



EMBRC
EUROPEAN
MARINE
BIOLOGICAL
RESOURCE
CENTRE

EMBRC scientific strategy

Report

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The EMBRC preparatory-phase



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I. Executive Summary

The oceans represent the largest set of ecosystems on Earth and harbour exceptionally high biological diversity. This biodiversity underpins a very wide range of basic and strategic biological and biomedical research. Marine organisms present a rich and diverse source of novel genes and compounds of importance for biological, medical and biotechnological applications. Marine research laboratories play a key role in unlocking this potential as well as providing facilities for food security and environmental and ecosystem services research.

The European Marine Biological Resource Centre (EMBRC) is an ESFRI distributed research infrastructure, linking 13 marine stations in 8 countries to provide common research goals, collaboration and crucial access to the highest quality of research services, platforms, data and expertise. EMBRC will become the leading infrastructure provider in Europe for marine biological research.

A focus on standardisation of protocols, data collection and sharing of best experimental practices and culturing techniques will ensure a high standard of research, easy access to data and sharing of results. EMBRC will provide technology and knowledge transfer platforms to allow fast and seamless dissemination and translation of scientific discovery into industrial applications and products. Service provision will be centred around four core themes: Access to Ecosystems, Aquaria & Culture, 'Omics technologies, and Mobility of Researchers and User Access.

The EMBRC Scientific Strategy Report describes how this distributed infrastructure will come about through the Preparatory Phase (ppEMBRC), the standards and services that it will provide and how it will operate and evolve through the remaining Preparatory, Construction and Operations phases to establish EMBRC as a single entry point to European marine research infrastructure. Throughout the preparatory and construction phases ppEMBRC member will formalise funding agreements with national and European funding bodies, set up a searchable EMBRC database of facilities, platforms, organisms and services and the first steps towards standardisation of databases and future data collection will be initiated. The legal structure and governance of the research infrastructure will be decided and a memorandum of understanding will be drawn up between the participating partners. Overlap and complementarity with related programmes and infrastructures will be addressed whilst working towards a single entry point for all RIs to ensure applicants access the most relevant facilities for their work. Sharing of aquaria and culture expertise and best practice guidelines will be set up and disseminated throughout the partner institutes. The co-ordination of Omics tools and capability throughout Europe and establishment of omics standards for design and analysis will be facilitated to provide a framework upon which Omics approaches will be developed throughout the infrastructure. The mechanism for access of EMBRC facilities will be adapted from the ASSEMBLE programme.

The Operations phase will see all services offered by EMBRC become available to applicants, as well as all administrative work transferred to a central HQ which will also handle all access applications.

Finally, EMBRC will be a major provider of services and facilities for Europe's new funding scheme, Horizon 2020, providing training for technical staff, young and established researchers and a platform for SMEs to carry out R&D. EMBRC will be a major asset in making Europe an attractive and highly competitive centre for marine biological research.

2. Introduction

The oceans represent the largest set of ecosystems on Earth and harbour exceptionally high biological diversity. Of the 36 recognised phyla of living organisms, only 17 occur on land, whereas 34 occur in the sea. Marine organisms present an extraordinary variety of often unique structures, metabolic pathways, reproductive systems, and sensory and defence mechanisms. Understanding this biodiversity is highly relevant for the sustainable development of human society, for example in relation to advances in biomedicine, biotechnology, gene technology, food security, environmental issues and ecosystem services.

Marine research laboratories play a key role in delivering essential research activities through provision of platforms, equipment, expertise, resources and information. There is an urgent need for better co-ordination of these activities at the European level in order to address future demands for marine resources, to seize the opportunities presented by better understanding of marine systems and technological advances and to meet the challenges of increasing uncertainties about the changing marine environment.

Europe has a very long and distinguished history in marine biological research and its coastal marine biological stations are among the oldest in the world, with many being established in the 19th century, providing transnational infrastructure sites to serve, enhance and develop collaborative marine research worldwide. However, these marine laboratories have traditionally operated rather independently as research infrastructures, providing stand-alone access to marine organisms, ecosystems and facilities for visiting and resident researchers.

The challenge of better co-ordination of the marine laboratories was first addressed by the FP6 Integrated Infrastructure Initiative (I3) project ASSEMBLE (2009-2013) which has created a network of leading European coastal marine biological research stations to provide collective transnational access to a representative set of marine ecosystems and a variety of marine model organisms, including an increasing number of experimental systems amenable to state-of-the-art genomics approaches. ASSEMBLE provides a logistical and strategic concept for creation of a European Marine Biological Resource Centre (EMBRC) with the aim of providing the European scientific community with integrated and sustainable access to a uniquely diverse set of coastal environments and model organisms.

Marine organisms have been the source of novel genes and novel compounds of importance for a range of biological (Green Fluorescent Protein (GFP), medical (bio-scaffolding) and industrial (marine micro and nano structures models for structural engineering, nanotechnology in anti-fouling coating for ships) applications. This stems from the range of marine biodiversity and its existence in a variety of habitats, from warm tropical seas to extreme deep-sea and hydrothermal vent environments. EMBRC will be central in the development of “blue biotechnologies and the dissemination of novel research findings will provide new opportunities in bio-discovery, molecular farming and marine biotechnologies, particularly in bioprospecting and bioharvesting (bio-discovery techniques); bioprocessing, bioremediation (process biotechnology techniques) and aquaculture or fisheries using gene, protein or other molecule-based techniques. Marine sciences are undergoing a major revolution with the consolidation of experimental, monitoring, ‘omics and analytical approaches driven by advances in technologies, making marine models and ecosystems more attractive to the wider scientific community, industry and SMEs. Marine biological research is rapidly developing new

foci on complex interactions at sub-cellular to ecosystem levels and the sustainable utilisation of marine resources. EMBRC will be central in the development of “blue biotechnologies”, bio-discovery and biomedical advances.

a. EMBRC Aims and Goals

EMBRC will:

- 1) Become the major European provider of marine biological research infrastructure and related services, providing a single access entry point to the best facilities available as well as the data and time series collected by member organisations through a successor program to ASSEMBLE. This will benefit the whole of the research community, from academic to commercial users, by providing access to marine habitats and platforms otherwise beyond their physical and financial reach.
- 2) Provide co-ordination and leadership through a strong management structure and through a pan-European programme of knowledge exchange activities, including scientific and strategic meetings and workshops that will inform the planning of future funding initiatives, catalyse research partnerships, and provide an important input for planning of future infrastructure requirements.
- 3) Ensure standardisation of data collection, storage and transmission, workflows and skills training. EMBRC will share best practise in research methodologies, aquarium and culture technologies.
- 4) Incorporate procedures to facilitate knowledge transfer into increased economic well-being and a higher quality of life. The base will be further developed to provide knowledge transfer for all disciplines catered for by EMBRC.

b. The purpose of the document

The EMBRC Scientific Strategy Report describes how this distributed infrastructure will come about through the Preparatory Phase (ppEMBRC), the standards and services that it will provide and how it will operate and evolve through the remaining Preparatory, Construction and Operations phases to establish EMBRC as a single entry point to European marine research infrastructure. The Report also provides recommendations and guidelines for services and collaborations to ensure close interaction with other existing and forthcoming European programmes and ESFRI projects.

The report also provides guiding information for other ppEMBRC work packages by:

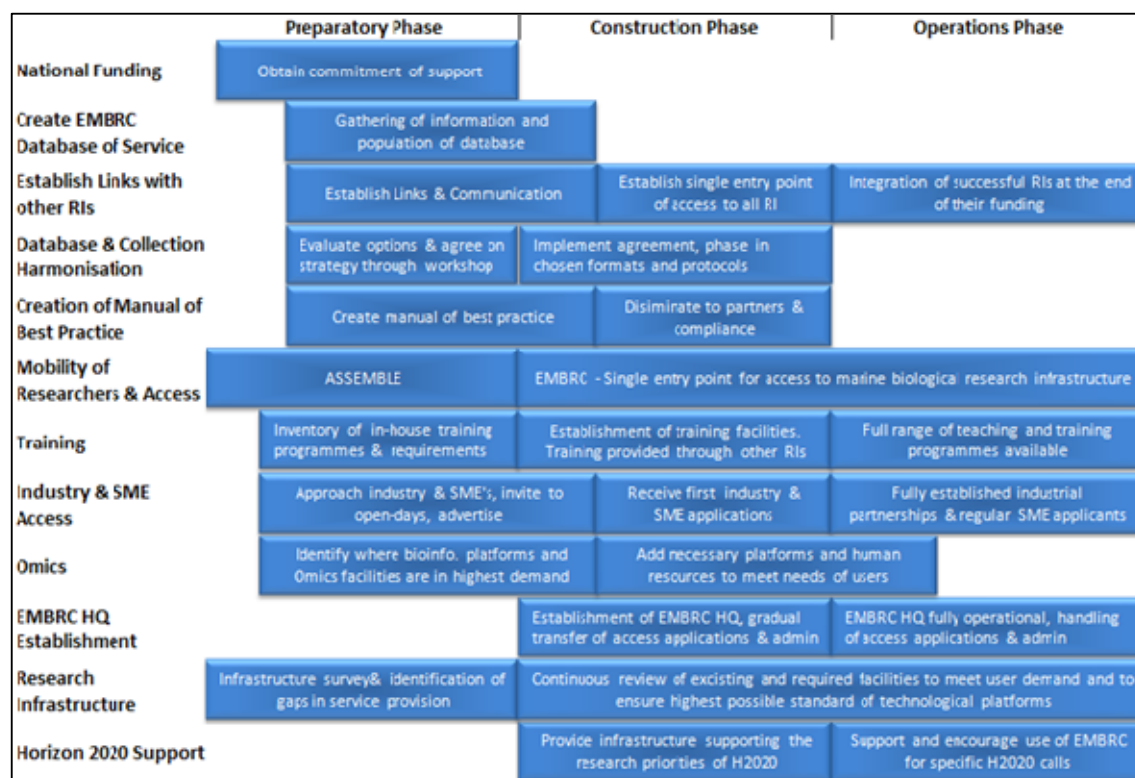
- highlighting e-infrastructure requirement for present and future services (WP3),
- outlining infrastructure requirement to meet demands (WP4),
- providing the vision, goal and structure of EMBRC on which to base the legal framework (WP5),

- identifying operational requirements to identify employee numbers and conditions of employment (VP8).

3. EMBRC practical operations, Structure and Evolution: Towards European Integration of Marine Stations

EMBRC will represent the major Research Infrastructure for marine biology in Europe, providing services and access to a host of facilities, expertise and data for internal and external users. A key commitment of EMBRC is to ensure that the major European Marine Laboratories will no longer work and evolve in isolation. A program of joint actions is proposed to ensure organisation and strategic placement of future infrastructure development and location of new material and platforms. This strategy outlines the requirements to achieve a smooth transition from *preparatory phase* to *construction*, and *operation*. The time frame of each strategic point is outline in a Gantt chart (figure 1), along with their progression through the three phases of the project.

Figure 1 - Gantt chart showing the major strategic priorities and their evolution over the 3 project phases.



Preparatory Phase

This phase will see the initiation of EMBRC in a limited capacity, particularly in terms of the organisation of infrastructure, interactions with other ESFRI and EU initiatives and the co-ordination of ppEMBRC partners in preparation for the construction phase. This phase requires close communication to define and organise future infrastructure and the necessary workshops outlined throughout the strategy. In particular joint efforts will concentrate on advancing the following strategic priority areas:

- **National funding.** ppEMBRC partners will require support from national funding bodies to ensure continued involvement in EMBRC. Targets are to influence national funding priorities that lead to direct funding opportunities.
- **The creation of an EMBRC services, facilities and organism database.** A web-based searchable directory of facilities and services available to users will be an essential feature of the RI. (see section 6a: Access to Ecosystems). A similar database under development in ASSEMBLE may form the template for the EMBRC service listing.
- **Establishment of communications channels with other ESFRI RIs** (e.g. AQUAEXCEL, MESOAQUA, EUROBIOIMAGING) and Networks of Excellence (e.g. EUROMARINE). Communication with these and other initiatives will ensure that needs are met and will avoid unnecessary duplication of efforts, platforms and infrastructure.
- **Data collection and database harmonization.** The target is to deliver efficient access to data collected by EMBRC partners through compatible methodologies and protocols for collection, storage and analysis. This should be achieved primarily through the adoption of existing and forthcoming initiatives in data management and database consolidation (see section 6a: Access to Ecosystems for details of initiatives and a 3-phase plan to introduce new measures).
- **Sharing of husbandry and culturing expertise.** Many ppEMBRC participants have long records of culturing marine species, with some laboratories specialising in certain organisms. Sharing of expertise will ensure that demand can be met and will broaden the species repertoire of each station. Efforts should also be made to collaborate to close the life cycle of problematic species that are of interest to the research community (see section 6b: Aquaria and Culture).
- **Creation of a best practice database.** To achieve high and compatible standards throughout EMBRC best practice of experimental methods, culture and husbandry, data collection and analysis needs to be established and adhered to (see section 6b: “Aquaria & Culture Strategy Outline”).
- **‘Omics platforms.** ‘Omics technologies will underpin many of the activities of EMBRC. The availability of centralised ‘omics platforms is currently largely limited to national facilities. Although ‘omics facilities are already numerous within ppEMBRC future demand is likely to be high so that additional platforms will be required. The target is to determine the relative demand for centralized and dispersed ‘omics centres and their specialization within EMBRC (see section 6c: ‘Omics Technologies Strategy Outline’).

- **Bioinformatics platforms.** Increased 'omics-based research will need to be underpinned by greater bioinformatics capacity. Currently, bioinformatics platforms and expertise represent a limiting factor for the application of 'omics within ppEMBRC. The target of efficient and co-ordinated expansion during the construction phase will require the involvement of ppEMBRC WP3 and improved communication with RIs currently developing such facilities (e.g. ELIXIR).
- **Mobility of researchers and training.** The successful ASSEMBLE model for the mobility of researchers will be used to create a single external access point to EMBRC. The preparatory phase target is to develop the ASSEMBLE model to allow external access to EMBRC facilities from the onset of the construction phase (see section 8: Mobility of Researchers and User Access).

A number of training courses have been proposed (see section 6: EMBRC Service Priorities: Working Group Strategy Papers). A ppEMBRC target is to determine the capacity for training that will be available for and so that short-comings may be rectified during the construction phase. Training opportunities offered by other projects, including INSTRUCT, MG4U and ASSEMBLE, will be investigated and incorporated, where appropriate, into the training programme of EMBRC.

- **Industry and SMEs.** EMBRC will play a key role in providing research infrastructure to industry and SMEs. ppEMBRC will target and encourage industrial participation and exploitation of facilities, for example through invitations to participate in workshops, training and facility visits.
- **Administration and legal framework.** Delivery of the EMBRC Science Strategy will require a robust legal structure prior to entry into the construction phase. At the end of the preparatory phase the minimum requirement is to have a memorandum of understanding (MoU) between partners outlining the legal structure of the RI, the obligations of participants and the services provided. The details of the legal structure and governance of EMBRC will be outlined by WP5. At this stage all assets and facilities will remain at the control of national nodes for practical and financial reasons. The resource required to establish a co-ordination office will be determined during ppEMBRC.

Construction phase

EMBRC already has substantial but uncoordinated infrastructure funded by National bodies with ambitious new builds and refurbishments already in the pipeline among several partners. The construction phase of EMBRC, starting in 2014, will see the co-ordination of future building and equipment procurement plans to increase efficiency and deliver the scientific strategy being developed for the infrastructure.

- **Mobility of researchers & access.** This phase should see the commencement of EMBRC in a limited capacity with the first calls being opened to apply for access using an improved ASSEMBLE model, or ASSEMBLE 2 should it receive funding. This will coincide with the completion of the EMBRC service database. This provides a realistic target in the current economic climate, as it allows for EMBRC to work to a proven model without the need for

significant national investment to guarantee the transition of EMBRC from preparatory phase to construction.

- **Training.** The primary aim is to increase the number and frequency of courses provided, during the construction phase. New and on-going courses will be hosted at EMBRC partners' facilities. Prioritisation will be given to technical staff training to establish common high standards of service EMBRC and dissemination of know-how equally throughout the RI, particularly in areas of husbandry, culture, 'omics technologies and bioinformatics.
- **Administration.** In conjunction with the start-up of EMBRC services, an EMBRC office should be established to coordinate the construction phase outlined in D2.3, D4.2 and D4.3 and guide collaboration. Funding for this centralised administration should be sought from the EU. The EMBRC office will be responsible to for organising the workshops outlined in the EMBRC Service Priorities (Section 6) and will serve as the entry point for users. The office will co-ordinate the activity of the EMBRC Working Group in year 3 of the construction phase that will monitor and advise on evolution and decommissioning of EMBRC facilities throughout the RI's operation (to be outlined in D2.4, delivery in M24).
- **Legal framework.** All participating marine stations will have accepted the legal framework prepared by WP5 and may begin accommodating users at the start of the Construction Phase. Further partners may be added at any point, subject to fulfilling criteria for service, platform, ecosystem or expertise provision that may be limited or unavailable within the current partners. Formal agreements, ownership and legal structure will be established during this phase.
- **Collaboration with other RIs.** At this stage contact will be established with other relevant RIs. In relation to coordinated teaching, data collection or forwarding of relevant applications to collaborating RIs (see section 4: Integration with other ESFRI RIs).
- **Research Infrastructure.** Throughout the construction phase EMBRC the imperative is to support all types of research outlined in D2.1 in the Report on Key Thematic Areas and research aimed at meeting the Grand Challenges outlined by the EU Horizon 2020 framework Programme. The goals to be achieved and the facilities that should be prioritised will be outlined in D2.3.
- **EMBRC & Industry.** To further encourage the participation of industrial and SME partners, EMBRC should directly engage with users through a variety of channels to encourage applications for access to facilities. A knowledge and technology transfer platform will also be created to allow industry and SME a go-to service for accessing scientific data and research relevant to their R&D. Longer term requirements of potential industrial users will be assessed through a formal feedback process. This strategy is to be defined by WP9 "Consolidation of EMBRC, embedding with stakeholders and the wider community".

Operation Phase

At the onset of the operations phase EMBRC Headquarters will take on the co-ordination of activities throughout the RI. Relationships between EMBRC centre and EMBRC national nodes will

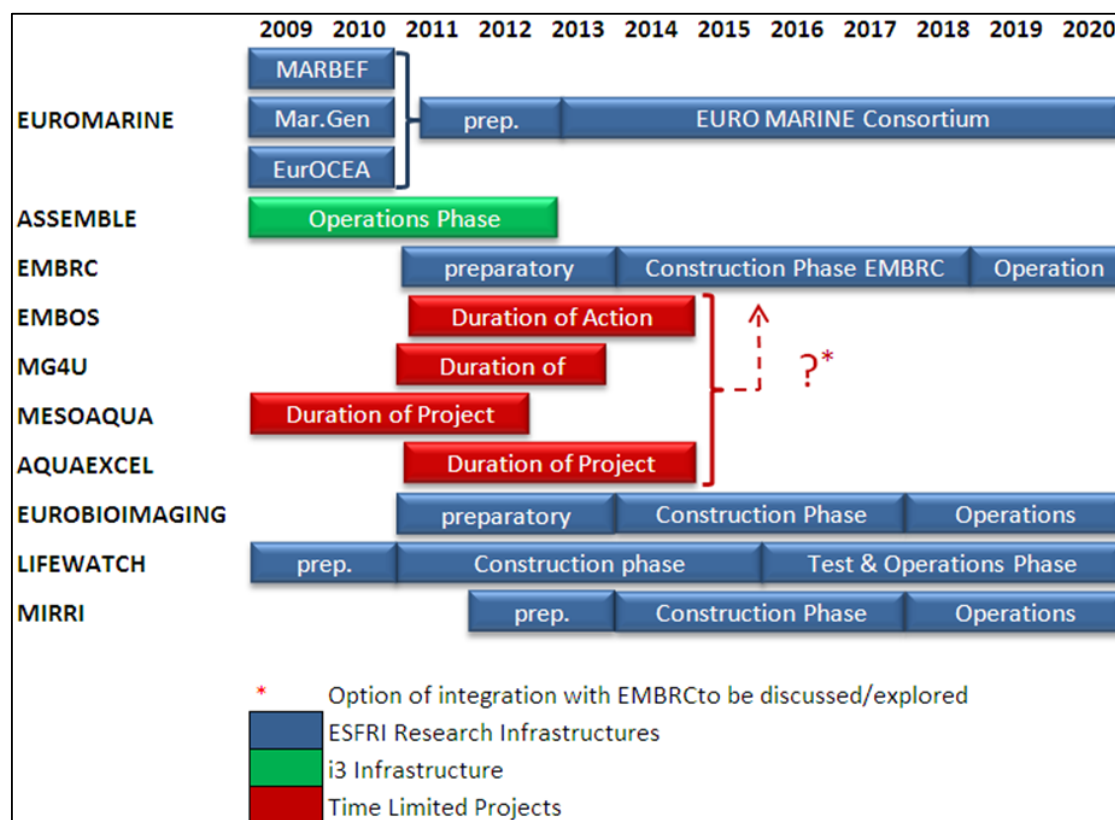
be governed by service agreements as outlined in the MoU. Control of local staff will remain with each national node that is hosting the facility. A governing body will manage EMBRC as recommended by WP5 during the preparatory phase. Priorities for the operation phase are:

- Co-ordinate proposals for longer term funding from national and other bodies.
- Continued provision of access and over-seeing of necessary expansion and over-seeing of the scientific and technological review system.
- Evolution towards larger scale integration of new members and facilities.

4. Integration with other research networks and infrastructures

A number of ESFRI Research Infrastructures and EU Initiatives are currently fully operational or entering various stages of operation (fig. 2). EMBRC will work to avoid duplication of efforts, and will ensure that facility sharing opportunities are maximised between infrastructures. The following projects and initiatives are of particular relevance and importance to EMBRC:

Figure 2 - Gantt chart showing the interaction between EMBRC and other Research Infrastructures and research initiative between 2009 and 2020.



Research Infrastructures

- LIFEWATCH will provide services to ecological and biodiversity research. There are opportunities for joint initiatives in provision of bioinformatics, data integration and interoperability, and training links for EMBRC users' access.
- ELIXIR is established to provide the infrastructure for collection and distribution of large datasets. EMBRC needs to establish good communication with ELIXIR to handle the expected demands of EMBRC. EMBRC workshops on data sharing and harmonisation (see section 6 "Access to Ecosystems Strategy Outline") should also include ELIXIR representatives to ensure compatibility between the two projects.
- EUROBIOIMAGING will provide a distributed biological and biomedical imaging infrastructure. EUROBIOIMAGING has a focus on establishing access and training, as well as sharing of best practices and image data, and thus provides an excellent opportunity for collaboration with EMBRC. EMBRC should seek to establish links with EUROBIOIMAGING to provide training in advanced imaging. MIRRI is a distributed research infrastructure providing micro-organism services facilitating access to more than 350,000 high quality strains, their derivatives and associated data for research, development and application. Due to potential overlap in supplies of organisms and related services it would be beneficial to both MIRRI and EMBRC to collaborate on organism provision, as well as sharing of culture expertise.
- MESOAQUA provides transnational access to mesocosms from the Arctic to the Mediterranean and includes two ppEMBRC partners. MESOAQUA is set to become the leading provider in mesocosm access.
- AQUAEXCEL is in the preparatory phase and aims to provide access to state-of-the-art facilities and technology to advance European aquaculture. This is a highly specialised RI and is likely to have some overlap with EMBRC.

EMBRC should take the initiative in creating a Research Infrastructure single entry points where applications made for access to services and infrastructure are submitted through one portal where a decision is made to which RI the application is best suited. This will avoid unnecessary overlap between RIs and ensure that applicants access the system most suited to their needs.

Other EU Initiatives and Consortia

- EUROMARINE: EUROMARINE is the integration of three former Networks of Excellence – EUR-OCEANS, MarBEF and Marine Genomics Europe. It is a major driver of European marine biological research strategy. EUROMARINE will provide a focus for application of genomic knowledge to ecosystems and will integrate closely with EMBRC for provision of facilities for research delivery. Communication is already established between EMBRC and EUROMARINE to identify infrastructure platforms of strategic importance. It is recommended that a EUROMARINE representative is appointed to the EMBRC Reference User Group (RUG).

- **EMBOS:** Several EMBRC partners are part of COST European Marine Biodiversity Observatory System (EMBOS) , a network of marine labs monitoring biodiversity responses to ecological, climatological and anthropogenic factors.. EMBRC will ensure that monitoring continues for these projects and will provide access to the data for non-participants.
- **MG4U (Marine Genomics for Users)** aims to facilitate knowledge transfer between genomics and industry. MG4U will be able to provide training opportunities, critical know-how and information to industrial users with interests in genomics. MG4U is planned to continue until mid-2013, after which the services provided by this initiative should be absorbed into EMBRC to ensure continuation and expanded to provide knowledge transfer for all marine biological.

As a number of RIs (i.e. AQUAEXCEL, MESOAQUA) and COST projects (e.g. EMBOS) are limited in funding to only a few years, EMBRC should seek to incorporate the partners of these projects to ensure that these services can still be provided, should they fail to secure future funding.

5. Meeting Future Research Needs: National Roadmaps and Horizon 2020

- **National Roadmaps**

Currently only a small number of participating nations have National funding Roadmaps that include EMBRC. Current levels of engagement with or commitment by national funding bodies vary between partner nations. Nonetheless all partners consider EMBRC to be a major mechanism through which national and European research priorities and funding initiatives can be delivered. EMBRC partners will need to present a unified set of arguments that clearly define the EMBRC in relation to national research priorities and the types and levels of added value that providing national support will bring to national research programmes.

- **Horizon 2020**

Horizon 2020 is the new European Union framework funding programme that will succeed Framework Programme 7.

It is expected that EMBRC will provide a major component of the infrastructure required to address the research priorities of Horizon 2020 in the marine sciences. Horizon 2020 outlines six priority areas for research funding:

- Health, demographic change and wellbeing
- Food security, sustainable agriculture, marine and maritime research and the bio-economy
- Secure, clean and efficient energy
- Smart, green and integrated transport

- Climate action, resource efficiency and raw materials
- Inclusive, innovative and secure societies

The key thematic research areas identified by ppEMBRC (D2.1 Report on Key Thematic Areas) cover these areas of prioritisation with ppEMBRC partners being particularly strong in the areas of food security, aquaculture, bio-fuel and energy and climate research, resource efficiency and raw materials.

Horizon 2020 aims to raise the level of excellence in Europe's science base and ensure world-class research to secure Europe's long-term competitiveness. It will support the best ideas, develop talent, provide researchers with access to priority research infrastructure, including e-infrastructure and make Europe an attractive location for the world's best researchers. In providing a mechanism for European-wide access to the most advanced facilities for biological sciences, EMBRC will represent a key element of this strategy within the marine sciences.

With an outreach programme already engaging SME and biotechnology companies, EMBRC is set to support the Industrial Leadership campaign of Horizon 2020. By making highly specialised facilities, technology transfer services (i.e. MG4U), training and know-how available to the industrial sector SMEs will be able to push their research and development further without prohibitive investment costs associated with capital infrastructure. By offering facilities for research, training in the newest techniques and equipment, and innovation EMBRC represents an excellent collaborator for the European Institute of Innovation and Technology (EIT), a major partner and driver in Horizon 2020. Effectively, EMBRC will be an excellent tool for disseminating expertise and knowledge within Europe.

Altogether, EMBRC will play a key role in raising the standards and ensuring that Europe continues to be a competitive and attractive region for marine biological research.

6. EMBRC Service Priorities: Strategy Papers

The following groups represent the core areas of service provision. This section outlines the rationale for their inclusion, an outline of the expected users and the strategic requirements of EMBRC to develop these services.

6.1 Access to Ecosystem Strategy Outline

Background

Marine stations provide scientists with points of access to marine organisms, their habitats and ecosystems. European and national policies emphasise the need of state-of-the-art research, education, training and innovation in order to meet the Grand Challenges that currently confronts European development and wellbeing. Marine resources constitute an integral, but still under-utilised part of the resources available to the European RTD community. Marine resources need to be made widely available for RTD in biodiversity, biomedicine, bioproducts, bioengineering, global change, and

sustainable marine resource management. As the use of model organisms are becoming of increasing importance in research there is a growing interest in determining their ecosystem function, but also to make in situ observations and experiments on these organisms in their natural environment to allow scientists, biotechnology and biomedicine companies the chance to explore the biological responses and potentials of the organisms. Ecosystem access services are likely to appeal to governmental and industrial users, as well as the wider independent research community, as it provides them with an infrastructure that provide the access, tools and expertise required to expand marine biological sciences into the future.

ASSEMBLE is an FP7 Access Program to a network of marine stations, including many of the EMBRC partner Institutions, which runs from 2009-2013. The ASSEMBLE program funded development work and peer reviewed grants to visit marine stations and/or provide off-site access to marine resources. ASSEMBLE has established the high demand for EMBRC services from the academic research community. EMBRC will build on the achievements of ASSEMBLE and extend access to marine infrastructure to industry, governmental and non-governmental organisations. As the majority of potential users do not have easy access to marine systems, EMBRC will provide ecosystem access as one of its core services. The EMBRC network of marine stations will provide daily access to a large number of shore and near-shore habitats, from sub-tropical to polar seas, as well as extreme habitats such as oxygen-poor and deep-sea realms, as well as access to artificial habitats for biofouling research and renewable energy test sites.

Critical aspects of ecosystem access are the platforms used to physically access habitats and ecosystems, the availability of scientific data describing these ecosystems, and the availability of local expertise concerning these ecosystem.

Physical access: An important and unique aspect of infrastructure services are the platforms used by the EMBRC partners to physically access the ecosystems they provide access to. The marine stations of the proposed network operate a number of research vessels ranging from large, high-seas capable state-of-the-art research ships with ice-breaking capability to coastal tenders that service buoys and collect local samples. There are also a number of Remote Operated Vehicles (ROV) available as well as a submersible. A number of stations also operate scientific diving centres for high-quality sampling, surveys, support to permanent under-water experimental designs, deployed instrumentation maintenance and under-water photography and video recording.

Access to data: EMBRC will become a gateway to the data that are regularly gathered into time series of marine station habitats. All marine stations have been sampling their ecosystems for decades on a regular basis and thus hold unique long-term databases of environmental change. These data will be of benefit to a large user community not only for identifying patterns and major drivers of biodiversity change, biogeographic shifts as well as natural and anthropogenic forcing in the marine environment on different scales of time and space, but also for the understanding of the biology, physiology and ecology of marine organisms. Not only will EMBRC provide a convenient portal to this data, it will also appeal to ecosystem users as their results can be put in an environmental context and compared with numerous time series and diverse habitats.

Access to local expertise: Crucially, EMBRC will provide a high level of in-house scientific expertise to their users. The availability, development and maintenance of this expertise in EMBRC marine stations are a critical aspect for the access to organisms, habitats and ecosystems. Visiting users will be able to benefit from local knowledge for specimens identification and collection, and habitat or

ecosystems characterisation. Having access to this expertise will enable users to optimise their experimental design, determine the best time to carry out the work and increase chances of a successful visit while decreasing the relevant costs. Taxonomic services are available in many stations, being able to provide support in identifying cryptic and rare species through a multitude of approaches. This will be of particular interest to those users visiting an area for the first time and users new to the marine field (e.g. biomedical and biotechnology researchers accustomed to terrestrial systems and models).

Strategy Recommendations

Establishing an EMBRC Services Database of habitats, organisms and cultures, platforms, databases and local expertise (link with WG-2: Aquaria & Culture & WP-3 E-Infrastructure). In order to provide a fast and effective over-view of available services it is important that EMBRC advertise and list the services they provide access to. The list will cover the following aspects:

1. *Habitats:* All habitats available through EMBRC partners, or schemes accessible through an EMBRC partner, should be identified according to EUNIS (European Nature Information System habitat classification system for species, habitat types and sites). This will also ensure that a search carried out on the EUNIS website for particular types of habitat will list the habitats available through EMBRC, increasing the network's exposure. A distinction will be made between "in-house" habitats, which are accessible on a day-to-day basis through a stations own vessels/equipment or road access, and habitats that CAN be visited but require extensive trips or planning (e.g. deep-sea sites, remote areas, some polar bases).
2. *Species:* These are the organisms that EMBRC can supply either cultured, collected, or for visiting scientists to use in the hosting stations laboratories. Species names will be provided according to WoRMS (World Register of Marine Species) standards. Distinction needs to be made between cultured and collected strains/organisms, and comments about availability (e.g. seasonally) need to be provided.
3. *Databases:* EMBRC will be able to provide access to a vast amount of time-series datasets from the various marine stations. The list of these will provide direct links to the stations website and access portals (and user agreements conforming to terms and conditions).
4. *Expertise:* Each EMBRC station have at its disposal a number of experts that may of great value to visiting researchers, such as taxonomic expertise, particular laboratory skills for molecular applications, sophisticated imaging techniques and local habitat knowledge. An indication of time available for visitors for consultation will also feature in the database.

The above objectives will be achieved by the expansion of the existing ASSEMBLE database that covers part of the requirements listed above. Due to the ASSEMBLE database being close to completion, it is expected that the level of detail that needs to be reached can be achieved by the first year of the construction phase.

This will add the unique attribute of EMBRC over other relevant infrastructures of encompassing datasets from all levels of the biological organisation from molecules to ecosystems and seascapes.

Expand Ecosystems/habitats available for access. Currently EMBRC provide access to a large amount of warm-temperate to polar ecosystems. However, it is essential that access is adaptable to meet the future needs of the independent research community and industrial R&D. Priority should be paid to facilitate access to sites with high anthropogenic impact (i.e. marine environments created, or significantly altered by man, such as marinas, artificial reefs) and "rental space" for off-shore technology, renewable energy platforms and monitoring where their in situ impacts can be accessed.

Expansion and Improvement of Scientific Diving Infrastructure. Scientific diving accessible to visitors is carried out at several stations in Europe, and within EMBRC, but is not a service that is utilised to its full potential. Efforts need to be focused on consolidating the diving centres and focus on providing adequate facilities. This will be further outlined in the Strategy Report on New Infrastructure Requirements (D2.3, delivery M18).

Database and Collection Harmonisation. Long-term datasets play an important role in understanding ecological processes and drivers. Currently information and data are scattered, lack an integrated approach and large scale visibility, as well as standards and quality control. In order to extract the greatest amount of information and make the data available as widely as possible data obtained from each station must have a minimum of comparability and compatibility. Efforts have been made in different marine laboratories to develop databases for ecological data obtained at different time and space scales, but these have been developed at different scales of integration, ranging from the databases developed by initiatives in the frame of specific research programmes to large scale European database (e.g. MarBEF database). There are a number of standards and initiatives that need to be considered for implementation across EMBRC, for (1) metadata collection and standardisation (e.g. INSPIRE directive, MEDIN), (2) taxa names (e.g. WoRMS), (3) habitats classification (e.g. EUNIS) (4) data acquisition (e.g. ICES, QUASIMEME, TARAOCEANS recommendations and protocols, or more locally Interreg MARINEXUS Program). Existing large scale databases such as the international databases PANGEA or MarBEF and more local initiatives (e.g. VLIZ, Flanders Marine Institute), are also to be considered. Close collaboration with ESFRI initiatives, such as LIFEWATCH, will also play a crucial role in how data is managed, shared and processed within EMBRC.

It is essential that the drive to participate in and utilise European-wide database initiatives is maintained within EMBRC to facilitate the integration of ecological data acquired by European marine stations and improve access to the user community. In line with this, EMBRC will be a supporter and a tool for the dissemination of large-scale European initiatives for data sharing and implementation of existing and forth-coming data collection and sharing initiatives (e.g. MarBEF, EMBOS). Standardising data and collection methodology is an important step towards making Europe a leading force in marine ecological research. However, the decision of which standards to adopt and their implementation is beyond the scope and decision power of one individual. Large-scale changes to procedures, data collection and the implementation of new database guidelines require coordination and time. It is recommended that a workshop between the Steering Committee, the institute directors, institute database managers and IT personnel is organised to discuss the various database and standardisation options is carried out at the end of the preparatory phase (pp) (short term) with the aim of implementing the agreed improvements during the construction phase (cp) (medium term) by 2017 (3 years to implement).

6.2 Aquaria & Culture Strategy

Strategic drivers

Aquaria and culture facilities for both macro- and microorganisms are at the heart of any marine biological resource centre. ASSEMBLE has proven the demand for on-site and remote access to marine biological resources within Europe. A majority of successful applications required the use of aquarium facilities either for maintenance or experiments. ASSEMBLE has supported ecological, ecotoxicological, physiological, evolutionary and biomedical research projects.

Biology is in the midst of a revolution driven by the development of “model” organisms for experimental and/or genomic approaches, high throughput ‘omics technologies and increased computing power, which are bringing fundamental advances in understanding. Model organisms are characterised by particular biological features, which make them tractable for studying a particular set of processes. Whole research communities build up progressively around each model species facilitating the development of biological (e.g. mutant strains) and molecular (genome sequences, transcriptomes, proteomes, antibodies, tools for functional analysis) resources. The marine environment is unique in the breadth of its taxonomic diversity and is providing an ever increasing number of important model animal species with annotated genomes. In parallel to supporting the rapid emergence of model species, continuing advances in high throughput sequencing technologies are also allowing genome scale studies on non-model species which are likely to increasingly impact on population genetics and ecology, fields which underpin stock assessment in fisheries and climate change research.

An analysis of the ASSEMBLE applications indicates there is demand for a broad range of species at present. We envisage that the next 10-20 years will see a dramatic increase in the demand for access to relatively unexplored species in order to test their suitability for development as models and/or for genomic studies over a wide taxonomic range. This will have important consequences for the development of the EMBRC aquaria and culture facilities. Firstly, there will be a need for improved technology for the sustainable culture of high demand species independently of wild caught specimens. Secondly, EMBRC partners will have to anticipate demand for a range of biological resources and services to respond to marine environmental, biological, and biotechnological research priorities of academic, governmental and industrial users in response to societal challenges.

Overall, we envisage continued and rising demand for a wide range of species in addition to full-blown models. As a consequence there is a requirement to maintain aquaria and culture facilities adjacent to a wide range of cold water, cool temperate and warm temperate ecosystems throughout Europe. There is increasing demand for developing aquaria capable of better simulating natural environments which will require further development work. EMBRC should help identify such facilities and promote their development with a view to addressing basic and applied research questions (impacts of marine renewables, climate change etc.).

Strategy Recommendations

1. **To incorporate the aquarium facilities** of existing ASSEMBLE members **within EMBRC** at SBR, and OOB (France), CCMAR (Portugal), SAMS (UK), Loven (Sweden) and SZN (Italy) into the new access program for EMBRC. To extend the offering of marine biological resources through the addition of EMBRC partners not currently in ASSEMBLE (AWI, MBA, OOV, SOI, and HCMR). AWI (Germany) provides a new capacity in the capture of polar organisms both Arctic and Antarctic and their long-term maintenance in specialist polar aquaria in Bremerhaven with associated access to experimental facilities. The MBA (UK) will provide specialist facilities for cephalopods, elasmobranch and osteichthian species and the SOI (UK) will provide large scale experimental facilities for research on sea mammals uniquely available in Europe. Associated satellite tag manufacturing facilities will enable behavioural and physiological data to be obtained by users in captive animals and in ecosystems. In addition it is proposed to further develop the inland marine facility at EMBL, Heidelberg which would be used as a test-bed for technological developments in completely recirculated systems derived from both the academic and commercial sectors.

An analysis of existing infrastructure carried out by WP4 has shown that in combination EMBRC has excellent and aquarium and associated experimental facilities for current needs (see also Fig. 2 D2.1). The majority of partners also have plans for the future development of their facilities to meet projected needs. Shared access will facilitate the evolution of capacity within Europe and gradually allow further specialisation at particular sites increasing the cost effectiveness of capital investment.

2. **To identify best practice** for aquarium and allied facilities and disseminate it throughout EMBRC so that the average standard of the infrastructure is raised. To achieve this goal EMBRC should enact the best practice guidelines for Biological Resource Centres developed by the Organisation for Economic Co-operation and Development (OECD) in 2007. The following areas should have priority:

- (i) Water quality standards including biological and non-biological filtration systems, pumping technologies and sanitation.
- (ii) Environmental control technology and automation systems, particularly the provision of electronic metadata to users.
- (iii) Biological security, including disease control, quarantine and containment of biohazards e.g. genetically modified organisms. The danger of inadvertent introduction of non-native species in new areas due to dissemination of marine organisms through research activities needs to be specifically addressed through strict control of discharged aquarium water.
- (iv) Developmental work to close the life cycle of high-demand organisms to facilitate their sustainable culture, the development of optimal culture conditions and nutrition, enacting methodologies to ensure the phenotypic and genotypic stability of cultured strains, and the duplication of key genetic resources in multiple sites in accordance with international guidelines.
- (v) Environmental standards particularly in relation to energy usage and waste water treatment.
- (vi) Staff-training and education in culture and husbandry techniques through EMBRC organised workshops.

The Aquaria and Culture Systems Working Group should be tasked with the organisation of periodic workshops on the above topics for professionals in the academic, governmental and commercial aquarium sectors under the auspices of the anticipated EU-funded access program which will follow ASSEMBLE. The reports arising from these workshops will provide guidelines for harmonisation of procedures and standards and for optimisation of technical solutions for aquaria, culture and related issues between the partners. Funding should also be requested under the ASSEMBLE follow-on program to carry out development work necessary to provide technical solutions to problems identified by the WG. Such development projects should be peer reviewed and competitive and involve third parties if required. For staff training funding should be identified to enable the secondment of staff for short visits in partner facilities to disseminate best practice and for knowledge transfer.

3. To co-ordinate and exchange information with related EU-funded programmes of marine biological resource provision, particularly MIRRI (microbial culture collections), AquaExcel (aquaculture resources), Mesocosm Access and LIFEWATCH to avoid duplication of effort and provide a seamless access of services by our user communities. This should involve the sharing of best practice for technical solutions by inviting technical officers from allied RIs to EMBRC organised workshops. We should work together to devise an access process which would allow applications to be diverted to the most appropriate RI. Such co-ordination is particularly important with respect to culture collections where EMBRC partners (SBR, SAMS and MBA, AWI) have important national collections of algae and protozoa. EMBRC should work with culture RIs (e.g. Mirri) to ensure the security of collections through the transfer of organismal cultures to additional sites.

4. To preserve biodiversity EMBRC should formally analyse the conservation requirements associated with on-site and off-line access to marine species as part of the application process to the infrastructure. Limitations should be put in place to ensure that removal of organisms from habitats is not excessive and conducted in the least invasive manner possible. This should also involve providing facilities and expertise to maximise local knowledge of the biology of available species through generating written documents and training a new generation of experts locally. Biological data should also be incorporated into a searchable database designed to provide information about the seasonable availability of key organisms in the partner Institutes, perhaps building on existing databases such as DASSH or MERLIN.

5. To promote best practice in animal welfare and ethics. Experimentation and welfare guidelines for cephalopods, chordates and vertebrates are already covered by extensive National and European legislation and are highly regulated. EMBRC needs to work with partner Institutes and national authorities to facilitate trans-border use of regulated facilities. This could involve help with meeting National license requirements through training and/or the identification of collaborators with license authority at the site of access. EMBRC should engage in a dialogue with the Animal Welfare and Ethics Committees in the partner Institutes or other bodies to identify minimum standards which would allow a common system of approval for non-regulated animal use throughout EMBRC.

6.3 'Omics Technologies Strategy Outline

Core Omics technologies, represented by genomics (DNA), transcriptomics (RNA), proteomics (proteins) and metabolomics (metabolites), are typified by high throughput analysis of molecular or biochemical classes. They represent some of the most powerful and widely used technologies in modern biology. This strategy report also considers Omics-associated technologies, including functional approaches (cell biology, electrophysiology, microscopy, NMR imaging and spectroscopy).

Omics approaches increasingly underpin advances in basic biology, biomedicine and biotechnology. Specific examples include exceptional advances in understanding of phylogenetic and evolutionary processes, developmental biology and signalling; Nobel Prize winning work with fluorescent proteins and their derivatives; antibiotics discovery and pharmaceutical development. Omics approaches also have the potential to unlock a deeper understanding of ecological and biogeochemical processes and to provide better resolution of information at all levels from the molecular to population. In the environmental sciences, metagenomics is bringing new understanding to microbial-dominated pelagic ecosystems and biogeochemical drivers. Coupling with the increasing availability of extensive physical, chemical and biological metadata offers the potential for extensive systems biology analyses of communities, ecosystems, and processes.

Many advances in biotechnology are underpinned by Omics technologies. The *ESF Marine Board Marine Biotechnology Strategy*¹ underlines the central role of Omics approaches as a basic toolkit for research. A key requirement is that through EMBRC access to organisms and extreme remote environments is improved. The potential of deep sea and polar biodiversity has yet to be exploited for omics models and biotechnological potential. Within Europe, there are well-established capabilities comprising research vessels, husbandry, organisms, access to ecosystems, mesocosms and long-term time series datasets that will underpin the potential of Omics. This is backed by considerable expertise in biochemistry, metabolism, physiology and ecology of marine organisms that is essential for understanding, interpretation, and annotation of genomes. Omics technologies are allowing scientists to diversify away from some of the well-established models to study organisms and systems that were not previously tractable but which potentially provide new models for ecology, genomics, biotechnology or the study of specific processes. At the same time Omics approaches are reinforcing the value of well-established model systems

A further significant driver for Omics technologies is the unparalleled growth in capacity for data gathering and analysis and decreasing costs of data acquisition and storage. A range of platforms for sequencing and analysis are accessible at national and international levels though there are no central European whole genome sequencing or metagenomics facilities. There are a number of national Omics facilities that serve partner organisations but these are not currently available to the EMBRC community as a whole. The majority of high-end sequencing platforms are not specifically marine-oriented². Omics-related facilities that provide functional analyses (e.g. microscopy, NMR imaging and spectroscopy, cell biology, culture collections, cryopreservation facilities) are often by necessity centre-specific and widely dispersed. There is a clear need for better provision of advice on where

¹ ESF Position Paper 15: Marine Biotechnology: A new vision and strategy for Europe.
www.esf.org/marineboard

² SB Roscoff has a dedicated marine proteomics/protein structure platform.

to go for the best or most appropriate service. EMBRC will need to develop agreements with European sequencing centres for potential access to 'omics platforms.

Policy drivers³ bring an increasing requirement to understand biodiversity, particularly in shelf and coastal regions. Omics technologies can play a key role in providing a better understanding of biodiversity, and providing evidence to assess ecological status.

There is a well-recognised and increasing dearth of expertise relating to bioinformatics analysis and biological interpretation of Omics data among European institutions. In particular there are increasing training needs in the areas of annotation, curation, assembly (including use of software tools⁴), genome structure and organisation and experimental design and statistics. Raising awareness of the problems of data analysis is a major challenge. There is also a perceived lack of integration of dispersed resources and an increasing need for standardization of collection and analysis. There is a lack of international data sharing agreements and a potential longer term problem relating to data transfer and storage which underlines the need for input into the development of the EMBRC e-infrastructure network.

In relation to environmental genomics, the substandard status of molecular taxonomy of marine organisms (especially microorganisms) is a brake to large scale metagenomics and environmental studies. Better integration between long term and historical datasets, biological resource centres and Omics repositories is needed. The potential of systems biology approaches in linking biological and biogeochemical processes at hugely different scales is under-developed. There is a pressing need for clarification of what support and infrastructure is required to realise the full potential of omics technologies.

Threats to the realisation of Omics potential are both omics-specific and generic. Specific threats include the potential diminishing of available human resources in this area and the danger that technology becomes obsolete faster than the training that is possible for the resource available. The most significant generic threats relate to current economic factors. National priorities for funding of research may shift at relatively short notice. There is a danger that national funding bodies may become less willing to support "overseas" Omics research and infrastructure developments.

Strategy Recommendations

Immediate Priorities:

- The co-ordination of Omics tools and capability throughout Europe and establishment of omics standards for design and analysis needs to be facilitated to provide a framework upon which Omics approaches will be developed throughout the infrastructure.
- The development of coordinated Omics data handling tools and expertise should be a priority of EMBRC.

³ List of key policy drivers: Marine Protected Areas, Marine Strategy Framework Directive. UK Marine Strategy, UK Marine Bill

⁴ e.g. Web-based tools such as Ensemble genomes at EMBL-EBI (ensemblgenomes.org).

Training:

- Dissemination of training tools is an urgent short- and long-term priority for Omics development throughout the EMBRC. This should be achieved by increased resources for training at all levels, including greater investment in training infrastructure within EMBRC.
- Training in data handling and analysis (curation, assembly (including use of software tools), genome structure and organisation and experimental design (including arrays, RNA sequencing) and statistics) should be prioritised over data generation in the immediate and medium terms.
- The convergence of requirements between EMBRC and EuroMarine for immediate emphasis on training needs to be acknowledged through close integration and alignment of training programmes, particularly during the development of the EuroMarine strategy.
- Training should be linked with continuous Professional Development (CPD) to maximise retention of trained personnel and career development.
- A wide range of training schemes and programmes should be implemented to address the different requirements of functional, environmental⁵ and “meta” Omics approaches.⁶

Platforms:

- The availability of centralised Omics platforms that provide outsourced services for large scale sequencing needs to be considered in the development of Omics facilities for the EMBRC community. The cost-effectiveness of maintaining marine-specific or centre-specific facilities of this nature should be assessed in the face of rapidly changing technology and the increasing numbers of commercial and centrally-funded facilities at an international level. While the benefits of “complete” marine Omics facilities should not be discounted, lower priority should be given to the construction of large scale Omics facilities, such as new whole genome sequencing centres specifically for marine research.
- Priority should be given to specific centres for infrastructure and expertise where appropriate for specialist Omics-related capability. Examples include analytical facilities⁷, electron

⁵ Environmental genomics requires a range of particular analysis approaches (e.g. meta transcriptomes, barcoding)

⁶ e.g. Annotation marathons; in-house training; advanced residential practical and theoretical workshop series; EMBO workshops, ASSEMBLE workshops; Masters courses

⁷ Acknowledging that considerable capability for biochemical purification is available through commercial and other organizations and that many analytical facilities (e.g. isotope analysis) do not need to be specifically marine

microscopy, micro-CT tomography, protein biochemistry and construct preparation⁸. It is acknowledged that facilities for live cell imaging generally need to be centre-specific. However, high-end live cell imaging is costly in terms of capital investment and this will necessitate that core facilities be sited in specific locations.

- A priority for EMBRC will be to facilitate access to large-scale purification and analytical facilities. As a first step, comprehensive information on the availability of relevant facilities should be assembled through a framework for knowledge transfer from existing Omics facilities and establishing EMBRC links and access agreements.

Communications and technology transfer:

- As part of a communications strategy, Omics developments within the EMBRC need to be underpinned by appropriate links and partnerships within and beyond the EMBRC.
- As a matter of urgency, The EMBRC Omics community should establish dialogue with national funding bodies to set priorities for marine Omics infrastructures and programmes in the marine sciences through national roadmaps and strategic priorities.
- EMBRC should develop agreements with major sequencing centres and marine Omics-relevant organisations that facilitate access for Omics projects (e.g. Sanger, Illumina Centre, Tara Oceans, Norwich, JGI, Genoscope, Genome Standards Consortium).
- Establish and maintain strong links with WP3 and the developing e-infrastructure.
- Improve communications, through reciprocal attendance at workshops etc., with other ESFRI infrastructures that have relevant Omics strategies (ELIXIR, EuroBioImaging).
- At the European level, establish close dialogue with the Innovation strategy of EuroMarine as well as with other FP7 programmes (e.g. Marine Genomics for Users (MG4U)) for knowledge transfer between partners and potential users.
- Communication with the technology translation departments of all ppEMBRC partners needs to be established to ensure seamless service provision.

⁸ e.g. RNAi libraries, the ability to generate and test libraries for transgenic approaches might be helpful to boost the development of individual model species, e.g. genome/transcriptome wide RNAi libraries or zinc-finger nuclease libraries.

6.4 Mobility of Researchers and Users Access Strategy Outline (ASSEMBLE to EMBRC)

The current landscape of Marine Stations

The need to access diverse marine organisms for research has stimulated construction of marine biological research stations around the European coast for more than 125 years. These have developed, largely independently, into world-class facilities. Taken together, these stations represent a critical mass of infrastructure and human resources that have a significant influence on marine research. To optimise the provision of service to in the life sciences to the European research community, the distributed and national marine stations have developed international cooperation strategies.

Networks of Excellence, notably Marine Genomics Europe, MarBEF and Euroceans have paved the way for 13 infrastructures such as ASSEMBLE. ASSEMBLE is an EU FP7 access to research infrastructure initiative comprising a network of marine research stations with sites across Europe as well as in Israel and Chile (www.assemblemarine.org). The fundamental objectives of ASSEMBLE are to enhance trans-national access to existing key infrastructures for marine sciences and to improve these infrastructures with respect to the provision of marine model organisms. By fostering user access EMBRC is the logical follow-up of ASSEMBLE, EMBRC will go significantly further in improving the entire research infrastructure and services provided 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.

ASSEMBLE is currently the main infrastructure for providing mobility of researchers in marine biology across Europe. During the ASSEMBLE programme best-practise guidelines have been developed to streamline the application procedure. EMBRC will inherit the experience and procedures in place with ASSEMBLE ensuring immediate implementation and efficient management by the EMBRC partnership from the beginning. ASSEMBLE provides the current best practice model to manage and provide access to the infrastructure sites within EMBRC. The key elements that have been identified as potentially transferable to EMBRC from ASSEMBLE are listed below:

Strategy Recommendations

1. On-line application system: a single entry point for users and administrators

A single entry point for users and administrators should be used to coordinate and optimise information, application systems and access mechanisms for both remote and/or on-site access. The online system will be monitored by EMBRC Central Headquarters who will co-ordinate the evaluation of applications. Centralisation of the administrative processes will increase the speed at which applications can be processed and increase the number of visits possible to EMBRC infrastructures.

Using this online system, users can apply for access to various infrastructure types and platforms available at partner institutes (laboratories, research vessels, field stations, field sites, etc), use it to

report achievements, to confirm the amount of access delivered, and to report publications resulting from the type of access.

2. On-site liaisons officers

Guests to EMBRC facilities should be supported by local contact persons. Local experts may give advice on experimental design in relation to the local environment, but also supply support with facilitating local permits for sampling and experimental procedures. These liaisons officers should be appointed during the construction phase and should either be members of staff or a person fully employed by EMBRC at the station.

3. Continuous improvement and harmonisation

It is recommended that EMBRC organises advanced training and workshops mainly for technical and administrative staff to harmonise techniques and services related to on-site access, remote access, animal transportation and handling of organisms and samples. The outcomes of such workshops should be included in EMBRC technical reports to be shared widely amongst nodes and visitors.

4. Outreach and advertisement

In order to provide a fast and effective over-view of available services it is important that EMBRC advertise and list the services and types of access provided at each node. This, along with the EMBRC service database (see WGI strategy paper “Establishing an EMBRC Service Database”) will be accessible on the EMBRC website. Summaries of approved projects will also be available through the website allowing potential applicants to gain an overview of the potential of EMBRC. Descriptions of the terms and conditions of access should be accessible online (see report D10.1). Finally, as part of the advertisement and promotion it should be highlighted that users may apply for access and multiple stations in an application, whether this be for using different platforms and facilities or for accessing and/or sample collection of multiple sites/habitats.

How can EMBRC learn from ASSEMBLE?

A workshop will be required early in the construction phase of EMBRC to enable non-ASSEMBLE partners in ppEMBRC to gain an understanding of how the access mechanism works and for the ASSEMBLE partners to pass on their experience. A further objective of this workshop will be to ensure inter-operability across all EMBRC partners in regard to on-site and remote access procedures. In addition, non-ASSEMBLE EMBRC partners should be invited to attend ASSEMBLE workshops during the EMBRC’s preparatory phase to gain insight into how these issues are dealt with in ASSEMBLE today.

Summary

EMBRC should adopt and use the following access mechanisms and procedures for on-site and remote access, that have been developed in the ASSEMBLE programme.

- On-line application system, a single entry point for administrators and applicants.
- Identified local support person(s) should accompany on-site visitors through the various stages of the process including the visit.

Operational workshops with administrative and technical personnel are advisable for continuous improvement and harmonisation of procedures.

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