



**EMBRC**  
EUROPEAN  
MARINE  
BIOLOGICAL  
RESOURCE  
CENTRE

---

**Policy document on the vision,  
scope and structure of EMBRC  
(1<sup>st</sup> edition)**

---

September 2011

***Deliverable D1.8***

The EMBRC preparatory-phase



## Synthesis

Marine organisms are becoming increasingly important outside the traditional field of marine science both as biological models for researchers and as a source for innovative products and services for society.

Our **vision** is to realize a distributed Marine Biological Research Infrastructure, called **EUROPEAN MARINE BIOLOGICAL RESOURCE CENTRE (EMBRC)**. This Research Infrastructure (RI) will provide: i) access to European coastal marine biota and their ecosystems; ii) an integrated supply of marine model organisms for research; iii) coordinated service to do research in various EMBRC institutes, and iv) interdisciplinary training to the European academic and RTD communities in the life sciences at large in these institutes. EMBRC will be formed by advanced marine biological research institutes along the European coasts and by the EMBL. To realize our vision, we will develop a coherent European strategy for interconnecting, harmonizing and upgrading these institutes and the services they provide in the light of common analysis and projection of Europe-wide user requirements.

This **Vision Paper** presents the importance, substance, opportunity, benefit and implementation of this marine biological RI for key stakeholders such as various end-user groups, aspiring members, member states, funding agencies and decision makers.

## The Need for an European Marine Biological Resource Centre

**WHY STUDY MARINE ORGANISMS?** The sea is home to an amazing biological diversity. All the fundamental Eukaryotic lineages evolved in the sea and became hugely diverse before some of its representatives adapted to living on land in the Silurian, about 440-410 Million years ago. All the extant marine biodiversity is essential in ecosystem functioning and for our quality of life. Yet, in comparison to life on land, marine biodiversity is still seriously under-explored. For instance, entire phyla and classes of marine organisms are still being discovered. Exploration of marine life lags behind that on land because access to it is more demanding, potentially dangerous and often requires dedicated technology. However, an understanding of Earth Systems including future climate change and its impact on marine resources cannot be achieved without a substantial investment in marine biological research.

The Oceans are also an important source of food and energy for the growing human population. Overfishing and pollution have imposed severe constraints on capture fisheries. Mariculture is becoming increasingly important, but needs to be underpinned by scientific advances to ensure sustainability and food security.

Furthermore, marine organisms are worth studying because they possess unique materials, chemicals, structures, metabolic pathways, reproductive systems, and sensory and defence mechanisms, which through research, biotechnological development and innovation have the potential to translate into biomedical advances, industrial applications and novel products. Many marine products are already commercialized; more are in development, and many, many more are undoubtedly waiting out there to be discovered.

**OPPORTUNITIES AND CHALLENGES TO MARINE BIOLOGY:** Marine biology is currently experiencing ground-breaking technological and theoretical advances. Cutting-edge genomic approaches and recent rapid developments in nanotechnology, imaging and data management offer unprecedented possibilities to contribute to the knowledge-based bio-economy in the marine sector. The application of these enabling technologies in marine biosciences is a powerful instrument to accelerate the predicted “blue revolution” in marine bio-industries. Applications include improving the efficiency of characterisation and mining of marine diversity for aquaculture, biotechnology products and bio-processes.

Yet, realization of this “blue revolution” requires proper exposure of the concepts, data and resources in marine sciences to its potential end-users, including researchers outside the traditional marine sciences and policy makers. Moreover, procurement and operation of these enabling technologies require major, sustained funding in a landscape of financial austerity.

**STRENGTHS AND WEAKNESSES OF THE CURRENT LANDSCAPE OF MARINE STATIONS:** The need to access marine organisms for research has stimulated construction of marine biological research stations along the European coast over the last 125 years. These have developed, largely independently, into world-class research institutes. Taken together, these institutes represent a critical mass of infrastructure and human resources that have a significant influence on marine research.

However, several constraints hamper optimal servicing the European research community in the life sciences. The marine stations are often modestly sized and their restricted number of in-house research staff cannot study all of the local biodiversity and cover every single scientific field. In addition, in-house researchers and associated collaborators constitute the principal users of the facilities, driving strategic development through their specific requirements. Moreover, the stations are funded by national agencies, which may let national interests prevail above a shared European vision.

**THE FUTURE OF MARINE RESEARCH INFRASTRUCTURE:** The way forward lies in developing trans-national, pan-European synergies and capitalizing on economy of scale. Networks of Excellence, notably Marine Genomics Europe, MarBEF and Euroceans have paved the way for 13 infrastructures such as ASSEMBLE, which provides European researchers across the life sciences with trans-national access to a huge variety of marine organisms at a series of marine biological institutes in Europe. EMBRC is the logical follow-up of ASSEMBLE by fostering not only the user access itself, but improving the entire research infrastructure to facilitate user access from across Europe and by opening the research infrastructures to users outside academia and the life sciences, profoundly developing the ERA.

## What is EMBRC?

**SHAPING MARINE STATIONS INTO A EUROPEAN RESEARCH INFRASTRUCTURE:** EMBRC is the driving force to organize the major Marine Biological Research Institutes in the ERA into a single distributed **EUROPEAN MARINE BIOLOGICAL RESOURCE CENTRE** with open access and highest training standards. Strategic decisions on RI development will be taken with European interests in mind. Resources will be applied to maximize complementarity, synergy and additivity and to avoid unnecessary multiplication.

**PROVIDING ACCESS TO MARINE BIOLOGICAL RESOURCES:** EMBRC will provide services of excellence including access to marine biodiversity, its associated meta-data and extractable products, as well as state-of-the-art research infrastructure needed. The RI will include biobanks and dedicated 'omics' platforms as well as services for structural and functional biology, microscopy and bioinformatics. The RI will be available to end-users from academia, SME's and industry working in RTD in, for example, the following areas:

- **HEALTH:** drug discovery (new families of antibiotics) using marine biotechnology approaches, RTD services in pharmaceuticals, prosthetics, dentistry, etc.;
- **ENVIRONMENT:** biodiversity, human impact, alternative management strategies on coastal ecosystems; solutions to mitigate or cope with climate change;
- **ENERGY:** development of marine renewable energy resources (biofuels, bio-lubricants, eco-innovation products) thus contributing to a low-carbon society;
- **AGRICULTURE AND FOOD:** sustainable food chains, new mariculture crops, bio/eco-fertilizers, etc.;
- **NANOTECHNOLOGY AND NEW MATERIALS:** discovering new compounds for the use on new materials, bio-plastics, nano-structures and smart biological concepts;
- **TRANSVERSAL AREAS:** supporting the production of new industrial enzymes, biochemicals, natural products, natural sensors, etc.

**IMPROVED HANDLING, STORAGE AND SHARING OF MARINE BIOLOGICAL DATA:** Facing the exponential growth of the rate of data generated by current scientific infrastructures, efficient storage and access to data has become a critical bottleneck to scientific progress. EMBRC will offer platforms for storing, remotely accessing, sharing and post-processing biological data on a large scale. Marine biological data show a bewildering diversity, including genomic and biochemical information, imaging and meta-data of tissues, organisms, species and ecosystems. The definition of standards on data storage, protection and analysis of such diverse data will be established in collaborations with sister RI's specialized in e-infrastructure and data management, chiefly ELIXIR, to foster transparency and ease of use and to enable scientists to share data between scientific disciplines and among different countries.

**TRAINING AND EDUCATION:** EMBRC will provide technical training of end-users, PhD programs, summer courses, workshops and outreach programs to educate the community at large. These training and education programmes will add to national and European education initiatives such as MG4U and the training and mobility initiative of EuroMarine, and increase expert knowledge of the present and future RTD community needed to utilize marine biological resources to its full capacity. In addition, it will develop the coordinated training programmes for in-house RI staff initiated in ASSEMBLE to ensure efficient functioning of its RI. Specific contributions to education will include:

- Ensuring mobility and trans-national training across the EMBRC EU distribution,
- Promoting industry-based training towards market needs, anticipating required skills,
- Providing services for life-long learning and adult learning, in coordination with stakeholders and new bio-markets' needs,
- Providing summer-school programmes to attract students to marine research and biotechnology.

Sharing expertise extends to sharing best practices across EMBRC facilities, as well as repositories of methods, tools, protocols, software applications and data that will make expertise widely available to the research community.

**THE KEY ROLE OF IN-HOUSE STAFF:** In-house research and technological staff will be key to the success of EMBRC. Its members play a key role in the RI because their expertise keeps the RI at the cutting edge of science and technology, and they provide the background knowledge to enable external end-users to make efficient use of the RI. The technological staff will, through their dedicated aid and expert training, enable end-users to access the RI facilities efficiently without losing time in configuring, procuring, installing and putting into

routine operation the instrumentation. External end-users will in their turn enrich the scientific potential and technological experience of the resident staff in EMBRC by means of, for instance, collaborative programs and exchange of ideas.

## Who is behind EMBRC?

**EUROPEAN SUPPORT:** European marine research communities have long since recognized the need for trans-national scientific cooperation to exploit new opportunities and respond to new challenges. This is why the European Strategy Forum on Research Infrastructures (ESFRI) placed EMBRC firmly onto their roadmap in 2008 together with a series of other Biological and Medical RI's in the Biological and Medical Sciences (BMS) Thematic Working Group.

**REGIONAL AND NATIONAL SUPPORT:** Coastal regions and member states all over Europe have supported construction and operation of marine biological institutes throughout the years and integrated their facilities in their national research and education programs. Many of the regions and member states already support the vision of creating EMBRC by merging parts of their existing marine institutes, funding the construction of new facilities at these institutes and guaranteeing (part of) their sustained operation. They clearly grasp the added value to join into a pan-European infrastructure in marine biology: higher exposure, higher stringency in benchmarking the infrastructures, expansion of collaborations in research, higher education and innovation. They also see the potential benefit for their respective regional and national maritime economies of such an increased inter-regional and transnational cooperation.

EMBRC has now a strong and growing supporter base. The consortium comprises twelve partners from eight European member states, and several marine institutes from additional member states and associated countries in the ERA have become aspiring members in the preparatory phase and wish to become full members during the construction- and operation phases. EMBRC is formally endorsed by numerous stakeholders including universities, research councils, funding bodies, ministries and industry partners.

## Added value of EMBRC for Europe and the regions

**IMPROVED SCIENTIFIC EXCELLENCE:** EMBRC will improve the scientific excellence and competitiveness of European researchers from across the life-sciences by facilitating access to marine organisms and their associated resources as well as to modern research facilities. EMBRC will support fundamental research because basic biological knowledge of marine biodiversity constitutes the foundation of successful applied research, technological

development and innovation. EMBRC will aid the translation of scientific knowledge via technological development and innovation into novel industrial products. EMBRC will also foster excellence in RI-building in the new EU member states through provision of advice on key strategic RI-development as well as through training of their extant and future staff in operating their RI.

Thus, EMBRC will foster European health, quality of life and competitiveness in key industry sectors such as mariculture, biotechnology, medical technologies and pharmaceuticals. Research results obtained at the RI will help Europe meet the Grand Challenges impeding economic progress and human wellbeing. These Grand Challenges include a diminishing competitiveness of European Industry, an ageing population, climate change, threats to biodiversity, an increased risk of global pandemics and a diminishing food security.

**ECONOMIC BENEFITS AND EMPLOYMENT:** EMBRC will create new jobs requiring young, skilled personnel and will maintain jobs by keeping senior, experienced personnel active in its workforce, all to support the excellence of the RI. It is estimated that a RI project can contribute 50% to 75% of its operating budget to the local economy – in staff jobs, local supply contracts, income from visitors and other sources.

An even larger impact on employment is expected from industrial innovation generated by EMBRC's RTD&I services. By providing all the elements needed to support the technological transfer of fundamental marine biological knowledge into the development of novel quality-products, -services, and jobs, EMBRC will contribute to the objectives of the Europe 2020 Strategy and the Innovation Union to increase European competitiveness and to build a new economy based on innovation.

**BENEFITS OF COOPERATION AND INTEGRATION:** EMBRC builds bridges towards other ESFRI RIs in the Biological and Medical Sciences, the Environmental Sciences and the Marine and Maritime Sciences to foster cooperation across the European scientific landscape and to counter fragmentation.

In addition, EMBRC will enable scientists in regions of less developed RI or without coastal access, to use cutting edge technologies, expertise and training either by enabling them to access established RI-sites or by aiding the establishment or upgrading of advanced RI in, for instance, new member states. In this way EMBRC increases its scientific, ecological and geographic coverage across the European Marine Regions and it contributes to the European Cohesion Policy. Cooperation with the other ESFRI RI's will complement these activities and together shape and strongly support the European Research Area.

European marine biodiversity constitutes only a part of the global biodiversity of the seas. Therefore, EMBRC will strive to establish collaborations with marine biological institutes outside Europe to provide the European research community in the life sciences with access to marine biodiversity worldwide.

## When will EMBRC be launched and its full potential achieved?

**PREPARATORY PHASE:** EMBRC entered the preparatory phase (ppEMBRC) February 2011 with 3 years funding ( 3.9M) from the European Commission. The current partners include twelve marine biological research stations in eight European member states, and the European Molecular Biology Laboratory in Heidelberg, Germany (see our website [www.embrc.eu](http://www.embrc.eu)). The ppEMBRC actively invites **aspiring partners** that adhere to the EMBRC mission and objectives, to join EMBRC as full partner in the next phases, given funding is provided from their national resources.

**CONSTRUCTION PHASE:** (2014-2019) The EMBRC infrastructure will be deployed by major upgrades of existing facilities and newly constructed facilities, funded by the member states. Total anticipated costs are of the order of 100M, but investment can be scaled to national needs and capabilities.

**OPERATION PHASE:** (2016-2041) EMBRC will provide training programmes in - and access to state-of-the-art enabling technologies – to utilize marine biological resources in a distributed infrastructure of marine biological research stations along the coasts of Europe. Operating costs will be approximately 60M per year to ensure continuous technology upgrades and the provision of highly trained staff. Quality of service will be continuously reviewed, and if needed, obsolete services will be scuttled to provide space for new strategic services requested by the end-user community. Funding mechanisms through a mix of European and Member State measures will be laid out in the Preparatory Phase Business Plan. However, it is expected that European funding will be essential to secure pan-European access to the infrastructure and to incentivize (lever) national investments into a shared European facility.

## How will the goals of ppEMBRC be realized?

During the preparatory phase, we will define the scope and structure of the future EMBRC and formulate a business plan defining how the consensus decisions on scope and structure can technically be translated into concrete actions in the construction phase. Therefore EMBRC will identify the key scientific and technological themes relevant to its functioning. The existing capacities and future infrastructure needs within each of the identified thematic

areas will then be established. Other work packages in ppEMBRC will be concerned with e-infrastructure planning, legal status, sustainable financing, human resources, embedding with stakeholders and the wider community, user access, procedures for adopting new partners, and outreach.

We will determine which elements of partner infrastructures will be integrated into the future RI EMBRC and how this RI will be governed. Consensus needs to be reached on which parts will be operated within the EMBRC core, which parts will remain nationally operated but open for access under the EMBRC umbrella, and which parts will remain outside EMBRC.

We will identify and interact with aspiring EMBRC partners; ppEMBRC is open to marine stations interested in joining EMBRC, but it is not all-inclusive. The admission procedure will take into account the strategic needs of EMBRC with regard to coverage of marine regions and ecosystems as well as technological and scientific excellence, open access to marine biological facilities, services and user-training as well as adherence to the EMBRC mission. Yet, at the end of the preparatory phase it will be the member states that through their funding decisions, determine which of the extant ppEMBRC partners and aspiring partners will join the construction and operation of EMBRC.

Economy of effort and cost is achieved by upgrading major facilities at an integrated pan-European level, rather than at national levels in order to avoid unnecessary multiplication. Likewise, facilities will be developed or upgraded preferentially at sites with pre-existing expertise and infrastructure, or at sites whose marine environments render these sites the obvious locations for these facilities. In general, ppEMBRC member institutes need to focus on pan-European interests when presenting their construction and operation plans to their national and regional financial stakeholders. In addition, the RI will have a single entry point to foster economy of scale also in management and administration.

Collaboration with other emerging RIs within the Biological and Medical Sciences (BMS) group and in the Environmental Sciences further increases efficiency and economy. Proper definition of the core tasks of EMBRC will help defining what tasks and services are better left to sister RIs or performed by them in connection with EMBRC, thereby increasing efficiency and end-user-friendliness through, for instance, across RI-standardization and shared design of data input, access, handling and storage.

Although the EMBRC perimeters were already decided in the ESFRI Forums and are firmly established, the scientific strategy, scope, vision and tactics need to be updated given novel technological developments and changing end-user requirements. Such changes require upgrading and increasing existing facilities, construction of new ones and discontinuation of obsolete ones as well as retraining and hiring staff to adapt proactively to the changing requirements. An additional advantage of this flexibility is that new partners joining in the

construction phase can influence the future direction of EMBRC, but it also needs a clear view on what will be its enduring core tasks.

EMBRC will develop European operational models that can be adjusted to the legal and administrative environments of the different member states. Already existing funding mechanisms and measures on various levels (local, regional, national, etc.) will be taken into consideration to implement EMBRC. However, it is expected that fulfilling the EMBRC eligibility criteria will impact funding decisions by national authorities and funding agencies.

**THE ROLES OF THE INTERNATIONAL ADVISORY BOARD (IAB) AND REFERENCE USER GROUP (RUG):** Originally, marine stations served the needs of an external scientific user-community, but in recent years, technological development and strategic decisions were determined exclusively by needs and desires of in-house users. EMBRC-policy dictates that the RI is made available to internal and external users alike, and that the user community expands beyond marine biology into all the life sciences, including e.g., biomedical research. Therefore, an International Advisory Board advises us on all the strategic decisions. A Reference User Group has been established in ppEMBRC to balance the input of the in-house staff on the strategic developments of EMBRC. This advisory group consists of representatives of various external end-user groups such as Users from academia and research institutes, international scientific organizations, SME's, industry and policy makers.

## How can you support EMBRC?

### **Become involved now!**

The ppEMBRC Consortium invites potential users of EMBRC to describe their expectations and needs and to give feedback to the developments during the preparatory phase of EMBRC. The earlier you become involved the easier it will be to make sure EMBRC serves your needs.

The Consortium invites aspiring partners to participate in the preparatory phase of EMBRC to discuss the strategic development and infrastructure planning. The earlier you become involved the easier it will be to make sure that the EMBRC's business plan matches your capabilities, a major basis for the funding decisions of the member states.

The Consortium also invites ministries, research councils, and all national as well as regional funding agencies from the ESFRI member states to actively participate in the Preparatory Phase to help shape the legal and financial framework for the RI. The earlier you become involved the easier it will be to make sure EMBRC serves your needs and its Business Plan

matches your expectations and capabilities. In the meantime, EMBRC engages with policy makers at the EC-level to advocate sustainable investment in its future RI.

## **Contacts**

EMBRC Project Manager: Dr. Wiebe H.C.F. Kooistra (SZN)

Phone: + 390815833271

[info@embrc.eu](mailto:info@embrc.eu)

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