these species with reduced levels of fish meal and fish oil.

By developing innovative vectors to deliver specific nutrients, ARRAINA will increase significantly the performance at all physiological stages thus improving overall efficiency of fish production. ARRAINA will apply targeted predictive tools to assess the longterm physiological and environmental consequences of these changes in the different species. This will provide flexibility in the use of various ingredients in the formulation of feeds which are cost-efficient, environmentally friendly and which ensure production of seafood of high nutritional value and quality. ARRAINA will design and deliver new pioneering training courses in fish nutrition to increase research capacities and expertise, particularly in countries of the enlarged EU. By developing applied tools and solutions of technological interest in collaborations with SMEs, ARRAINA will further strengthen the links between the scientific community and the EU feed industry and will contribute to increase the productivity and performance of the aquaculture sector leading to competitive advantage to the whole sector at a global level.

# BECOTEPS

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## Coordinating the activities of KBBE relevant European Technology Platforms

**Call number:** FP7-KBBE-2008-2B

**Contract number:** 226526

**Contract type:** Coordination and Support Action

**Starting Date:** 01/03/2009

**Duration (months):** 25

**Project website:** [www.becoteps.org](http://www.becoteps.org)

**EC Contribution:** 699.989 euro

**Coordinator:** Travella Silvia; EUROPESE ORGANISATIE VOOR WETENSCHAPPELIJK PLANTENONDERZOEK E.P.S.O. IVZW (BE)

The nine European Technology Platforms (ETPs) that focus on the Knowledge-Based Bio-Economy (KBBE) join forces in this support action 'BECOTEPS'. The main objectives and the respective activities will be: 1) Achieve closer and more coordinated collaboration between the KBBE ETPs. 2) Develop recommendations for better interaction between KBBE ETP stakeholders along the product chains and the sustainability issue regarding multidisciplinary research, application and policy issues. BECOTEPS will help to link science and application by addressing synergies and gaps i) between the SRAs of the ETPs and ii) with respect to the research preparedness of the scientific community by topical workshops on cross-cutting KBBE issues. The first workshop will address trust and collaboration in the food and feed chain, the second the integration of the non-food chains, and the third cross-cutting sustainability issues. The workshop recommendations on research and policy will be summarised in a White Paper. 3) Encourage discussions among public research initiatives - European and national and between the public and the private research initiatives to foster implementation of the Strategic Research Agendas based on the recommendations developed between the ETPs. In addition, BECOTEPS will promote the KBBE concept with the European Commission, European Parliament and national ministries in the member states including the relevant ERA-NETs. A small number of dissemination events will be held to discuss the KBBE, recommendations from the workshops on implementing cross-cutting issues from the ETPs' Strategic Research Agendas (including Lead Markets, SMEs, education and training), and future collaboration.

# BIVALIFE

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## Improving European mollusc aquaculture: disease detection and management

**Call number:** FP7-KBBE-2010-4

**Contract number:** 266157

**Contract type:** Small or medium-scale focused research project

**Starting Date:** 01/02/2011

**Duration (months):** 36

**Project website:** [www.bivalife.eu](http://www.bivalife.eu)

**EC Contribution:** 2.995.636 euro

**Coordinator:** Renault Tristan; INSTITUT FRANCAIS DE RECHERCHE POUR L'EXPLOITATION DE LA MER (FR)

The two core objectives of BIVALIFE are (i) to provide innovative knowledge related to pathogens infecting oysters and mussels and (ii) to develop practical approaches for the control of infectious diseases and resulting mortality outbreaks these pathogens induce. The project will address the major issue identified by the European commission (i.e. detection and management of infectious diseases in oysters and mussels) at the EU level since the increase in international and intra EU trade and exchanges of animals increases the risk of pathogen transfer and infectious disease outbreak occurrence.

In this context, the specific objective of BIVALIFE are:(i) transfer and validate existing methods for detection and identification of oyster and mussel pathogens;(ii) improve the characterisation of oyster and mussel pathogens and develop innovative complementary diagnostic approaches;(iii) characterise culture sites in Europe regarding presence of oyster and mussel pathogens in relation to the presence or absence of mortality;(iv) investigate the life cycle, mechanisms allowing oyster and mussel pathogens to survive outside the host and their original source;(v) identify pathogen intrinsic virulence factors and effects on host defence mechanisms;(vi) assess the relationship between the presence of oyster and mussel pathogens and their role in observed mortality;(vii) develop methods and recommendations for pathogen control and eradication in Europe.

The project will focus on three mollusc species, namely the Pacific cupped oyster *Crassostrea gigas* and two mussel species *Mytilus edulis* and *M. galloprovincialis*, the most important species in terms of European production. Interestingly, Pacific oysters and mussels display different levels of susceptibility to diseases. The targeted pathogens will be the virus OsHV-1, *Vibrio* species including *V. splendidus* and *V. aestuarianus*, as well as the parasite *Marteilia refringens* and the bacterium *Nocardia crassostreae*.

# BRIGHTANIMAL

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## **New and converging technologies for Precision Livestock Farming in European animal production systems**

**Call number:** FP7-KBBE-2008-2B

**Contract number:** 227138

**Contract type:** Coordination and Support Action

**Starting Date:** 01/05/2009

**Duration (months):** 24

**Project website:** [www.brightanimal.eu](http://www.brightanimal.eu)

**EC Contribution:** 997.425 euro

**Coordinator:** Lehr Heiner; FOODREG TECHNOLOGY SL (ES)

BrightAnimal will contribute to economically, socially and environmentally sustainable development by outlining a practical and acceptable methodology for precision livestock farming. To achieve this goal, BrightAnimal has the following mission: To produce a framework for European and non-European small and medium enterprises on effective and acceptable precision livestock farming and to create an international, interdisciplinary network for further development and dissemination. The main activity and achievement of BrightAnimal will be the elaboration of a book on effective Precision Livestock Farming in Europe and world-wide with special consideration of small and medium enterprises. The book aims at describing current and near-future techniques in PLF, especially taking into account both the practicality for SMEs as well as their acceptability (in the broader sense). The book will also try to set the scene for future developments. As the second component of the framework, BrightAnimal will produce best precision livestock farming practices (BPLFP) in a series of “problematic” areas such as aquaculture, beef, sheep and chicken. These best practice guides will be released to the public domain in the form of booklets. A third deliverable of the project will be a practical showcase activity showing the Good Practices in action in the European Centre of Excellence of Automatic Identification and Data Capture in the UK. BrightAnimal will organise interdisciplinary conferences for opinion exchange and cross-disciplinary discussions. It is of great importance to include opinions from outside Europe. We have been pleased to accept partners from the following ICPC countries: Thailand, Malaysia, South Africa, Brazil and China and from Australia as a third country. Other non-funded partners from third countries will also join the project.

# COLORSPORE

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## **(Bio-)technologies for the production of food additives, colorants and flavours**

**Call number:** FP7-KBBE-2007-1

**Contract number:** 207948

**Contract type:** Small or medium-scale focused research project

**Starting Date:** 01/06/2008

**Duration (months):** 42

**Project website:** n/a

**EC Contribution:** 2.999.101 euro

**Coordinator:** Cutting Simon; ROYAL HOLLOWAY AND BEDFORD NEW COLLEGE. (UK)

Functional foods provide a buoyant growth sector and the use of carotenoids is the most dynamic not only as colorants but as food additives. One issue with these products is their instability both on the shelf and upon digestion. Recently, gastric-stable bacterial-derived carotenoid preparations have been discovered by members of this consortium and these 2nd generation carotenoid preparations, and the bacteria that produce them will be studied. Existing prototypes will be developed as potential food additives but an extensive screen for new 2nd generation prototypes will also be made from marine environments. The consortium includes microbiologists, biochemists and food biotechnologists and will determine the identity of new carotenoid preparations and the bacteria that produce them. The nutritional value of these bacteria will be assessed and a risk-benefit assessment made using modern metabolomic technologies as well as traditional toxicology in order to designate the prototypes as QPS (ie, qualified presumption of safety). Bioprocessing of these bacterial carotenoid preparations will eliminate traditional chemical synthesis and the use of organic solvents. Also the delivery system will utilise a synergistic biological matrix making it a sustainable source. The use of these bacteria as colour-nutritional additives will be assessed by process optimisations, colour and texture analysis. The consortium includes 9 partners, including one ICPC and one associated country. Two IND partners, one an SME, will work together to exploit prototypes as additives, colourants and as functional foods. This will include patenting, licensing and the opening of new markets. Both IND partners are looking for new markets in the food additive/functional food sector and this project will enable them to identify new markets. The project will directly impact the food industry by developing new, natural as well as novel food additives and ingredients that can replace synthetic ones.

# CONFIDENCE

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## Detecting contaminants in the food and feed chain

**Call number:** FP7-KBBE-2007-1

**Contract number:** 211326

**Contract type:** Small or medium-scale focused research project

**Starting Date:** 01/05/2008

**Duration (months):** 56

**Project website:** [www.confidence.eu](http://www.confidence.eu)

**EC Contribution:** 5.800.100 euro

**Coordinator:** De Jong Jacob; STICHTING DIENST LANDBOUWKUNDIG ONDERZOEK (NL)

RASFF alerts show that monitoring of chemical contaminants in food and feed is very relevant in European food safety. Also consumers placed chemical contaminants on top of the “worry-scale” of food-related risks. According to the General Food Law, food and feed industries are responsible for the safety of their products. Often expensive instrumental single-analyte methods are being applied by regulatory and industrial laboratories. There is an urgent need for replacement by validated screening tools which are simple, inexpensive and rapid, but also show multiplex capability by detecting as many contaminants in parallel as possible. The CONFIDENCE proposal has been designed to provide long-term solutions to the monitoring of persistent organic pollutants, perfluorinated compounds, pesticides, veterinary pharmaceuticals (coccidiostats, antibiotics), heavy metals and biotoxins (alkaloids, marine toxins, mycotoxins) in high-risk products such as fish and fish feed, cereal-based food/feed and vegetables. A balanced mix of novel multiplex technologies will be utilized, including dipsticks, flow cytometry with functionalised beads, SPR optical and electrochemical biosensors, cytosensors and metabolomics-like comprehensive profiling. After validation, the simplified methods will be applied in impact demonstrators that contribute to exposure assessment and validation of hazard models. Moreover, hazards of emerging contaminants will be assessed through toxicological testing. Dissemination to scientists and to relevant stakeholders, including the food and feed industry, regulatory control bodies, DG-SANCO, EFSA, exporting countries, CRLs, routine laboratories, CEN and consumers will be assured by e-communication, press releases, public workshops, open days, presentations, publications and a science education module. The consortium consists of 17 partners from 10 countries, representing 9 research institutes, 5 universities, 2 large food and feed industries and 1 SME.

# COPEWELL

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## Understanding of the basic mechanisms involved in coping strategies of fish towards improvement of welfare

**Call number:** FP7-KBBE-2010-4

**Contract number:** 265957

**Contract type:** Small or medium-scale focused research project

**Starting Date:** 01/07/2011

**Duration (months):** 54

**Project website:** [www.imr.no/copewell](http://www.imr.no/copewell)

**EC Contribution:** 4.498.718 euro

**Coordinator:** Kristiansen Tore S; HAVFORSKNINGSINSTITUTTET (NO)

COPEWELL aims to provide a better understanding of the underpinning mechanisms and basic knowledge about the physiology, biology, and behaviour of fishes and to give a deeper understanding of the basic mechanisms involved in coping styles. We will use an innovative hypothesis-driven multidisciplinary approach that aims to explore the links between brain function, behaviour and adaptive plasticity (WPs 1 and 2). Underlying mechanisms will be addressed by localising key elements of the stress-responsive serotonergic and learning and memory systems in the telencephalon, and for the first time also analyse rates of brain cell proliferation, neurogenesis, and expression of genes controlling other aspects of brain function, as learning and memory, in fish expressing different coping styles. The project will also focus on the understanding of how animals experience their world, based on appraisal theory and experimental studies of appraisal mechanisms in farmed fish, and not simply on the description of animal behaviour or stress responses (WP2 Appraisal). COPEWELL will further study the ontogeny of brain function and neuroendocrine stress responses in the call species

Atlantic salmon (*Salmo salar*), European sea bass (*Dicentrarchus labrax*) and sea bream (*Sparus aurata*), and will provide new insights on the interrelations between different relevant husbandry practices, plasticity of brain function and stress response during early ontogeny. COPEWELL will explore potential consequences of early life stress experiences on the welfare and quality of juvenile fish, substantiate the concept of allostatic stress regulation in fish and determine thresholds between eustress that are considered positive for welfare and distress that can have severe negative consequences for fish welfare as: it will attempt to discriminate between normal adaptive stress responses and situations of potential consequence to animal welfare, in relation to different relevant husbandry practices and rearing methods (WP3 Allostasis and WP4 Ontogeny). The expected impact the COPEWELL project is to deepen our knowledge on the development of the brain function, behaviour and stress response in relation to the different husbandry practises and rearing methods. It will also serve to define how short or long episodes of stress during the early life affect the welfare and quality of juveniles and adult fish (WPs 3 & 4). It will significantly contribute in providing and extending the knowledge basis for the development of tools such as new individual-based indicators for a better assessment of fish welfare, e.g. by identifying and verifying non-invasive indicators of coping styles. Perhaps most important, COPEWELL will provide a new framework, based on evolutionary principles and an understanding of subjective experience of welfare as an evolved survival mechanism, making welfare available for scientific inquiry.

# DEEPFISHMAN

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## Deep sea fisheries management

**Call number:** FP7-KBBE-2008-2B

**Contract number:** 227390

**Contract type:** Small or medium-scale focused research project

**Starting Date:** 01/04/2009

**Duration (months):** 36

**Project website:** [www.ifremer.fr/deepfishman](http://www.ifremer.fr/deepfishman)

**EC Contribution:** 2.924.156 euro

**Coordinator:** Lorance Pascal; INSTITUT FRANCAIS DE RECHERCHE POUR L'EXPLOITATION DE LA MER (FR)

Deepwater fisheries pose particular difficulties for management. Target species are difficult to assess with high levels of uncertainty, they are generally vulnerable to overfishing and sustainable levels of exploitation are low. Ecosystems are impacted by fishing due to the removal of target species, bycatch of numerous fish and other organisms and the crushing of benthos such as e.g. cold water coral and large sponges.

However, the impact of fishing on the deepwater ecosystem in general is poorly quantified. DEEPFISHMAN will develop a range of strategy options for the management of deepwater fisheries in the NE Atlantic that will take account of these factors. Firstly, the aim will be to identify new and more effective assessment methods, reference points, control rules and management strategies to be used in the short term, making better use of available data. Secondly, a reliable long-term framework will be developed for which additional data needs will be specified in order to fill current information gaps to achieve reliable long-term management requirements. This work will be developed by examining a range of case studies selected to reflect the different types of deepwater fishery found in the NE Atlantic. In addition two case studies outside the NE Atlantic are selected to give a wider perception of the management and monitoring of deepwater fisheries elsewhere in the world. For each case study current problems with assessment or management will be identified and new methods will be developed and tested.

Recommendations for future methods and approaches will be made. The socio-economic profile and projected impact of the management strategy options as applied both through a short- and long-term framework will be examined for selected fisheries. In this way the project outputs will aim to provide robust guidelines for deepwater fisheries management suitable for adoption within the Common Fishery policy. The work will involve an ICPC country.

# ECSAFESEAFOOD

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## Contaminants in seafood and their impact on public health (The Ocean of Tomorrow)

**Call number:** FP7-KBBE-2012-6-singlestage

**Contract number:** 311820

**Contract type:** Small or medium-scale focused research project

**Starting Date:** 01/02/2013

**Duration (months):** 48

**Project website:** n/a

**EC Contribution:** 3.999.874 euro

**Coordinator:** Marques Antonio; INSTITUTO NACIONAL DE RECURSOS BIOLÓGICOS I.P. INRB (PT)

Seafood has been recognized as a high quality, healthy and safe food item. Yet, some seafood can accumulate environmental contaminants with potential impact on human health. Limited information is available for those without maximum limits set by authorities for seafood, like priority contaminants, biotoxins from harmful algal blooms and marine litter. In order to increase seafood safety to consumers and reduce human health risks, ECsafeSEAFOOD aims to assess safety issues mainly related to nonregulated priority contaminants and evaluate their impact on public health.

ECsafeSEAFOOD addresses these objectives with eight work packages (WPs) targeting priority environmental contaminants, including biotoxins from harmful algal blooms and marine litter. WP1 will elaborate a database with relevant information required for risk assessment gathered from literature and national monitoring programmes. WP2 will monitor contaminants in seafood using an ambitious sampling strategy following the recommendations of the Marine Strategy Framework Directive (Descriptor 9) and assess the effect of seafood processing/cooking on contaminants. In WP3, risk assessment (with data from WP1-2) and mitigation strategies will be implemented to reduce the impact of risky contaminants on human health. WP4 will develop fast screening/detection methods for relevant contaminants tailored to suit stakeholders needs to promote consumers' confidence in seafood. WP5 will carry out the toxicological characterization of contaminated seafood in realistic conditions and will use alternative toxicological methods to provide tools for the risk assessment (WP3). WP6 will assess the links between the level of contaminants in the environment and that in seafood through controlled trials and case-study species, taking into account the effect of climate changes. WP7 details a strategy for education, training with clear and practical dissemination of results. WP8 will ensure efficient project management.

# EUROSHELL

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## **Bridging the gap between science and producers to support the European marine mollusc production sector**

**Call number:** FP7-KBBE-2012-6-singlestage

**Contract number:** 312025

**Contract type:** Coordination and Support Action

**Starting Date:** under negotiation

**Duration (months):** 18

**Project website:** n/a

**EC Contribution:** 649.983 euro

**Coordinator:** Chantereau Sebastien; COMITE NATIONAL DE LA CONCHYLICULTURE (FR)

Under the acronym EUROSHELL, this proposal will provide solutions to identified challenges that may constrain the transfer of knowledge to the shellfish sector and thus affect its sustainable development. It will focus on identification of the underlying factors that inhibit effective knowledge management in the sector and provide regional forums to facilitate dialogue between shellfish companies (especially through their regional or national producers' organisations) and researchers, with a strong focus on developing efficient methodology for knowledge transfer. This will result in the production of visions for the future of the sector and the identification of key research objectives that could be integrated in the European Aquaculture Technology and Innovation Platform (EATIP) and also provide clear cooperation opportunities with the Fisheries Local Action Groups (FLAGS) of the European Fisheries Areas Network (FARNET) through enhanced methodology for an extension network. The core objectives of EUROSHELL are to:

- Enhance integration of knowledge into the production cycle of the main farmed species, by assessing current critical problems experienced by the sector that have a direct link to research and reviewing current knowledge and especially the extent of its uptake.
- Assess the current structural organisation that links knowledge to practice in key European production countries and identify solutions that will address structural difficulties (where these exist) for shellfish SME's to participate in RTDI initiatives.
- Identify future visions for the European shellfish sector by industry, including the identification of gaps and research needs, so as to lay the basis for more effective methodology for future dialogue and possible integration of the sector into the EATIP.

EUROSHELL does not seek to create new STRUCTURES for knowledge management in the sector, but looks to strengthen the existing relationships between the existing one.

# FISHPOPTRACE

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## The structure of fish populations and traceability of fish and fish products

**Call number:** FP7-KBBE-2007-1

**Contract number:** 212399

**Contract type:** Small or medium-scale focused research project

**Starting Date:** 01/03/2008

**Duration (months):** 39

**Project website:** <http://fishpoptrace.jrc.ec.europa.eu>

**EC Contribution:** 2.949.984 euro

**Coordinator:** Carvalho Gary; BANGOR UNIVERSITY (UK)

Although exploited fishes have traditionally been managed on a geographic basis, for conservation purposes they should be managed at the population level: the extent and dynamics of population structuring underlies resilience and sustainability. More effective enforcement and conservation demands a focus on identification and monitoring of wild fish populations and traceability of products. FishPopTrace brings together expertise in fish traceability projects (Fish and Chips, FishTrace, FISH-BOL) to:

1. Integrate data from European fish species traceability projects, and to generate a single compatible database and tissue archive managed by the Joint Research Centre of the European Commission.
2. Examine single nucleotide polymorphisms (SNPs) and otolith microchemistry and morphometrics in widely distributed populations of cod, hake, herring and sole. Outputs will comprise population-level signatures associated with fish origins in early life and representative spawning groups.
3. Undertake validation of traceability tools in relation to end-user technology.
4. Develop a population monitoring system based on genetic and otolith data that will assess population stability in a temporal and spatial framework.
5. Test the utility of additional novel traceability systems (fatty acid profiles, proteomics, gene expression, microarray platform for SNP genotyping).
6. Facilitate technology transfer in relation to enforcement and conservation policies of the EU Common Fisheries Policy (CFP) and associated socio-economic consequences.

Outputs from FishPopTrace will improve the traceability of fish and fish products and protection of consumer interests through enhanced understanding of the dynamics, temporal stability and distribution of major populations of four key exploited fish species. Central elements of the output will be the development and evaluation of end-user tools, a Cost Benefit Analysis and a final report setting FishPopTrace in the context of the CFP.

# GMSAFOOD

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## Assessment of short and long term effects of GMOs on human and animal health

**Call number:** FP7-KBBE-2007-1

**Contract number:** 211820

**Contract type:** Small or medium-scale focused research project

**Starting Date:** 01/08/2008

**Duration (months):** 44

**Project website:** [www.gmasfoodproject.eu](http://www.gmasfoodproject.eu)

**EC Contribution:** 2.606.622 euro

**Coordinator:** Epstein Michelle; MEDIZINISCHE UNIVERSITAET WIEN (AT)

The function of post market monitoring is to further assess possible nutritional and health effects of authorized GM foods on a mixed population of human and animal consumers. Currently, however, little is known about exposure levels, whether adverse effects are predictable, and the occurrence of any unexpected effects following market release of GM foods. Our objective is to identify a panel of anatomic, physiologic, biochemical, molecular, allergenic, and immunogenic biomarkers, which could be used to predict harmful GMO effects after product authorization. Using a prototype allergenic  $\alpha$ -amylase inhibitor GM-pea, we will extrapolate multiple biomarker databases that correlate GMO effects during gestation, growth, maturation in various animal models with humans. We will establish biomarkers in GMO-fed pigs, salmon, rats, and mice, in addition to indirect effects of GM feeding in the food chain and GMO influence during an underlying allergic disorder. These experiments will yield data on general health with a specific focus on allergy and immunology. To extrapolate our data to humans, we will establish a comparative database with antigenic epitopes and antibody crossreactivity in legume allergic patients and human-mouse chimera in which a human immune system is transplanted into a mouse lacking an immune system. Taken together, these results will yield databases from multiple biological systems that will be used in a mathematical modeling strategy for biomarker discovery and validation. Our consortium consists of partners from Austria, Turkey, Hungary, Ireland, Norway, and Australia and constitutes a diverse interdisciplinary team from veterinary medicine, nutrition, agriculture, immunology, and medicine that is dedicated to the development and validation of biomarkers to be used for post market monitoring of animals and humans consuming newly authorized GMOs.

# LIFECYCLE

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## Essential biological functions related to the most relevant stages of aquaculture fish life-history

**Call number:** FP7-KBBE-2007-2A

**Contract number:** 222719-2

**Contract type:** Small or medium-scale focused research project

**Starting Date:** 01/02/2009

**Duration (months):** 48

**Project website:** [www.lifecycle-fp7.eu](http://www.lifecycle-fp7.eu)

**EC Contribution:** 5.995.801 euro

**Coordinator:** Bjornsson Thrandur; GOETEBORGS UNIVERSITET (SE)

LIFECYCLE will deliver a knowledge-base to improve competitiveness and sustainability of European aquaculture, through a combination of question-problem driven approaches. The focus will be on early developmental events, growth and environmental adaptation throughout the lifecycle, and on the physiology and immunology of key life-stage transitions, such as metamorphosis, smoltification and puberty. To advance current knowledge on mechanisms governing essential biological functions in fish, state-of-the-art physiological research will be combined with functional genomics by leading European research groups. LIFECYCLE will focus on all major life stages of sea bass, sea bream, Atlantic salmon and rainbow trout. For these important aquaculture species, substantial resources and biological information exists which will be exploited and integrated to potentiate the overall impact. Two key conceptual approaches will be taken: 1. Changes in physiological systems at different points during the lifecycle will be studied to establish how early factors impact on later stages. 2. Cross-cutting experiments will address integration and crosstalk between physiological systems. LIFECYCLE is planned to direct research at current production bottlenecks. The knowledge generated about development and growth, adaptation and homeostasis, the immune system, sex differentiation and puberty will have a major impact on alleviating problems linked to abnormal larval development, skeletal deformities, poor growth and energy utilization, mortalities related to life stage transitions, poor environmental performance, and unwanted sexual maturation. The focused dissemination of such knowledge will make the EU aquaculture industry more efficient and stimulate its sustainable expansion. The knowledge-base established will pave way for future advances within fields of stress and disease control, breeding selection, environmental performance and species diversification.

# PREVENT ESCAPE

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## Assessment and mitigation of the impact of aquaculture on wild populations

**Call number:** FP7-KBBE-2008-2B

**Contract number:** 226885

**Contract type:** Small or medium-scale focused research project

**Starting Date:** 01/04/2009

**Duration (months):** 36

**Project website:** [www.preventescape.eu](http://www.preventescape.eu)

**EC Contribution:** 2.970.646 euro

**Coordinator:** Dempster Tim; SINTEF FISKERI OG HAVBRUK AS (NO)

The escape of fish from sea-cage aquaculture is perceived as a serious threat to natural biodiversity in Europe's marine waters. Escaped fish may cause undesirable genetic effects in native populations through interbreeding, and ecological effects through predation, competition and the transfer of diseases to wild fish. Technical and operational failures of fish farming technology cause escapes. Cages break down in storms, wear and tear of the netting causes holes, and operational accidents lead to spills of fish.

Sea-cage equipment is marketed and used across Europe, thus knowledge relevant to the culture of numerous species in diverse environments is required to produce robust equipment and implement risk adverse operations. The Prevent Escape project will conduct and integrate biological and technological research on a pan-European scale to improve recommendations and guidelines for aquaculture technologies and operational strategies that reduce escape events. Through research focused on sea-cages and their immediate surrounds, we will assess technical and operational causes of escape incidents, assess the extent of escapes of reproductive gametes and fish, determine the inherent behaviours that predispose certain species of fish towards a higher probability of escaping, and document the dispersal of escapees to develop and test recapture strategies. Information from these components of the project will feed into research specifically aimed at benchmarking the performance of equipment under farming conditions and thereby improving operations and equipment production, and advancing national and international standards for the design, construction and use of aquaculture equipment. These key pieces of information, when added to existing knowledge, will allow determination of practical, implementable measures to prevent escapes and mitigate the effects of escapees. If prevention and mitigation are more successful, genetic and ecological impacts should diminish.

# PRO-EEL

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## From capture based to self-sustained aquaculture

**Call number:** FP7-KBBE-2009-3

**Contract number:** 245257

**Contract type:** Small or medium-scale focused research project - Coordination and Support Action

**Starting Date:** 01/04/2010

**Duration (months):** 48

**Project website:** [www.pro-eel.eu](http://www.pro-eel.eu)

**EC Contribution:** 2.999.307 euro

**Coordinator:** Tomkiewicz Jonna; DANMARKS TEKNISKE UNIVERSITET (DK)

The recent decline of European eel (*Anguilla anguilla*) and no signs of recovery has brought attention to the biologically unsustainable exploitation of the stock. In September 2007, the EU has adopted the Council Regulation 1100/2007 establishing measures for the recovery of the European eel stock. However, eel are still fished intensively for human consumption while aquaculture and restocking rely exclusively on the supply of glass eels caught each year. A controlled production of eel larvae is ever more urgent. The objective of PRO-EEL is to develop standardised protocols for production of high quality gametes, viable eggs and feeding larvae. The approach is to expand knowledge about the intricate hormonal control and physiology of eels which complicates artificial reproduction. This knowledge will be applied in the development of suitable methods to induce maturation considering different rearing conditions. Knowledge about the gametogenesis and maturation pattern will be developed in small scale tests and applied to establish standardised fertilisation procedures. New knowledge about functional anatomy of embryos and yolk sac larvae will be applied to develop suitable feed. Protocols for larval production will be tested in full scale experimental facilities managed in collaboration with a qualified SME. The integrated protocols and technology development will be evaluated relative to the output of healthy embryos and yolk sac larvae. Larval feeds will be developed towards pioneering first-feeding in European eel larvae, which will be a major breakthrough and promising step towards a self-sustained aquaculture. The strength of the project is its interdisciplinary approach and the unique expertise of the consortium. PRO-EEL brings together leading institutes in eel reproduction complemented by excellence in disciplines filling gaps in knowledge and technology. A tight collaboration with the aquaculture industry promotes the applicability of developed technology.

# PROMICROBE

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## Microbial control for more sustainable aquaculture

**Call number:** FP7-KBBE-2008-2B

**Contract number:** 227197

**Contract type:** Small or medium-scale focused research project

**Starting Date:** 01/02/2009

**Duration (months):** 48

**Project website:** [www.promicrobe.ugent.be](http://www.promicrobe.ugent.be)

**EC Contribution:** 2.996.531 euro

**Coordinator:** Bossier Peter; UNIVERSITEIT GENT (BE)

Aquaculture is still facing a number of bottlenecks. To further develop aquaculture, the major bottlenecks need to be systematically removed. At the production level, unpredictable larval survival and larval/juvenile quality and robustness are major bottlenecks which have strong microbial components. With respect to microbial interference, we need to make use of the natural mutualistic symbiotic relationships that have evolved over million of years between the host and the microbial community.

Hence, we need to understand the mutual and reciprocal interactions between them and use these interactions to the benefit of the viability and robustness of the fish under aquaculture conditions. This "join them" approach is contradictory to the traditional "beat them" strategy generally applied in microbial management used in human medicine, agriculture and aquaculture. This project suggests bringing together various European research groups that have contributed to some important methodological breakthroughs that can be used in the study of host/microbe interactions and can help to disentangle the complex interplay between the different components of the aquaculture ecosystem. The work packages are directed towards the systematic gathering of novel information in relation to the axis host-host microbial community-system microbial community. It is anticipated that this novel information will allow developing new concepts that will be translated into new or adapted protocols to rear aquaculture organisms in a biological stable and economical efficient way.

# REPROSEED

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## Improving mollusc spat production in hatcheries

**Call number:** FP7-KBBE-2009-3

**Contract number:** 245119

**Contract type:** Small or medium-scale focused research project

**Starting Date:** 01/04/2010

**Duration (months):** 48

**Project website:** [www.reproseed.eu](http://www.reproseed.eu)

**EC Contribution:** 2.994.853 euro

**Coordinator:** Nicolas Jean-Louis; INSTITUT FRANCAIS DE RECHERCHE POUR L'EXPLOITATION DE LA MER (FR)

Secure and stabilised hatchery production of bivalve seed is the unifying objective of the REPROSEED project. Development of innovative new methods will lead to high quality seed of guaranteed physiological health, sanitary status and genetic diversity. By considering the biology of bivalve life stages and the trophic and microbial environment of rearing conditions REPROSEED researches ways of controlling key processes, like reproduction, larval rearing and metamorphosis. New technological advances, like recirculation systems and outdoor algal culture, will provide ways to reduce costs. The need for hatcheries is growing in Europe due to demands from the shellfish industry for quality juveniles and concerns about wild seed due to inconsistent spatfall or environmental harm caused by seed collection of some species. Four economically important molluscs were selected to represent these needs: two species already reared in hatcheries, *Crassostrea gigas* and *Pecten maximus*, and two emerging hatchery species, *Mytilus edulis* and *Ruditapes decussatus*. Scientific research is most advanced for *C. gigas*, so its further development will enable us to attain a level of excellence.

Knowledge on this species and on *P. maximus*, an excellent model for solving particular bivalve rearing problems, can also help improve hatchery culture of the other species. Inter-specific differences enable comparative study of important traits. REPROSEED investigates the physiological basis of early sexual maturation, gamete competency, immunity and metamorphosis, at cellular and molecular levels, including genomics and proteomics. Application of these results and dedicated studies will be made on practical aspects of controlled bivalve reproduction, nutritional needs for broodstock conditioning and larval growth (including testing of mutant yeasts and lipid microcapsules) and the benefits of probiotics. Advances will be shared with end-users throughout the project.

# SEAT

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## Sustainability of the food chain

**Call number:** FP7-KBBE-2007-2A

**Contract number:** 222889-2

**Contract type:** Small or medium-scale focused research project

**Starting Date:** 01/08/2009

**Duration (months):** 48

**Project website:** [www.seatglobal.eu](http://www.seatglobal.eu)

**EC Contribution:** 5.815.578 euro

**Coordinator:** Little David; THE UNIVERSITY OF STIRLING (UK)

Trade in aquatic products is the largest global food sector, by value, and Asia represents the main external source of aquatic products into the EU. Current EU policy supporting international trade between Asia and Europe concentrates on issues of food safety as measures of quality, whilst market-forces drive development of standards and labels that identify social and environmental parameters. This project proposes to establish an evidence-based framework to support current stakeholder dialogues organised by a third party certifier. This will contribute to harmonising standards, helping consumers to make fully informed choices with regards to the sustainability and safety of their seafood. The 'Ethical Aquatic Food Index', a qualitative holistic measure of overall sustainability to support consumers' purchasing decisions, will be based on detailed research centred around a Life Cycle Assessment of current processes involved in ensuring aquatic products reach consumers, aligned with analyses from the sustainable livelihoods approach and systems thinking. SMEs based in the EU will participate in this project, particularly the action research phase, enhancing their relative competitiveness.

By strengthening the knowledge base surrounding EU-Asia seafood trade the project will provide the evidence required to support further expansion whilst ensuring a fair deal for producers who are meeting appropriate social and environmental goals and offering a safe and sustainable product for consumers. The sectors covered represent the main aquaculture products reaching EU markets; tilapia, catfish, shrimps and prawns. Known case study stakeholders include SMEs in Bangladesh, China, Thailand and Vietnam where sustainability is essential in the face of rapid growth. The research will secondarily improve understanding of opportunities for European exports to supply the expanding middleclass in Asia. Outputs will be promoted through workshops, websites, journal and press articles.

# SECUREFISH

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## Reducing post-harvest losses for increased food security — SICA

**Call number:** FP7-KBBE-2011-5

**Contract number:** 289282

**Contract type:** Small or medium-scale focused research project

**Starting Date:** 01/01/2012

**Duration (months):** 36

**Project website:** [www.securefish.net](http://www.securefish.net)

**EC Contribution:** 2.997.422 euro

**Coordinator:** Howell Nazlin; UNIVERSITY OF SURREY (UK)

Food security is a major concern for all countries in the face of population increase and diminishing energy and water supplies. Over one billion people in low and middle income countries suffer from malnutrition. To meet the UN Millennium Development Goals to eradicate hunger and poverty, it is essential to reduce post harvest losses, including in the fisheries sector. The overall objectives of SECUREFISH are to strengthen capacity in low cost technology; to improve the preservation of existing fish supplies; to utilize waste and bycatch to produce value-added products; to develop an integrated quality management tool and finally to test the developed technology and quality management tool in different real third country conditions.

There are six work packages (WP). WP1 will ensure the efficient management of the project. WP2 will develop low cost innovative processing tools based on traditional technology for preserving fish including a solar tunnel drier, a modified solar assisted extruder and fast freezing/ continuous atmosphere freeze-drier (CAFD). In WP3, underutilised bycatch and waste by-products of fish processing will be recovered and converted to high value products. WP4 will develop an effective total quality management tool (safety and risk assessment; HACCP quality cost and traceability, nutritional and eating quality and carbon footprint) of three fish product chains (solar dried, extruded and frozen/CAFD) which will be tailored to suit local needs.

The technological advances (WP2) and quality management tool (WP4) will be evaluated in the three fish product chain case studies in Africa (Kenya, Namibia, Ghana), Asia (India and Malaysia) and Latin America (Argentina) to include different economic, cultural and social conditions. The case studies involve stakeholders including SMEs to ensure sustained implementation of project results. WP6 details a strategy for education, training and dissemination to widely promote the results and guidelines.

# PEGASUS

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## Exploring the pros & cons and the public perception of GM animals

**Call number:** FP7-KBBE-2008-2B

**Contract number:** 226465

**Contract type:** Coordination and Support Action

**Starting Date:** 01/08/2009

**Duration (months):** 36

**Project website:** [www.pegasus.wur.nl/UK](http://www.pegasus.wur.nl/UK)

**EC Contribution:** 978.088 euro

**Coordinator:** Frewer Lynn; UNIVERSITY OF NEWCASTLE UPON TYNE (UK)

PEGASUS aims to provide policy support regarding the development, implementation and commercialisation of GM animals, and derivative foods. The results will contribute to the FP7 KBBE by integrating existing social, (including existing public perception) environmental and economic knowledge regarding GM animals. The use of GM in farmed animals (aquatic and terrestrial) will be reviewed. A foresight exercise will be conducted to predict future developments. Two case studies (1 aquatic, 1 terrestrial) will be applied to identify the pro's and con's of GM animals from the perspectives of the production chain (economics, agri-food sector) and the life sciences (human and animal health, environmental impact, animal welfare, sustainable production). Ethical and policy concerns will be refined through application of combined ethical matrix and policy workshops involving EU and non-EU stakeholders. The case studies will be used to demonstrate best practice in public engagement in the policy process. The activities will provide European policy support regarding GM animals and the foods derived from them, taking into account public perceptions, the competitiveness of EU animal production, and risk/benefit assessments linked with human and animal health, environmental impact, and sustainable production. A final stakeholder dissemination workshop will disseminate the results to the EU policy community.

# SELFDOTT

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## From capture based to self-sustained aquaculture

**Call number:** FP7-KBBE-2007-1

**Contract number:** 212797

**Contract type:** Small or medium-scale focused research project

**Starting Date:** 01/01/2008

**Duration (months):** 47

**Project website:** [www.sites.google.com/site/selfdottpublic](http://www.sites.google.com/site/selfdottpublic)

**EC Contribution:** 2.979.966 euro

**Coordinator:** De La Gandara Fernando; INSTITUTO ESPANOL DE OCEANOGRAFIA (ES)

SELFDOTT proposes to implement knowledge already obtained on the artificial control of reproduction of the Atlantic bluefin tuna (BFT), *Thunnus thynnus*, to obtain viable eggs, and study embryonic and larval development for the production of fry (juveniles). At the same time, suitable and environmentally performing feeds for the growout of BFT will be developed, thus reducing or eliminating the practice of raw fish importation and feeding by the fattening industry. Wild juvenile and mature BFT will be reared in captivity at two sites in the Mediterranean, and will be used to study puberty, gametogenesis, and the influence of diet on reproductive maturation and gamete quality. Mature fish will be induced to spawn using hormone implants and the eggs will be collected using devices designed specifically for cages. To establish the knowledge-base for controlled development of BFT larvae, the mesocosm and artificial larval rearing methods will be employed. The ontogenesis of essential biological functions will be studied, including environmental perception, digestion, immunity and behaviour. A protocol for the commercial-scale larval rearing of BFT will be recommended at the end of the project. Whole body and stomach composition of wild fish will be analyzed and serve as a guide to formulate nutritionally complete artificial feeds for BFT. Juveniles will be captured from the wild, adapted to captive conditions and used to carry out weaning and feeding experiments, using moist and dry pelleted diets. The environmental impact of the formulated feeds will be examined and compared to existing raw-fish practises. SELFDOTT will produce the basic knowledge necessary for the development of a self-sustained aquaculture industry for the BFT in the Mediterranean, thus enhancing the competitiveness of the EU aquaculture industry, while at the same time reducing the pressure on the wild BFT stocks and ensuring the conservation and recovery of this magnificent fish.

# TARGETFISH

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## Prevention of important diseases of farmed fish species

**Call number:** FP7-KBBE-2012-6-singlestage

**Contract number:** 311993

**Contract type:** Small or medium-scale focused research project

**Starting Date:** under negotiation

**Duration (months):** 60

**Project website:** n/a

**EC Contribution:** 5.999.979 euro

**Coordinator:** Wiegertjes Geert; WAGENINGEN UNIVERSITEIT (NL)

European aquaculture production provides direct employment to 65.000 people with a turnover of 3 billion €. However, the lack of authorised veterinary medicinal products and the consequent disease outbreaks in farmed fish species costs the sector 20% of the production value. The most appropriate method for disease control, both on economical and ethical grounds, is disease prevention by vaccination. TargetFish will advance the development of existing (but not sufficient) and new prototype vaccines against socio-economically important viral or bacterial pathogens of Atlantic salmon, rainbow trout, common carp, sea bass, sea bream and turbot. The project will develop targeted vaccination strategies for currently sub-optimal and for novel vaccines. Improved vaccines will be brought closer to industrial application by addressing practical issues such as efficacy, safety and delivery route. TargetFish will also establish a knowledge and technology-base for rational development of next generation fish vaccines. To achieve these challenging tasks, we brought together 29 partners from 11 EU member states, 2 associated countries and 1 International Cooperation Partner Country (ICPC). In this large multidisciplinary consortium an approximate equal number of RTD and SME partners will cooperate closely while keeping an intensive communication with the large vaccine and nutrition industries via an Industry Forum. Specifically, TargetFish will 1) generate knowledge by studying antigens and adjuvants for mucosal routes of administration while analyzing the underpinning protective immune mechanisms; 2) validate this knowledge with response assays for monitoring vaccine efficacy and study safety aspects, including those associated with DNA vaccines; 3) approach implementation of prototype vaccines by optimizing vaccination strategies thus 4) shortening the route to exploitation. Thereby, this project will greatly enhance targeted disease prophylaxis in European fish farming.

# TRANSDOTT

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## Boosting the translation of FP projects' results into innovative applications in the field of agriculture, forestry, fisheries and aquaculture

**Call number:** FP7-KBBE-2012-6-singlestage

**Contract number:** 311904

**Contract type:** Small or medium-scale focused research project

**Starting Date:** 01/04/2012

**Duration (months):** 24

**Project website:** n/a

**EC Contribution:** 892.196 euro

**Coordinator:** Bridges Christopher; HEINRICH-HEINE-UNIVERSITAET DUESSELDORF (DE)

Due to declining stocks and increased fishing pressure there are serious concerns that the present fisheries and fattening industry for Bluefin Tuna (*Thunnus thynnus*) is not sustainable and that every effort should be made to develop BFT aquaculture.

TRANSDOTT represents a “top-down” approach from five SMEs and three non SMEs to build on the scientific results obtained from two previous projects REPRODOTT in (FP5) and SELFDOTT (FP7) and to translate them into a commercially viable innovative marketable application for tuna aquaculture. Starting in April 2012, based on an already established broodstock in a central Mediterranean major SME in Malta, fertilized tuna eggs will be provided in June 2012 and 2013 for larval rearing in three industrial scale hatchery SME’s for rearing scenarios in Spain, Israel and Italy together with two experimental hatcheries in Malta and Israel. RTD will involve the validation of existing protocols with the generation of fingerlings in late summer to be transferred from the industrial hatcheries to grow- out sea cages. Previously tried and tested, successful weaning and grow-out diets from SELFDOTT will be supplied by a subcontractor. The economic viability of these methodologies will be studied and used for the development of commercialization and capitalization of this process to provide sustainable Tuna Aquaculture.

# WILDTECH

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## Using new technologies to identify (re-)emerging pathogens from wildlife reservoirs

**Call number:** FP7-KBBE-2007-2A

**Contract number:** 222633-2

**Contract type:** Small or medium-scale focused research project

**Starting Date:** 01/07/2009

**Duration (months):** 48

**Project website:** [www.wildtechproject.com](http://www.wildtechproject.com)

**EC Contribution:** 5.996.822 euro

**Coordinator:** Hannant Duncan; THE UNIVERSITY OF NOTTINGHAM (UK)

With the increasing impact of mankind's activities on the natural environment, diseases naturally harboured by wild animals, both within the geographical limits of the EU and elsewhere, are becoming increasingly significant both for public health and health of livestock, in addition to having direct concerns for wild animal species. We are proposing a project which will combine (i) technological development to enable high throughput arraybased screening of samples from a wide variety of wild animals with (ii) surveillance of terrestrial, aerial and marine wild animal species within Europe and from countries which act as portals of disease entry into the EU, (iii) epidemiological analysis and risk assessment using data generated during the project and from other sources, and (iv) development and proposal of a model framework for disease surveillance within Europe developed in parallel with the burgeoning systems in North America. The proposal will place the EU at the centre of wildlife disease surveillance and also enable the translation of high throughput array-based technologies into human and veterinary medicine.

# MarineBiotech

