This project has received funding from the *European Union's Horizon 2020 research and innovation programme* under grant agreement No 727453

Coordination and Support Action

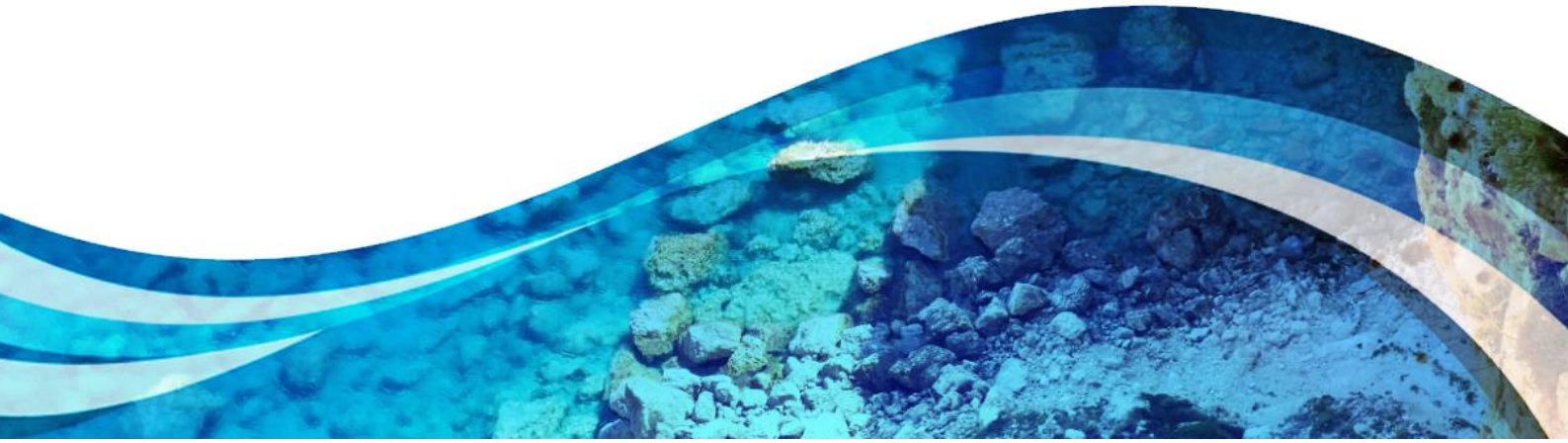
Horizon 2020 - BG-13-2016
Grant Agreement 727453

"Research Infrastructure Assessment"

D3.3

Due date of deliverable: 30-09-2017
Actual submission date: 30-10-2017

Author: Authors: Nicolas Arnaud, Jean-François Cadiou, Margherita Cappelletto, Aurélien Carbonnière, Branko Čermelj, José Ignacio Diaz, Elisabeth Kohler, Vlado Malačič, David Gonzalez Martinez, Laurent Mortier, Behzad Mostajir, Nikos Papandroulakis, Charlotte Restif, Francesco Salvatore, Carlos García Soto, Abraham Trujillo, Georg Umgiesser



Project Full title	BLUEMED		
Project Acronym	BLUEMED		
Grant Agreement No.	727453		
Coordinator	Fabio Trincardi - CNR (Italy)		
Project start date and duration	01-10-2016 (48 months)		
Project website	www.bluemed-project.eu		
Deliverable Nr.	D3.3	**Deliverable Date**	30-10-2017
Work Package No	3		
Work Package Title	Framework conditions		
Responsible	CNRS/Ifremer		
Authors & Institutes Acronyms	Nicolas Arnaud (CNRS) Jean-François Cadiou (Ifremer) Margherita Cappelletto (CNR) Aurélien Carbonnière (Ifremer) Branko Čermelj (NIB) José Ignacio Diaz (IEO) Elisabeth Kohler (CNRS) Vlado Malačič (NIB) David Gonzalez Martinez (MINECO) Laurent Mortier (LOCEAN) Behzad Mostajir (CNRS) Nikos Papandroulakis (HCMR) Charlotte Restif (CNRS) Francesco Salvatore (CNR) Carlos García Soto (IEO) Abraham Trujillo (AEI) Georg Umgiesser (CNR)		
Status:	**Final (F)**	●	
	Draft (D)		
	Revised draft (RV)		
Dissemination level:	**Public (PU)**	●	
	Confidential, only for members of the consortium (CO)		

CONTENTS

Executive summary / Abstract

In order to achieve BLUEMED's objectives identified in the SRIA, research infrastructures (RI) are key. BLUEMED aims to promote a roadmap for the deployment of research infrastructures that will be delivered in November 2019. The deliverable D3.3 will first make a preliminary study and assessment of existing research infrastructures, to identify needs and gaps and suggest actions to be taken to propose the final roadmap to high level policy makers. Five categories of RI have been identified and investigated: research vessels and equipment, marine based facilities, land based facilities, satellites and spatial and marine data management. For each one of these categories, existing infrastructures will be identified, as well as related literature and web links of projects and initiatives. A gaps analysis and further steps will be developed, following by a table connecting BLUEMED SRIA's priorities to identified research infrastructures.

Scope

This Research Infrastructures Assessment refers to the Task 3.2 of the CSA BLUEMED and aims to verify whether marine and maritime Research Infrastructures (RI) in the Mediterranean relevant for the SRIA goals already exist or should be upgraded or built, and whether existing RI are satisfactory shared. The deliverable will assess their potential and needs, and provide recommendations for their future development and optimized use. This Task is one of the key challenges for the implementation of the BLUEMED SRIA. This Research Infrastructures Assessment will focus especially on:

- Identifying and profiling existing Mediterranean marine and maritime Research Infrastructures
- Observing systems and operational oceanography capacities dedicated to both open ocean and coastal zones (surface and underwater technologies and prototyping)
- Experimental ecology and valorization of biological resources, ecosystem services and biotechnology, health and marine system, deep-sea exploration
- Trans-national access, interoperability and data management and standards

Table of acronyms

AUV: Autonomous Underwater Vehicle
CNES: Centre national d'Études spatiales (French national space studies center)
CSA: Coordination and Support Action
ESA: European Space Agency
ESFRI: European Strategy Forum on Research Infrastructures
HF: High Frequency
IR: Infrared
MRE: Marine Renewable Energy
NASA: National Aeronautics and Space Administration
RI: Research Infrastructure
ROV: Remotely Operated Vehicle
SRIA: Strategic Research and Innovation Agenda

TNA: Trans-National Access
TRL: Technology Readiness Level

Introduction

BLUEMED is a European project (Coordination and Support Action-CSA) for coordination of marine and maritime research and innovation activities in the Mediterranean. The BLUEMED initiative offers a shared strategic framework for working towards a healthy, productive and resilient Mediterranean Sea that is better known and valued. The BLUEMED project aims at boosting Blue Growth in the Mediterranean by promoting the concrete and operational implementation of the BLUEMED Strategic Research and Innovation Agenda (SRIA), converting its 12 key challenges into actions. BLUEMED is the result of joint efforts by Cyprus, Croatia, France, Greece, Italy, Malta, Portugal, Slovenia and Spain, with the support of the European Commission.

In order to achieve BLUEMED's objectives, research infrastructures (RI) are key. BLUEMED will thus promote a roadmap for the deployment of research infrastructures, testing first on a preliminary study and assessment of existing research infrastructures, to identify needs and gaps. Research infrastructures are expensive to establish, develop and maintain and it is necessary to think their use and development in a cost-effective way to guarantee best possible investments and common strategic decisions.

Mediterranean Research Infrastructures have been sorted into five categories of infrastructures, based on the structure recommended in the Deliverable 10.1 *Short bibliography on MRIs*, from the project "The Atlantic: our shared resource – Making the vision reality". These five categories and their definition are the following:

1. Research vessels and equipment: for sea access and deep sea exploration/sampling
2. Marine based facilities: structures for seawater and seabed monitoring and observation, offshore in sea water testing laboratories, including in situ platforms, marine test facilities and in situ observing systems
3. Land based facilities: aquaculture (including production of micro-algae and by-products), onshore platforms/renewable energy (towing tank, wave basin), shipping (different from towing tank), harbors, coastal basin, ballast water management, mesocosms, land based test facilities and basins, observation systems including HF radar facilities
4. Satellites and spatial: remote sensing for sea-surface monitoring
5. Marine data management: structures for data validation, storage and dissemination through web portals

The BLUEMED Research Infrastructure Workshop organized in La Seyne-sur-Mer, France, on 3 and 4 July 2017, set the scene for the structure of this deliverable. 40 experts from 13 Mediterranean countries, including non-EU countries, gathered and drafted the first conclusions on marine and maritime research infrastructures. The list of participants of the workshop is attached in Annex 6. Experts worked in small groups according to commonly predefined list of five major categories of infrastructures. They worked on the links between existing or foreseen infrastructures and the key priorities of the SRIA (Annex 1 to 5 *Table with SRIA priorities*, one table for each five categories of infrastructures) exploring locks and best ways to share and sustain RIs especially through Trans-National Access activities (interaction with WP2).

The five tables show the links between main existing or foreseen listed infrastructures (vertical) and the 12 BLUEMED SRIA key priorities (horizontal).

There are 3 matching levels:

- 1 - the infrastructure is partly matching the key priority;
- 2 - the infrastructure is matching the key priority; and
- 3 - the infrastructure is fully matching the key priority.

Vertically, the sums of each "match" show the high or low correlation between the SRIA priority and the category of infrastructures. Horizontally, the sums of each "match" show the high or low correlation between each listed infrastructures and each SRIA priorities.

1-Research Vessels and equipment

a) Existing infrastructures and key points

The fleet of research vessels and underwater vehicles operating in the Mediterranean Sea includes a large variety of vessels and vehicles. Research vessels include ships of very different lengths, from oceanic class vessels operating only part of their ship time in the Mediterranean to coastal vessels with year-long operation in one of its sub-basins. Underwater vehicles include manned submersible, ROVs (Remotely Operated Vehicles) and AUVs (Autonomous Underwater Vehicles), or USV (Unmanned Surface Vehicles). Most of these infrastructures are owned by few European countries: Croatia, France, Greece, Italy, Spain… However, Mediterranean non-EU countries are also equipped with research vessels. In Morocco for example, the INRH (Institut national de Recherche halieutique - National Institute for Fishery Research) has two vessels: one oceanographic, another for trawling, and the INRH is planning on getting a third vessel. The CANA vessel, operated by the National Council for Scientific Research of Lebanon (CNRS-L), is the result of the cooperation between Italy and Lebanon. Turkey has vessels that can operate both in the Mediterranean Sea and in the Black Sea. Israel has recently acquired a multipurpose research vessel of medium to oceanic class.

Besides infrastructures per se, European programs have been developed to coordinate, structure and enhance collaboration between countries and research vessels. Here below are some of the networks that are enhancing this collaboration.

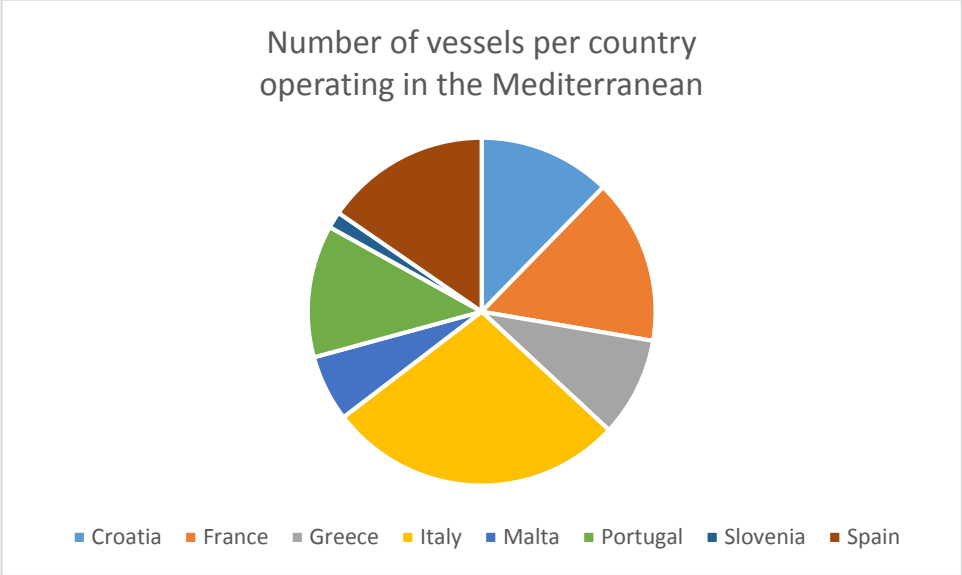
The European project EUROFLEETS, *Towards an alliance of European research fleets*, was launched in 2009. With 24 partner organizations from 16 EU countries or associated countries, the main objective of the project is to establish a coordination within European research vessels. Access is the core issue of the project, aiming to provide an easier access to research vessels for European scientists working in all fields of marine science, including environmental and biodiversity protection, coastal zone management, geodynamics and climate change research. EUROFLEETS also includes access to a large diversity of equipment like ROVs. Only excellent scientific projects are funded by EUROFLEETS. The data produced during cruises are available in open access. At least two partners from two different countries must be involved in the demand for ship time. Training of young scientists is encouraged.

ERVO *European Research Vessels Operators* is a network created in 1999 to manage the fleets in Europe. It fosters networking and exchanges of good practices, cooperation and standardization. 18 countries are participating: Belgium, Bulgaria, Denmark, Finland, France, Germany, Iceland, Ireland, Italy, the Netherlands, Norway, Poland, Portugal, Romania, Spain, Sweden, Turkey and the United Kingdom.

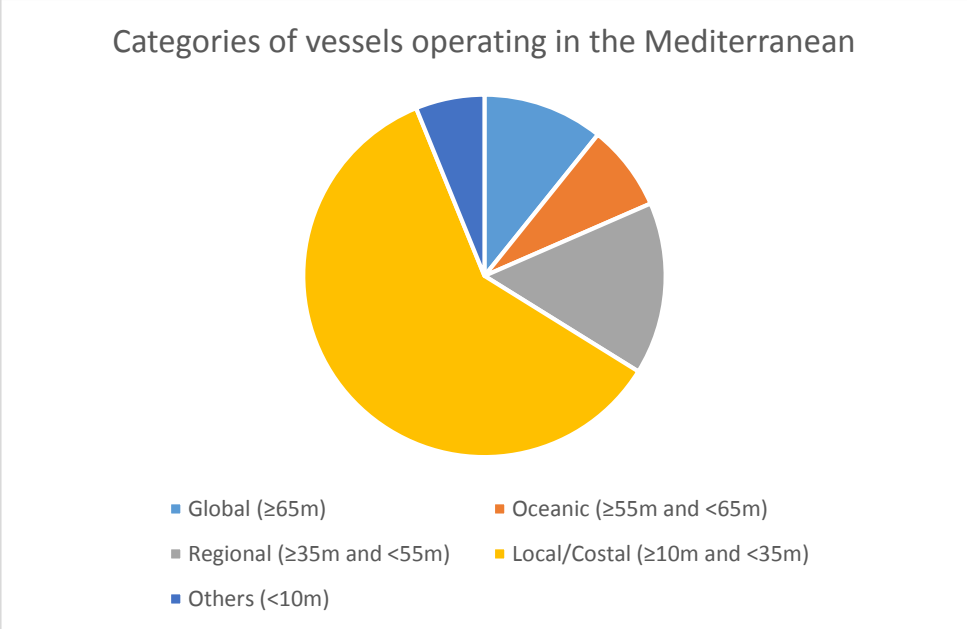
OFEG *Ocean Facilities Exchange Group* was established in 1996 in order to facilitate ship time exchanges between the fleets of France, Germany, the Netherlands, Norway, Spain and the United Kingdom. Ifremer is a member of OFEG. In 2006, CSIC (Consejo Superior de Investigaciones Cientificas, Spain) joined the group.

EurOcean *European Research Vessels Infobase* is a database of all European research vessels operating in the world. Annex 7 (page 44 of this document) is a table with

EurOcean listed vessels operating in the Mediterranean owned by one of the BLUEMED CSA countries. According to EurOcean, among the vessels listed in this database that are operating in the Mediterranean, 8 belong to Craotia, 10 to France, 6 to Greece, 18 to Italy, 4 to Malta, 8 to Portugal, 1 to Slovenia and 10 to Spain.



According to EurOcean, among the vessels listed in this database that are operating in the Mediterranean and owned by one of the BLUEMED CSA countries, 7 are global, 5 oceanic, 10 regional, 39 local/coastal and 4 others.



Research vessels operated by public or private foundations, or even by private companies, are also operating in the Mediterranean. They can perform very advanced scientific research (e.g. the Tara Oceans project of the Tara Expeditions Foundation) as well as public awareness activities dedicated to burning scientific or environmental

issues such as microplastic pollution. Most of these foundations use their vessel to support well-established ocean literacy and outreach policies.

Literature and Webography for Category 1: Research vessels and equipment

- *Marine Research Infrastructures updated overview, European integration and vision for the future-Research vessels and their underwater vehicles*, WP7 D7.4.1_2, Author: Ifremer (France), October 2012, Seasera Programme "*Towards integrated European marine research strategy and programmes*"
- *Marine Research Infrastructures updated overview, European integration and vision for the future*, WP4 D4.1.1, Author: Ifremer (France), Milestone M4.1.1, October 2012, Seasera Programme "*Towards Integrated European marine research strategy and programmes*"
- *Marine Research Infrastructures updated overview, European integration and vision for the future-Executive summary*, WP7 D7.4.1_1, Author: Ifremer (France), December 2012, Seasera Programme "*Towards Integrated European marine research strategy and programmes*"
- *Short bibliography on MRIs,* Deliverable 10.1, Authors: Aurélien Carbonnière, Jean François Masset (Ifremer, France), WP10 of *The Atlantic, our shared resource – Making the vision reality*
- *MRIs common management guidelines for joint research activities,* Author: Ifremer (France), WP4, D4.2.1, March 2013, Seasera Programme "*Towards Integrated European marine research strategy and programmes*"
- ERVO: *European Research Vessels Operators*
Website: http://www.ervo-group.eu/np4/home
- EUROFLEETS (2009-2013) and EUROFLEETS 2 (2013-2016): *New operational steps towards an alliance of European research fleets*
Website: http://www.eurofleets.eu/np4/home.html
- European Research Vessels Infobase
Website: http://www.rvinfobase.eurocean.org/
- OFEG: *Ocean Facilities Exchange Group*
Website: http://www.ofeg.org/
- Vessel tracker
Website: http://www.vesseltracker.com/en/Vessels/Home.html

b) Gaps analysis and further steps

At European scale, there is a will to better coordinate research vessels. Some European coordination organizations of research vessels already exist, like Eurofleet, ERVO and OFEG. As there are big differences in fleet operation mechanisms among countries, it is important to promote exchanges within these groups for setting realistic schemes of cooperation. As research vessels and equipment are expensive, coordination is important in order to reduce costs of cruises. There is a benefit to share facilities (vessels, large equipment…) because ship cost per day decreases if the ship is running regularly throughout the year. Additional running cost is mainly fuel; crew and maintenance has to be paid even if the ship is not running. International cooperation and coordination is needed for a better use of the already existing infrastructures and will benefit to the most.

Furthermore, ships are used sometimes for multipurpose goals like research cruises and for monitoring. The collected data is also used sometimes for both purposes. In this case, coordination is needed between all stakeholders. Moreover, due to jurisdictional issues, scientific cruises do not have access in practice to the whole Mediterranean basin. For example, Egyptian and Algerian territorial waters and Exclusive Economic Zone or Fisheries Protection Zone are hardly accessible for scientific research by other countries. International cooperation within the BLUEMED framework can help to solve the issue of access permission in waters under national jurisdictional regimes.

The Mediterranean Region is also used by National Navies from many countries, including NATO countries, for naval surface or underwater exercises. This can introduce access limitation to exercise zones to avoid collision. Best practices or specific technical devices to ease the clearance process for research cruises should be encouraged, as the present one is particularly complex.

Data produced during cruises is also a key issue. Given how expensive those cruises are one should ensure the largest use of the collected data. It is important to consider the whole process around data (collection, archiving, ownership, access…). Common rules should be defined to regulate this process and to enhance and promote open access data. European countries are now committed to open policies by the INSPIRE directive which has favored in last year a lot of projects to enhance this process, such common rules should be used or adapted if necessary to allow similar commitments from non-EU countries. A specific effort to hire and train more technicians and engineers to implement this process in a coherent manner in all Mediterranean countries is also needed.

One issue at stake is to better share information on scientific campaigns and activities and to optimize operations. BLUEMED could encourage further thinking about the development of a global coordination for research vessels, “Voluntary Observing Ships (VOS)” or “Ship of Opportunity” (SOP) at the Mediterranean scale. Such VOSs or SOPs programmes (see for example the JCOMM Ship-of-Opportunity Programme, an international programme from the World Meteorological Organization and UNESCO International Commission on Oceanography) are excellent example of win-win and cost-effective cooperation between research and private sector. At Mediterranean level, the FerryBox project, being part of the EuroGOOS network, is organizing various ship routes across the sea, running regularly between different European and non-EU countries. An interactive map shows information on research centers using the collected data and the GPS Data of every ship route can be downloaded directly from the website. BLUEMED should liaise with the organizations that are active for such type of observations to create relevant synergies and give them access to the appropriate decision level and partners, such as maritime associations of ship owners.

To conclude, BLUEMED can work very practically on the ways to experiment fleet time-sharing and transnational access to vessels via some pilot projects, and facilitate the access across regions for research purposes. A system based, at the beginning, on exchanges of “time token” instead of fluxes of money could enhance exchange and best use of ship time and/or large equipment. At high level, stakeholders should work on conditions that limit access to waters under national jurisdictions to try to obtain political agreements at the highest level to get an easier access for scientific cruises.

This project has received funding from the *European Union's Horizon 2020 research and innovation programme* under grant agreement No 727453

Annex 1: Table with SRIA priorities

	BLUEMED priorities												
Infra-structure name	Mediter-ranean Sea ecosystems: services, resources, vulnerability and resilience to natural and anthropo-genic pressures	Mediter-ranean Sea dynamics: developing services in the field of sustainable adaptation to climate change and plans for mitigation	Hazards and the protection of coastal areas in the Mediter-ranean	Innovative businesses based on marine bio-resources in the Mediter-ranean	Ecosystem-based manage-ment of Mediter-ranean aqua-culture and fisheries	Sustainable tourism in the Mediter-ranean	Maritime clusters in the Mediter-ranean	Maritime Spatial Planning and Integrated Coastal Zone Mana-gement in the Mediter-ranean	Smart, greener maritime transport and facilities in the Mediter-ranean	Observing systems and operational oceano-graphy capacities in the Mediter-ranean	Multi-purpose offshore platforms in the Mediter-ranean	Marine and coastal cultural heritage in the Mediter-ranean: discovering, protecting and valuing	Total
Oceanic Research vessel	1		1	1			1			1		1	**6**
Coastal Research vessel	1	1	1	1	1	1	1	1		1	1	1	**11**
Underwater vehicles	1		1	1	1	1	1	1		1	1	1	**10**
Total	**3**	**1**	**3**	**3**	**2**	**2**	**3**	**2**	**0**	**3**	**2**	**3**	

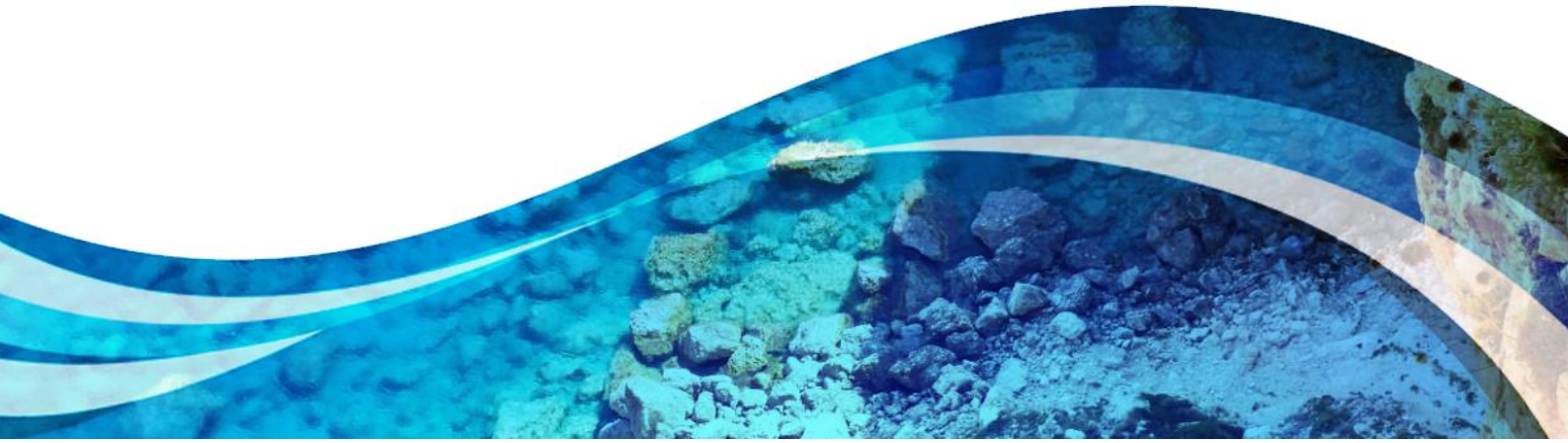
This project has received funding from the *European Union's Horizon 2020 research and innovation programme* under grant agreement No 727453

2- Marine based facilities

a) Existing infrastructures and key points

Marine based facilities mostly concerns observing platforms and observing systems. Other marine based facilities – mostly coastal and offshore platforms and test sites – are also considered here, as they can offer a wide variety of services in relation with the needs of industrials for the blue economy.

The need for a European integrated observing system (coastline, river and lagunas observing systems are also considered here) has already been taken into account by many countries. Many projects of observing systems and forecasting initiatives emerged and are progressively developed, from regional to international scale. Several European networks of observation systems have been established, composed with diversified observing structures, aiming to make the most of this network of heterogeneous structures, to boost ocean observation and to better address environment issues and societal needs. Other thematic observing networks (e.g. for biological observations) exist, in general on a simple voluntary basis with only limited governance rules. However, they are now evolving for an integration into the more structured ones, sharing thus common functionalities like data management or analytical facilities. In the ESFRI framework, EuroArgo and EMSO now plays a central role in the Mediterranean for profiling floats (EuroArgo) and fixed point bottom and water column (EMSO) open ocean observation. At Mediterranean level, the ANTARES infrastructure, located in the Ligurian Sea 42km from land, is a good example of multidisciplinary marine platforms and is used for geosciences and marine environmental sciences. DANUBIUS-RI and eLTER-RI project, apart from observational and analytic facilities, a thematic node is working on the coordination of modeling activities that are carried out in the transitional areas like estuaries, deltas and coastal lagoons. The Mediterranean Operational Network for the Global Ocean Observing System (MONGOOS) has been created in 2012 and is part of the global pan-European observation system EuroGOOS. MONGOOS has developed broad expertise in operational and processed based modeling.



Bilateral initiatives between two Mediterranean countries were also established, for example the joint observatory between France and Lebanon O-LIFE that aims to study water resources, biodiversity, natural hazards, management of the marine and terrestrial environment and land use around the Mediterranean.

Apart from observation, marine platforms can also support various uses for sea exploitation, operational monitoring or the implementation of in situ testing systems. Multi usage settlements must be developed to achieve platforms boarding monitoring systems, aeolian or hydrolian energy production, aquaculture. Such multi usage platforms could also offer services for increased biodiversity protection/production, or even test chambers for various kinds of maritime technologies. Some projects have already tested this concept (e.g. the FP7 TROPOS project) and pilot settlements have been opened.

Literature and Webography for Category 2: Marine based facilities

- Strategy for an Integrated Ocean Observing System in the Mediterranean and Black Sea, The « *Kostas Nittis scientific and strategic workshop* » vision document
- ANTARES
Website: http://www.fixo3.eu/observatory/antares/
- DANUBIUS-RI: *The International Center for Advanced Studies on River-Sea System*
Website: http://www.danubius-ri.eu/
- E-AIMS (2013-2016): *Euro-Argo Improvements for the GMES Marine Service*
Website: http://www.euro-argo.eu/EU-Projects-Contribution/E-AIMS
- EMSO (ESFRI project since 2006, EMSODEV (2015-2018), EMSO ERIC since 2013): *European Multidisciplinary Seafloor and water column Observatory*
Website: http://www.emso-eu.org/
- EUROARGO-RI
Website: http://www.euro-argo.eu/
- EurOcean, European Center for Information on Marine Science and Technology
Website: http://www.eurocean.org
- EuroGOOS: *European Global Ocean Observing System*
Website: http://eurogoos.eu/
- FIXO3 (2013-2016): *Fixed point Open Ocean Observatory*
Website: http://www.fixo3.eu/
- GROOM (2011-2014): *Gliders for Research, Ocean Observation and Management*
Website: http://www.groom-fp7.eu/doku.php?id=start
- JERICO (2011-2015) and JERICO NEXT (2015-2019): *Joint European Research Infrastructure network for Coastal Observatory – Novel European eXpertise for coastal observaTories*
Website: http://www.jerico-fp7.eu/
- MARINERGI (2017-2019): Planning an Integrated European Research Infrastructure
Website: http://www.marinerg-i.eu/
- MaRINET (2011-2015): *Marine Renewables Infrastructure Network*
Website: cordis.europa.eu/projects/rcn/98372_en.html
- MaRINET-2 (2017-2021): *Marine Renewables Infrastructure Network for Enhancing Technologies - 2*
Website: http://www.marinet2.eu/
- Hydralab+ Adaption for Climate Change
Website: www.hydralab.eu

- MedSeA: *Mediterranean Sea Acidification in a changing climate*
Website: http://medsea-project.eu/
- MERMEX (2007): *Marine Ecosystems Response in the Mediterranean Experiment*
Website: http://mermex.pytheas.univ-amu.fr/
- MONGOOS: *Mediterranean Oceanography Network for the Global Ocean Observing System*
Website: http://www.mongoos.eu/

b) Gaps analysis and further steps

One of the points that springs into mind is the still restricted integration of modeling facilities into observational networks. Modeling allows for the spatial and temporal integration of observations and is therefore indispensable for supplementing and optimizing the observational network. A common strategy is needed, together with private sector and research community, in order to achieve sustainability of long-term series of observations.
One of the points that springs into mind is the nearly missing common strategy between the private sector and research community. The private sector is an important provider of data that are in general collected locally for a given purpose without long-term perspective. Such data could be greatly valorized thank to the existing CMEMS services. CMEMS provide open ocean and regional models suitable to give boundary conditions to local models. Such strategy can allow for the spatial and temporal integration of observations offering such much higher value services.

Furthermore contamination in the Mediterranean Sea is a major issue. One of the challenges to tackle this issue is appropriate and up-to-date data and information on existing and emerging new pollution. Most of the existing observing networks collect the so-called “essential ocean variables” (sea level, temperature, sea colour, water quality, waves and winds, nutrients…) which are oriented for operational oceanography and research. They do not share their marine based facilities as they could do with adequate sensors for contamination that are now on the shelf or being developed. BLUEMED could help improve this situation and propose to work on coordination for join collection of essential variables and contamination data and data sharing on this key issue. BLUEMED could also participate in the efforts for a better dissemination of already existing and available data.

Moreover BLUEMED could improve knowledge by developing new observing systems dedicated to biology and contaminants and by adapting existing ones. This could help the process and go one-step further towards the definition of a larger set of key “Ocean parameters” that are more suitable to the SRIA objectives: sea level, temperature, sea colour, water quality, waves and winds…

Finally multi-purpose platforms development must be favored. BLUEMED should promote all kinds of early exchanges between stakeholders whenever a new platform is foreseen in order to enhance efficient platform conception and sharing to allow coherent integration of stakeholders’ own objectives.

This project has received funding from the *European Union's Horizon 2020 research and innovation programme* under grant agreement No 727453

Annex 2: Table with SRIA priorities

Infra-structure name	BLUEMED priorities												
	Mediter-ranean Sea ecosystems: services, resources, vulnera-bility and resilience to natural and anthropo-genic pressures	Mediter-ranean Sea dynamics: developing services in the field of sustainable adaptation to climate change and plans for mitigation	Hazards and the protection of coastal areas in the Mediter-ranean	Innovative businesses based on marine bio-resources in the Mediter-ranean	Ecosystem-based management of Mediter-ranean aquaculture and fisheries	Sustainable tourism in the Mediter-ranean	Maritime clusters in the Mediter-ranean	Maritime Spatial Planning and Integrated Coastal Zone Management in the Mediter-ranean	Smart, greener maritime transport and facilities in the Mediter-ranean	Observing systems and operational oceano-graphy capacities in the Mediter-ranean	Multi-purpose offshore platforms in the Mediter-ranean	Marine and coastal cultural heritage in the Mediter-ranean: discovering protecting and valuing	Total
SOCIB, ES						2		2		3		2	**9**
IEO/Observing systems, ES		2	1		1		1				1		**6**
PDE, ES								2	2	3			**7**
MOOSE, FR	2	2						2		3			**9**
ILICO	2	2	1					2		3			**10**
Euro-Argo/Med-Argo, FR/IT										3			**3**
EMSO (+ National IR)/ FixO3		2	2							3			**7**

Network of Marine stations (MARS), EMBRC, EU	2												**2**
JERICO Next, EU			2	1						3			**6**
RitMare, IT	1			1				2		3			**7**
CMCC	1	3								1			**5**
C3S		3											**3**
Adriatic projects	1			1						3			**5**
Poseidon system, GR										3			**3**
ERABEACH project, GR			2										**2**
METU, TK	1	1								3			**5**
MERCI, IL			2							3			**5**
LMI, Tunisia, FR			2	1									**3**
INSTM/INAT, Tunisia	1									2			**3**
SOMBA, Algeria										2			**2**
INRH, Morocco	1				1					1			**3**
University of Malta			1			1		1		3			**6**
OC-UCY										2			**2**
Cyprus Institute	2	1											**3**
Platform - sea-floor observatory, CS NET, CY											1		**1**
CIESM Observing programme	1	1	1							1			**4**
ENVRI +, EU	1	1	1							1			**4**
ICOS, EU	1									1			**2**

IOC tsunami network			2										**2**
DANUBIUS, EU	2	2	2					1		1			**8**
ShareMed, EU			2										**2**
MONGOOS	1	2	1				2		3	2			**11**
MerluMed project/GMOS			1										**1**
IPMA, PT			1							3		1	**5**
LifeWatch, EU	1			1		1							**3**
Total	**21**	**22**	**24**	**5**	**2**	**4**	**3**	**12**	**5**	**56**	**2**	**3**	

This project has received funding from the *European Union's Horizon 2020 research and innovation programme* under grant agreement No 727453

3- Land based facilities

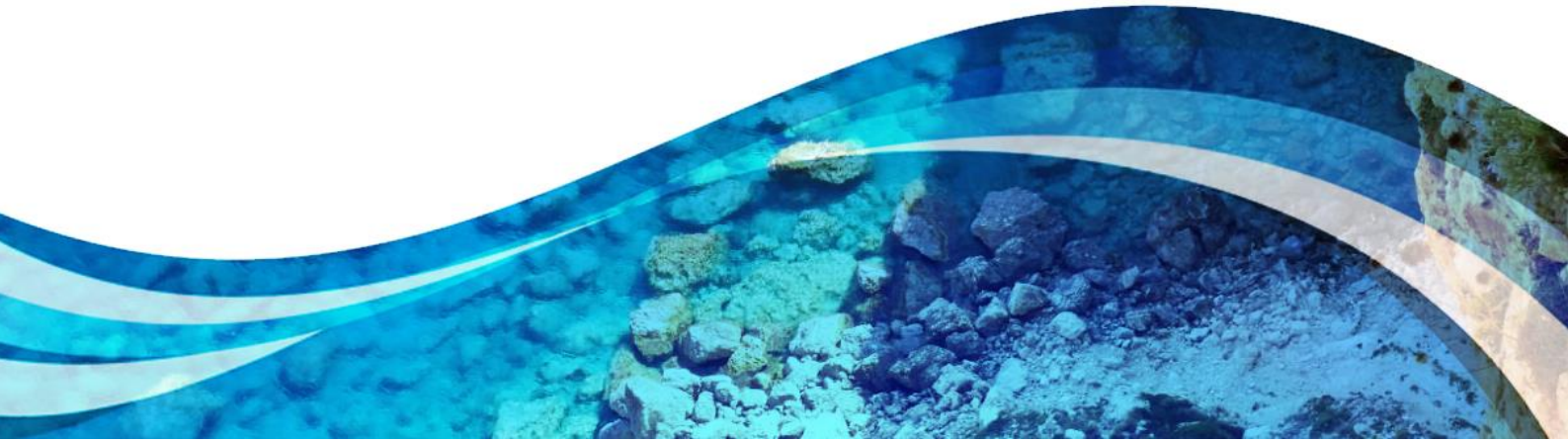
a) Existing infrastructures and key points

The Mediterranean Sea is a complex region with a very rich biodiversity and large economic activities related to the sea and notably aquaculture, shipping and energy. It is clear that in situ marine infrastructures cannot comply with all the needs for the Mediterranean exploration and must be complemented by land-based facilities dealing with experimentations and complementary analysis. Regarding observing systems, mesocosms in particular through experimental research on controlled conditions will enhance knowledge about the effects of Mediterranean climate change and other local changes on biodiversity, biogeochemical cycles, resilience of marine food webs and species mitigation. Mesocosms facilities with Transnational Access open to researchers and industries are listed in the AQUACOSM EU network for research on marine and freshwater ecosystems.

Large analytical facilities used by a large community of users must be secured and shared, and therefore complementing *in situ* observation systems. A very good example of sharing land based facilities for marine biology and ecology researches is EMBRC (and EMBRC-ERIC for development of blue biotechnologies) providing logistic support for field experiments, access to the sea, laboratories and equipment, as well as accommodation.

Land based facilities encompass all kinds of technological testing systems, such as towing tanks, flume tanks, cavitation tunnels and wave basins. This forms a heterogeneous group of facilities relevant for studies in hydraulics, coastal engineering, ship and offshore platform design. A detailed list can be retrieved from the database made available by EurOcean, the European Center for Information on Marine Science and Technology, where also other types of installations are addressed.

European regions facing the Mediterranean boast a large portfolio of wave basins and flume tank infrastructures providing a suitable environment for studies on coastal erosion and sediment transport, wave/structure interactions, coastal infrastructure



design. Some 20 facilities of this type have large dimensions (i.e. basin surface higher than 500 m^2 and flume tank longer than 35 m), and offer a wide range of testing conditions, while many other of smaller size provide easy access for basic studies on waves, and their effects on marine structures. These infrastructures are run by universities and by public or private research centers, and access by external users as individual or through joint R&D initiatives is largely supported. Considering the large community they represent and the widespread distribution in Mediterranean EU coastal regions, the range of testing capabilities they offer and the expertise of research teams, it is considered that stronger networking initiatives should be promoted to fully develop the potential impact in many R&D sectors addressing the marine environment and human activities on it.

Also significant is the presence of land-based testing infrastructures specific for R&D activity in ship and offshore structure design and analysis. This includes towing tanks, seakeeping basins and hydrodynamic/cavitation tunnels with recognised impact in research activities as well as for services provided to shipbuilding and offshore industry at global level. Testing infrastructures have large or very-large dimensions, some of them among the largest worldwide (e.g. the 460 m long Towing Tank and the Depressurised Circulating Water Channel at CNR-INSEAN, Italy). Facilities are owned by universities, public research centers and by national navies. A full exploitation of the potential of these infrastructures is hindered by expensive maintenance that reflect into high access costs, and for the restricted access to facilities owned by the navy (e.g. CEHIPAR, Spain, CEIMM, Italy).

Among economic activities having a direct impact on the marine environment, the exploitation of renewable energy from marine resources, notably offshore wind, waves and currents, is in its pioneering phase, and a significant development in the next decades is foreseen. The growth of this new technology and the related industrial sector increases pressure on existing land-based testing facilities, while needs for new infrastructures and stronger collaboration among the existing ones is already apparent. Current integration efforts at UE level have been and are the subject of research projects EU-FP7 MaRINET (completed in 2015) and H2020 MaRINET-2 (2017-2021). With these two projects, a network among the most important research infrastructures relevant for the development of Marine Renewable Energy (MRE) technologies has been established. In addition to R&D activities, a significant part of project budget has been devoted to support Trans-National Access (TNA) projects aiming at increasing the Technology Readiness Level (TRL) of concepts for the exploitation of MRE. Today, MaRINET-2 presents a consortium of 38 partners and 57 experimental facilities; 6 of them are land-based and located in Mediterranean countries (Italy, France).

The TNA program is also in the core of the Hydralab series of projects (EU-funded between 1997-2004, and self-funded by participants to present) with emphasis on hydraulics, geophysical fluid-dynamics, ship dynamics and ice-engineering. The consortium offers a network of 18 experimental installations; two are land-based and are located in Mediterranean countries (Spain, France).

Aquaculture facilities developed across the Mediterranean for the last 20 years. This rapidly growing sector can be an opportunity to continue to exploit fishing resources while preserving existing natural ones. Aquaculture is therefore a good example of blue

growth potential in the Mediterranean area. Aquaculture facilities can be either land-based (tanks) or sea-based (cages). Experiments are mainly focused on genetic, nutrition and health of fishes. Aquaculture facilities are also used for larval rearing and fish reproduction.
AQUAEXCEL, the project for the common use and sharing of aquaculture facilities, was created in 2011. Twelve countries were participating to this first initiative aiming to provide a platform including key European aquaculture facilities to enhance cooperation and knowledge sharing within the European aquaculture community. The platform included freshwater, marine, cold and warm water environments, as well as small, medium and industrial scale of production. AQUAEXCEL ended in 2015, followed by AQUAEXCEL 2020 (2015-2020), with additional infrastructures including disease challenge facilities. AQUAEXCEL 2020 also provides trainings.

Literature and Webography for Category 3: Land based facilities

- *Marine Research Infrastructures updated overview, European integration and vision for the future*, WP4 D4.1.1, Milestone M4.1.1, Author: Ifremer (France), October 2012, Seasera Programme "*Towards Integrated European marine research strategy and programmes*"
- AQUACOSM: *Network of European AQUAtic MesoCOSM Facilities Connecting Mountains to Oceans from the Arctic to Mediterranean*
Website: http://www.aquacosm.eu/
- AQUAEXCEL (2011-2015) and AQUAEXCEL 2020 (2015-2020): *Aquaculture infrastructures for excellence in European fish research*
Website: http://www.aquaexcel.eu/
- ASSEMBLE (2009-2013): *Association of marine biological laboratories*
Website: http://www.assemblemarine.org/
- DANUBIUS-RI: *The International Center for Advanced Studies on River-Sea System*
Website: http://www.danubius-ri.eu/
- eLTER: *Long-term Ecosystem Research in Europe*
Website: http://www.lter-europe.net/elter
- EMBRC: *European Marine Biological Resource Centre*
Website: http://www.embrc.eu/
- ESFRI: *European Strategic Forum on Research Infrastructures*
Website: http://www.esfri.eu/
- HYDRALAB IV (2011-2015)
Website: http://www.hydralab.eu/
- Hydralab+ Adaption for Climate Change
Website: www.hydralab.eu
- ICOS: *Integrated Carbon Observation System*
Website: http://www.icos-ri.eu/ ; Ocean Thematic Centre: http://otc.icos-cp.eu/
- LIFEWATCH: *E-Science European Infrastructure for Biodiversity and Ecosystem Research*
Website: http://www.lifewatch.eu/
- MARINERGI (2017-2019): *Planning an Integrated European Research Infrastructure*
Website: http://www.marinerg-i.eu/
- MaRINET-2 (2017-2021): *Marine Renewables Infrastructure Network for Enhancing Technologies - 2*
Website: http://www.marinet2.eu/
- MaRINET (2011-2015): *Marine Renewables Infrastructure Network*

Website: cordis.europa.eu/projects/rcn/98372_en.html
- Eurocean, *European Center for Information on Marine Science and Technology*
Website: http://www.eurocean.org
- MESOAQUA (2009-2012): *Network of leading MESOcosm facilities to advance the studies of future AQUAtic ecosystems from the Arctic to the Mediterranean*
Website: http://mesoaqua.eu/

b) Gaps analysis and further steps

Land based facilities are already well organized, in some cases secured by the « ESFRI » label (for example EMBRC-ERIC, ICOS, DANUBIUS-RI) for observing, sea and laboratory access, accommodation, analytical and modeling purposes. However, new observing systems dedicated rather to biology and contaminants, linked to adequate analytical facilities, must be promoted. A better sharing of analytical facilities must be sought, as well as a network for technological researches such as towing tanks, cavitation tunnels and wave basins which could all be further developed in the Mediterranean. Access to the already existing land based facilities can be improved, especially shared access with southern Mediterranean countries. Transfer of technology is particularly important to allow sharing with southern Mediterranean countries.

A stronger collaboration among RI and their upgrade is also made necessary to face the challenges of new emerging activities with impact on the Mediterranean, as in the case of the exploitation of MRE sources, notably offshore wind, waves and currents. The establishment of the first integrated and coordinated Research Infrastructure network for MRE is underway as the H2020 MARINERG-I Project, with plans for an application to the ESFRI roadmap. The ambition is to evolve the successful experience with the EU-FP7 MaRINET and the current H2020 MaRINET-2 projects into a coordinated RI platform to facilitate the maturation of the new technology sector related to MRE. Recalling the focus in these initiatives located in the Atlantic-arc regions, where the largest MRE resource is available, it is fundamental that Mediterranean countries harmonize knowledge and capacities in order to provide scientific and technology support for the maturation of the MRE industry at regional level.
Current gaps are identified in the necessity of the existing infrastructures to undergo significant upgrade programs to enlarge and improve the range of testing services they are asked to provide. In fact, most of these infrastructures have been designed decades ago for coastal engineering and ship hydrodynamics problems. The application to MRE technologies is welcome as a new business that can significantly increase the quantity and quality of access to the facilities, with inherent advantages in terms of knowledge, job places and valorization of existing infrastructures.

This project has received funding from the *European Union's Horizon 2020 research and innovation programme* under grant agreement No 727453

Annex 3: Table with SRIA priorities

Infrastructure Name	BLUEMED priorities												
	Mediterranean Sea ecosystems: services, resources, vulnerability and resilience to natural and anthropogenic pressures	Mediterranean Sea dynamics: developing services in the field of sustainable adaptation to climate change and plans for mitigation	Hazards and the protection of coastal areas in the Mediterranean	Innovative businesses based on marine bio-resources in the Mediterranean	Ecosystem-based management of Mediterranean aquaculture and fisheries	Sustainable tourism in the Mediterranean	Maritime clusters in the Mediterranean	Maritime Spatial Planning and integrated Coastal Zone Management in the Mediterranean	Smart, greener maritime transport and facilities in the Mediterranean	Observing systems and operational oceanography capacities in the Mediterranean	Multi-purpose offshore platforms in the Mediterranean	Marine and coastal cultural heritage in the Mediterranean: discovering protecting and valuing	Total
HCMR	2	2		2	2	2 (monitored underwater park with artificial reefs for scuba)		2		2	2 (to be created)	2	**16**
ICRE8	2	2	2		2	2		2	2		2	2	**18**
NTUA hydrodynamic testing installations							2		2	2	2		**8**
UAEGEAN			2					2		2			**6**
CNR-INSEAN hydrodynamics testing Center (Italy, Rome)				2		2	2	2	2		2		**12**

Artelia hydraulic laboratories (Pont de Claix, France)	2		2				2	2	2				**10**
CEPYC, Harbour and Coastal Studies Center (Madrid, Spain)	2		2				2	2	2				**10**
Coastal Engineering Laboratories, Technical Univ. Bari (Bari, Italy)	2		2				2	2	2				**10**
MEDIMEER (France - Sète)	2	2			2							2	**8**
CELIMER (France - Sète)	2		2	2	2					2	2		**12**
EMBRIC Banyuls-Sur-Mer			2	2									**4**
ASSEMBLE Plus - Banyuls-Sur-Mer			2										**2**
MIO	2	1	1				1	2		2	2		**11**
Inalve* (*industrial biotech-nology start-up specialized in the production of innovative products from microalgae, based in Nizza, France)				2									
EMBRC-France	2	2		2									
Total	**16**	**7**	**17**	**10**	**6**	**4**	**11**	**14**	**12**	**8**	**10**	**4**	

This project has received funding from the *European Union's Horizon 2020 research and innovation programme* under grant agreement No 727453

4- Satellites and spatial

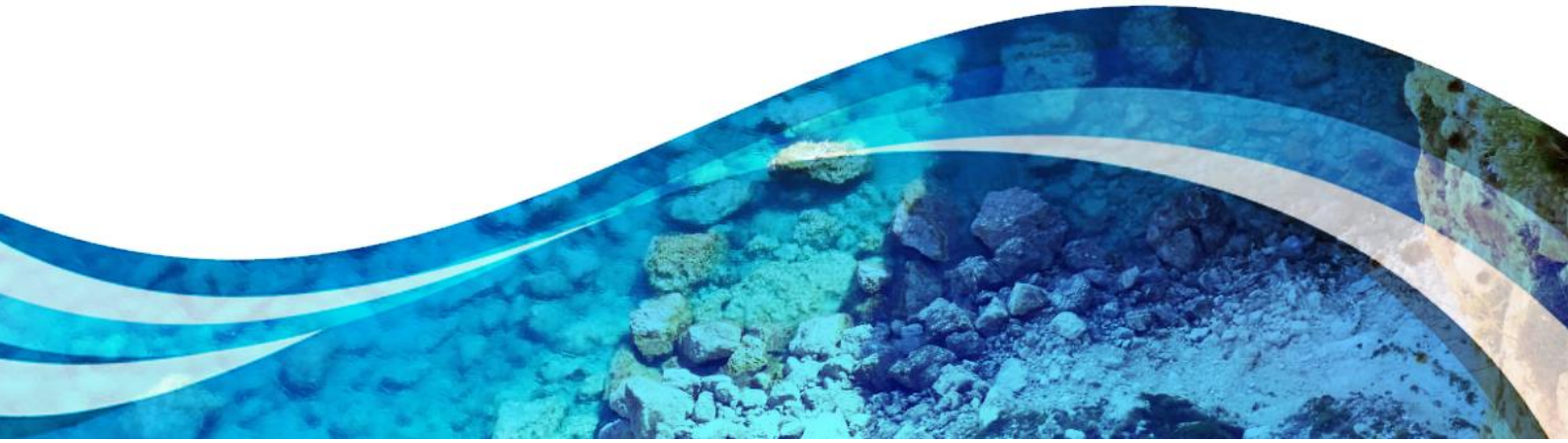
a) Existing infrastructures and key points

Satellites and spatial activities are very useful to gather data on marine sciences and to better know and understand seas and seacoasts, and cover fundamental science as well as a growing number of operational services. They can be used in the following domains: physical/biological oceanography like ocean circulation, wind and waves, sea surface temperature and salinity, ocean reservoir of heat, phytoplankton and algae blooms; climate change assessment: sea level change with altimetry; remote sensing improvement with ocean technologies; ocean cartography: monitoring of the algal bloom, spatial planning, monitoring of contaminants from land and rivers. Here below are some programs and list of European satellites infrastructures dedicated to marine observation.

COPERNICUS, previously known as GMEMS (Global Monitoring for Environment and Security), is a program aiming to develop capacity for earth observation and monitoring. Data is collected from satellites and from ground-based, airborne and seaborne measurement systems. This collected information are **freely and openly** accessible to its users. In France COPERNICUS is strongly coordinated with in situ marine data through the Data and Service Portal ODATIS.

The first satellite in Europe dedicated to earth observation was initiated in 1978 with the SPOT program (Satellites pour l'Observation de la Terre / Satellites for Earth Observation) jointly created by France, Belgium and Sweden. For marine sciences purposes, the satellite was useful to observe vegetation and anthropogenic impact, and to do a cartography of river mouths and coastlines.

The ORFEO (Optical and Radar Federated Earth Observation) Program, a cooperation between Austria, Belgium, France, Italy, Spain and Sweden, launched six high-resolution satellites: 4 Cosmo-Skymed satellites and the 2 very-high-resolution optical Earth-imaging satellites of the Pleiades constellation. The COSMO-SkyMed satellites are very useful for marine sciences, as they provide continuous and accurate



information about conditions of seacoasts, seas and inland waters. They can also evaluate coast erosion, pollution and sea traffic. As for the Pleiades constellation, the satellites are especially used for the coastal strip observation.

In the framework of the EUMETSAT Polar System (EPS) programme, three satellites have been launched or are planned to be: Metop-A (launched on 2006) and Metop-B (launched on 2012) are providing detailed observations of the global atmosphere, oceans and continents, while Metop-C is planned to be launched in 2018. The program is aiming to provide data sets on environmental forecasting and global climate monitoring.

Following the Topex-Poseidon mission, three satellites, Jason 1, 2 and 3 were launched respectively in 2001, 2008 and 2013 initiated by CNES and NASA with the aim to gather data over a period long enough to study ocean long-term variations and to have quality data on the coastlines.

Meteosat Second Generation (MSG) is a program resulting from the collaboration between the European Space Agency and EUMETSAT, providing images of the earth and data for weather forecasts including sea surface temperature through four geostationary meteorological satellites, along with ground-based infrastructure. Meteosat 8, 9, 10 and 11 were launched respectively in 2002, 2005, 2012 and 2015.

There is another complementary segment of satellite technology, usually overlooked by the marine community: since 1992, there is an on-going initiative linked to the Small Satellite Systems and Services ('4S') which grew enormously within the last decade. The technology linked to small satellites of a mass of a few kg (CubeSats) at most is supported and recognized by ESA. The cost-efficiency of these satellites equipped with sensoring devices suitable for the sea-observation (spectral-fluorimeters, IR temperature sensors, also video imaging) with more flexible orbiting offer new possibilities in sea observation and should be accounted for in the space infrastructure in a nearest future.

Literature and Webography for Category 4: Satellites and spatial

- *Marine Research Infrastructures updated overview, European integration and vision for the future*, Annex 5: Satellites and oceans observation, WP4 D4.1 Annex 5, Milestone M4.1.1, Author: Ifremer (France), October 2012, Seasera Programme "*Towards Integrated European marine research strategy and programmes*"
- *Marine Research Infrastructures updated overview, European integration and vision for the future*, WP4 D4.1.1, Milestone M4.1.1, Author: Ifremer (France), October 2012, Seasera Programme "*Towards Integrated European marine research strategy and programmes*"
- 4S Symposium in May 2018
Website: http://atpi.eventsair.com/QuickEventWebsitePortal/4s2018/4s
- 4S Symposium in Malta, 2016
Website: http://earth.esa.int/web/guest/events/all-events/-/article/small-satellite-systems-and-services-the-4s-symposium-3839
- AIS International: *Aerospace International Service*
Website: http://www.ais-europe.com/
- Announcement document about the launch of multiple light satellites

Website: http://emits.sso.esa.int/emits-doc/ESRIN/L3_VEGA_NEWS/L3_ANNOUNCEMENT_OF_OPPORTUNITY_PoC.pdf
- Copernicus Marine Service CMEMS (since May 2015) / Copernicus Marine Environment Monitoring Service (following MyOcean (2009-2012), MyOcean2 (2012-2014) and MyOcean follow-on (October 2014-March 2015)
Website: http://marine.copernicus.eu/
- EPS: *EUMETSAT Polar System*
Website: http://www.eumetsat.int/website/home/Satellites/CurrentSatellites/Metop/index.html
- ESA engineering & technology activities linked to CubeSats
Website:
http://www.esa.int/Our_Activities/Space_Engineering_Technology/Technology_CubeSats
- GEO: *Group on Earth Observations* / GEOSS: *Global Earth Observation System of Systems*
Website: http://www.earthobservations.org/geoss.php
- JASON-2 / OSTM: *Ocean Surface Topography Mission*
Website:
http://www.nasa.gov/mission_pages/ostm/overview/index.html#.VbnNyvm8T6M
- Medspiration ESA European Space Agency
Website: http://cersat.ifremer.fr/thematic-portals/projects/medspiration
- ORFEO: *Optical and Radar Federated Earth Observation*
Website: http://pleiades.cnes.fr/en/PLEIADES/A_prog_accomp.htm
- PLEIADES High Resolution satellites (CNES): *High resolution observing and mapping Earth's surface (incl. coastal areas)*
Website: http://pleiades.cnes.fr/en/PLEIADES/index.htm
- Sentinel
http://sentinel.esa.int/web/sentinel/home
- SPOT: *Satellites pour l'Observation de la Terre*
Website: http://spot.cnes.fr/

b) Gaps analysis and further steps

A gap that BLUEMED can bridge concerns the interaction between the scientific community and the space agencies. The needs of the scientific community have to be better taken into consideration in space observation programs, by reinforcing interactions with space agencies. There is also a need for reinforcement of systematic systems allowing for data discovery encompassing satellite and in situ data.

This project has received funding from the *European Union's Horizon 2020 research and innovation programme* under grant agreement No 727453

Annex 4: Table with SRIA priorities

Infrastructure name	BLUEMED priorities												
	Mediterranean Sea ecosystems: services, resources, vulnerability and resilience to natural and anthropogenic pressures	Mediterranean Sea dynamics: developing services in the field of sustainable adaptation to climate change and plans for mitigation	Hazards and the protection of coastal areas in the Mediterranean	Innovative businesses based on marine bioresources in the Mediterranean	Ecosystem-based management of Mediterranean aquaculture and fisheries	Sustainable tourism in the Mediterranean	Maritime clusters in the Mediterranean	Maritime Spatial Planning and Integrated Coastal Zone Management in the Mediterranean	Smart, greener maritime transport and facilities in the Mediterranean	Observing systems and operational oceanography capacities in the Mediterranean	Multi-purpose offshore platforms in the Mediterranean	Marine and coastal cultural heritage in the Mediterranean: discovering protecting and valuing	Total
Copernicus MEMS	1	2	1						1	3			**8**
Medspiration ESA		2				1							**3**
"AIS" International			1					1	1	1			**4**
VEGA launcher of ESA for small satellites	1	1	1	1				1		1		1	**7**
Total	**2**	**5**	**3**	**1**	**0**	**1**	**0**	**2**	**2**	**5**	**0**	**1**	

This project has received funding from the *European Union's Horizon 2020 research and innovation programme* under grant agreement No 727453

5- Marine data management

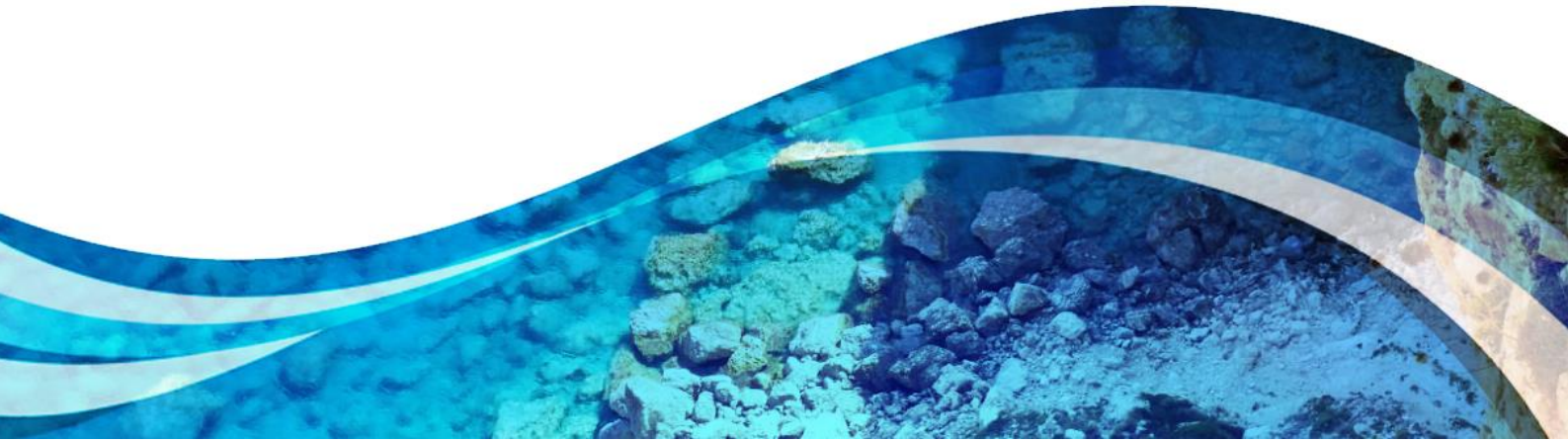
a) Existing infrastructures and key points

The availability and accessibility of data is a priority for stakeholders involved in marine and maritime policy, but also for the private sector. Structured networks and databases already exist at European level, including the Mediterranean.

The PERSEUS oceanographic information management system provides user-friendly and fast access to physical, geochemical and biological data of the Mediterranean and Black Seas' ecosystems. The database includes both data collected by PERSEUS (100 cruises) and previous European projects such as SESAME, MyOcean and EMODnet. The database aimed to contain data for almost 8,000 cruises at the end of the project in December 2015. About 98% of the data is freely available to any user after online registration. Other data can be obtained through negotiation with data provider. The database is easy to use, with a data structure and a document guide to help users go their way through data. The project gives also the possibility to contact the data administrator.

SEADATACLOUD is the continuation of the SEADANET infrastructure, which will be setup on a modern concept. It aims at considerably advancing SEADANET Services and increasing their usage, adopting cloud and high performance computing technology for better performance.

One of the key issues of marine data is the access to data once it is collected. Scientists need to be able to have access to well-structured and easily accessible data. In France the Data and Service Portal ODATIS offers such a service. Data visibility and web presentation of data improvement could be a great step further towards a better use of data. New projects are being currently developed like Copernicus Academy Network that aims to connect European universities and research institutions, both private and non-profit organizations, to develop a well-organized network of stakeholders dedicated to academic and research cooperation. Lectures, training sessions and traineeships will be organized to train young scientists to use Copernicus database and



information services. The trained scientists will be able to use and manage big data – not only Copernicus data – in a more efficient and coordinated way. The development of international cooperation and exchange of ideas will be encouraged, as well as collaboration with the private sector.

Literature and Webography for Category 5: Marine data management

- BLUEBRIDGE
Website: http://www.bluebridge-vres.eu/
- CFP: *Common Fisheries Policy*
Website: http://ec.europa.eu/fisheries/cfp/
- CMEMS (since May 2015, following MyOcean (2009-2012), MyOcean2 (2012-2014) and MyOcean follow-on (October 2014- March 2015) projects): *Copernicus Marine Environment Monitoring Service*
Website: http://marine.copernicus.eu/
- DCF: *Data Collection Framework*
Website: http://datacollection.jrc.ec.europa.eu/dcf-legislation
- DG Mare EMODNET (since 2009): *European Marine Data and Observation Network*
Website: http://www.emodnet.eu/
- DG Mare European Atlas of the Seas
Website: http://ec.europa.eu/maritimeaffairs/atlas/maritime_atlas/#lang=EN;p=w
- EEA: *European Environment Agency*
Website: http://www.eea.europa.eu/
- EEA Waterbase - Transitional, coastal and marine waters
Website: http://www.eea.europa.eu/data-and-maps/data/waterbase-transitional-coastal-and-marine-waters-11
- EVEREST: *European Virtual Environment for Research – Earth Science Themes: a solution*
Website: http://ever-est.eu/
- Galileo
Website: http://galileognss.eu/
- GFCM: *General Fisheries Commission for the Mediterranean*
Website: http://www.fao.org/gfcm/fr/
- ICES: *International Council for the Exploration of the Sea*
Website: http://www.ices.dk/Pages/default.aspx
- ICES Data Centre
Website: http://admin.ices.dk/Submissions/index.aspx?t=1
- i-Marine (since 2011): *Data e-Infrastructure Initiative for Fisheries Management and Conservation of Marine Living Resources*
Website: http://www.i-marine.eu/pages/Home.aspx
- JRC EMIS: *Environmental Marine Information System*
Website: http://emis.jrc.ec.europa.eu/
- MSFD: *Marine Strategy Framework Directive*
Website: http://ec.europa.eu/environment/marine/eu-coast-and-marine-policy/marine-strategy-framework-directive/index_en.htm
- MSS: *Maritime Security Strategy*
Website: http://ec.europa.eu/maritimeaffairs/policy/maritime-security_en
- ODIP (2012-2015): *Ocean Data Interoperability Platform*
Website: http://www.odip.eu/content/content.asp?menu=0010000_000000

- PERSEUS: *Policy-Oriented Marine Environmental Research in the Southern European Seas*
Website: http://isramar.ocean.org.il/perseus_data/Default.aspx
- SEADATACLOUD
Website: http://www.seadatanet.org/About-us/SeaDataCloud
- SEADATANET (2006-2011) and SEADATANET 2 (2011-2015): *Pan-European infrastructure for Ocean and Marine data management*
Website: http://www.seadatanet.org/
- WFD: *Water Framework Directive*
Website: http://ec.europa.eu/environment/water/water-framework/index_en.html

b) Gaps analysis and further steps

Tools and projects on data need to be further developed, in order to become more accessible and even easier to use for the users (scientists, public stakeholders, policy makers, private companies or ordinary citizens…). It is not only the question of collecting data, but also how to work on that in order to give back to the users easy understandable quality information. Furthermore, more innovative and interactive tools should be developed, like interactive online maps. Developers should not only consider online tools as programs that can be used on a computer. New innovative applications on mobile phone should be developed in parallel to programs on computer. Access is facilitated on mobile phone: users can connect easily almost everywhere.

For example, the Sea bathing water quality project in Croatia is a mapping of Croatian sea water quality. Data on temperature, salinity of water, quality of water etc. is updated regularly. Users can also find on the website pictures of the beaches and coasts and a map with touristic infrastructures (restaurants, changing rooms, hotels…). The information is public and free, and it is also available on mobile phone, with a dedicated application. In July 2017, near 25,000 users visited the webpage in Croatian and more than 27,000 visited the webpage in English. This project is a good example of what could be developed under the umbrella of blue growth: science and economy can boost each other if we link both sectors together. These kind of databases merging scientific and economic data already exist at sea basin level, but not at Mediterranean level. BLUEMED could link the already existing networks together and create a meta-network at Mediterranean level.

Moreover BLUEMED could raise awareness within the science community and change the way of thinking about how researchers and scientists manage and share their data. Some of them could be hesitant about sharing their data to a large public of users. BLUEMED could lead and drive this change of mindset, and to get people to understand that sharing data is the first step to enhance research and innovation.

Another key issue to make data easily available to everyone is the harmonization of standards and interoperability of data. It is usually difficult to compare and to put together information coming from different sources, as databases usually do not have the same structure and organization. In order to boost cooperation between countries, organizations and stakeholders, we need to develop harmonized and corresponding

information in a more integrated way, based on the same standards. We also need to be able to communicate about these databases, so we also need to use the same vocabulary about instruments, measures and equipment. For example, the Moroccan Institute INRH (Institut national de Recherche halieutique - National Institute for Fishery Research) is working together with the French Ifremer Center on database management. In order to be able to work together, the INRH adapted to the Ifremer information system.

BLUEMED could push forward the cooperation at Mediterranean level by facilitating communication and collaboration between existing infrastructures and organisations/programmes. Scientists and researchers would be more aware of all the possibilities that already exist and infrastructures and services would be used at their full potential. BLUEMED could create links and connections between all stakeholders involved, and act as a database of databases.

Last but not least, data collected in the framework of a project often get lost as the project comes to its end. Before the project is closed, the data should be send to a metadatabase for long-term storage.

This project has received funding from the *European Union's Horizon 2020 research and innovation programme* under grant agreement No 727453

Annex 5: Table with SRIA priorities

na - not available; not enough information about the project and organization

	BLUEMED priorities												
Infra-structure name	Mediterranean Sea ecosystems: services, resources, vulnerability and resilience to natural and anthropogenic pressures	Mediter-ranean Sea dynamics: developing services in the field of sustainable adaptation to climate change and plans for mitigation	Hazards and the protection of coastal areas in the Mediter-ranean	Innovative businesses based on marine bio-resources in the Mediter-ranean	Ecosystem-based mana-gement of Mediter-ranean aqua-culture and fisheries	Sustainabl e tourism in the Mediter-ranean	Maritime clusters in the Mediter-ranean	Maritime Spatial Planning and Integrated Coastal Zone Mana-gement in the Mediter-ranean	Smart, greener maritime transport and facilities in the Mediter-ranean	Observing systems and opera-tional oceano-graphy capacities in the Mediter-ranean	Multi-purpose offshore platforms in the Mediter-ranean	Marine and coastal cultural heritage in the Mediter-ranean: discovering, protecting and valuing	Total
Copernicus	3	3	2		1				1	3			**10**
EMBRC	2	2	1	3	2	1	1	1					**13**
EMODNET	2	1				1				1			**4**
Seadatanet	2	1								3			**3**
Marine Strategy Framework Directive (MSFD) / Data Collection Framework (DCF) / Water Framework Directive (WFD)	3	3	2		2	1		1		1			**13**

EEA (European Environment Agency)	1	1											**2**
GFCM (General Fisheries Commission for the Medi-terranean)	3				3								**6**
ICCAT	3	na	na	na	3	na	na	na	na	na	na	na	**6**
Total	**19**	**11**	**5**	**3**	**11**	**3**	**1**	**2**	**1**	**1**	**0**	**0**	

This project has received funding from the *European Union's Horizon 2020 research and innovation programme* under grant agreement No 727453

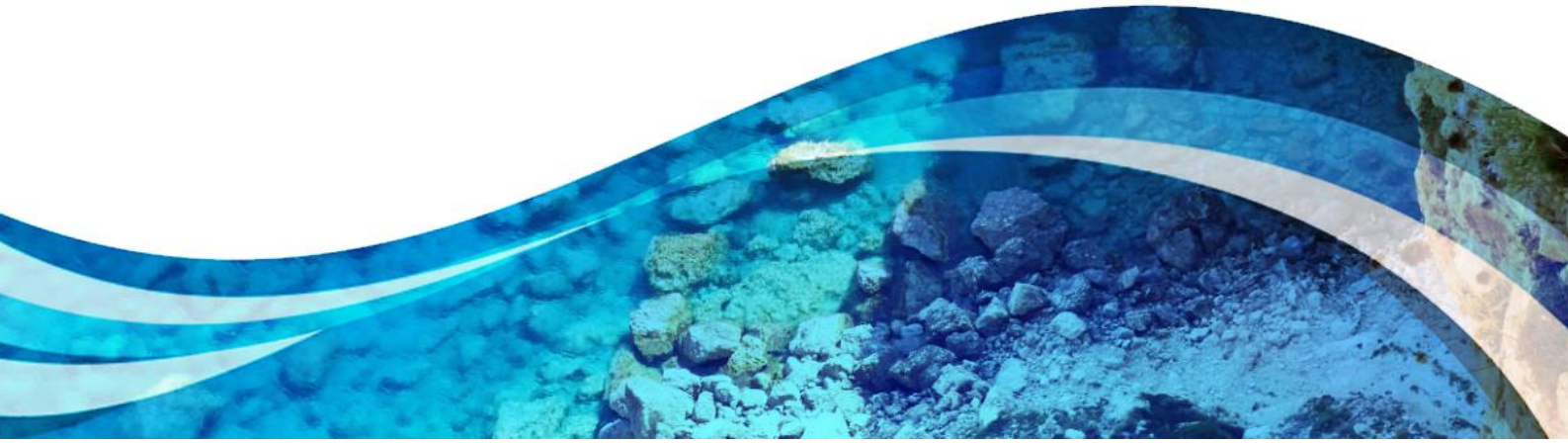
Conclusion and preliminary recommendations

RI have strongly developed in the past year and cover already a large proportion of the scientific needs of research and innovation communities. However BLUEMED can help strongly in promoting actions dedicated to sustain and promote higher sharing of facilities and necessary upgrades, and the next months will be dedicated to conduct necessary work to precise possible actions offered to the high level stakeholders meeting to construct the final roadmap.

Two sets of subjects must be addressed in the next months, with strong interaction with the platforms:
For example, exchanges can be developed on the following questions: what should be considered for future ships? What could be the characteristics of future harbors?

1. Sharing RI: how to link and to facilitate collaboration between different scientific domains in order to boost knowledge. The classical division between observation, experimentation, analysis and modelling is too restrictive; a cooperation is needed. “Capacity nodes” must be defined to ensure smooth transmissions. The platforms created in the framework of the CSA BLUEMED could further enhance dialogue among all stakeholders involved in blue growth in the whole Mediterranean basin, especially the technology platform.
2. Long term sustainability: how to maintain them, how to upgrade their equipment and tools, and how to enhance training of people. A specific focus should also be put on experimental technological facilities for marine and maritime technologies.

This Research Infrastructure Assessment and the Workshop on Research Infrastructures organized in July 2017 in La Seyne-sur-Mer will pave the way both for the Research Infrastructure high-level Conference in June 2019 and for the BLUEMED Research Infrastructure Roadmap in November 2019. European and non-EU stakeholders will be involved in the development of this Roadmap. The bottom-up strategy will bring the expectations and needs of the blue growth stakeholders working on the ground to the highest political level at the High-Level Conference in June 2019, through collaboration with the national pivots and the BLUEMED platforms. In line with the other workpackages of the BLUEMED project, and in particular the four



platforms, the priorities for actions will be defined for the Mediterranean and will continually enrich and guide the reflection carried out on research infrastructures in the Mediterranean. As for the Roadmap, it will lay the foundations for a general policy for the Mediterranean, including stakeholders from various sectors (public and private, research and innovation, economy etc.) and all categories of research infrastructures. It will give an overview of the actions to be carried out in the Mediterranean, both on the political and financial level, in terms of research and innovation. As the Roadmap has a long-term view and goals for the Mediterranean, special emphasis should be placed on the younger generation of researchers and stakeholders (training plans, actions to promote blue growth concept, etc.).

Annex 6: List of participants of the BLUEMED Research Infrastructure Workshop organized in La Seyne-sur-Mer, France, 3 and 4 July 2017

First name and name	Country	Expert RI/CSA representative	Mail address
Damir Ivanković	Croatia	Expert RI	ivankovic@izor.hr
Daniel Hayes	Cyprus	Expert RI	dhayes@ucy.ac.cy
Charlotte Restif	France	CSA representative	charlotte.restif@cnrs-dir.fr
Bruno Blanke	France	CSA representative	bruno.blanke@cnrs-dir.fr
Jan Opderbecke	France	Expert RI	jan.Opderbecke@ifremer.fr
Guy Herrouin	France	CSA representative	herrouin@polemermediterranee.com
Richard Sempere	France	Expert RI	richard.sempere@mio.osupytheas.fr
Nicolas Arnaud	France	CSA representative	nicolas.arnaud@cnrs-dir.fr
Aurélien Carbonnière	France	Expert RI	Aurelien.Carbonniere@ifremer.fr
Behzad Mostajir	France	Expert RI	behzad.mostajir@umontpellier.fr
Nicolas Reul	France	Expert RI	Nicolas.Reul@ifremer.fr
Elisabeth Kohler	France	CSA representative	elisabeth.kohler@cnrs-dir.fr
Laura Sedaine	France	CSA representative	laura.sedaine@cnrs-dir.fr
Jean-François Cadiou	France	CSA representative	Jean.Francois.Cadiou@ifremer.fr
Gilbert Maudire	France	Expert RI	Gilbert.Maudire@ifremer.fr
Laurent Mortier	France	CSA representative	mortier@locean-ipsl.upmc.fr
Nikos Papandroulakis	Greece	CSA representative	npap@hcmr.gr
Nikos Streftaris	Greece	CSA representative	nstrefta@hcmr.gr
Vassiliki Celia Vassilopoulou	Greece	CSA representative	celia@hcmr.gr
Marco Borra	Italy	Expert RI	marco.borra@szn.it
Georg Umgiesser	Italy	Expert RI	georg.umgiesser@ismar.cnr.it
Elena Ciappi	Italy	Expert RI	elena.ciappi@cnr.it
Margherita Cappelletto	Italy	CSA representative	margherita.cappelletto@cnr.it
Milad Fakri	Lebanon	Expert RI	milosman@cnrs.edu.lb
Aldo Drago	Malta	Expert RI	aldo.drago@um.edu.mt
Alan Deidun	Malta	Expert RI	alan.deidun@um.edu.mt
Elena Sultana	Malta	CSA representative	elena.sultana@gov.mt
Rachida Houssa	Morocco	Expert RI	houssa@inrh.ma
Laura Ribeiro	Portugal	Expert RI	lribeiro@ipma.pt

Maria da Conceição	Portugal	CSA representative	conceicao.santos@dgpm.mm.gov.pt
Ventura de Sousa	Portugal	CSA representative	ventura.sousa@ain.pt
Marco Silva	Portugal	Expert RI	marco.silva@ipma.pt
Branko Čermelj	Slovenia	Expert RI	branko.cermelj@nib.si
Vlado Malačič	Slovenia	CSA representative	vlado.malacic@nib.si
Albert Palanques	Spain	CSA representative	albertp@icm.csic.es
Jose I. Diaz	Spain	Expert RI	jose.diaz@st.ieo.es
Marc Torner	Spain	Expert RI	mtorner@socib.es
Salwa Sadok	Tunisia	Expert RI	salwa.sadok@instm.rnrt.tn

Annex 7: Table with EurOcean listed vessels operating in the Mediterranean owned by one of the BLUEMED CSA countries

Country	Name of vessel	Global (≥65m)	Oceanic (≥55m and <65m)	Regional (≥35m and <55m)	Local/Costal (≥10m and <35m)	Others (<10m)	Total per country
Croatia	Bios Dva			1			8
	Hidra				1		
	Nase More				1		
	Navicula				1		
	Palagruza			1			
	Shamal				1		
	Triton				1		
	Vila Velebita				1		
France	Albert Lucas				1		10
	Le Suroit		1				
	Antedon II				1		
	Haliotis				1		
	Janus II				1		
	L'Europe				1		
	Nereis II				1		
	Pourquoi pas?	1					
	Tethys II				1		
	Thalassa	1					
Greece	Aegaeo		1				6
	Hydrographic launch 14				1		
	Naftilos		1				
	Philia				1		
	Pytheas		1				
	Stravon				1		
Italy	Andrea				1		18
	Astrea				1		
	Cerruti				1		
	CRV Leonardo				1		
	G. Dallaporta			1			
	Litus				1		
	Luigi Sanzo				1		
	Maria Grazia			1			
	Minerva Uno			1			
	NRV Alliance	1					
	OGS-E1plora	1					
	Regione Lazio 1				1		
	Santa Teresa				1		
	Tecnopesca II				1		

	TRER				1		
	Urania		1				
	Vega Uno				1		
	Vettoria				1		
Malta	Isis II					1	**4**
	Madonna Ta'Pinu				1		
	Undaunted					1	
	Wilfred					1	
Portugal	Diplodus				1		**8**
	Noruega			1			
	Andromeda				1		
	Auriga				1		
	D. Carlos I	1					
	Almirante Gago Coutinho	1					
	Puntazzo				1		
	Tellina				1		
Slovenia	Sagita				1		**1**
Spain	Angeles Alvarino			1			**10**
	Emma Bardan				1		
	Francisco de Paula Navarro				1		
	Garcia del Cid			1			
	José Ma Navaz				1		
	Las Palmas			1			
	Miguel Oliver	1					
	Plocan 1					1	
	Ramon Margalef			1			
	SOCIB				1		
	Total:	**7**	**5**	**10**	**39**	**4**	**65**

This project has received funding from the *European Union's Horizon 2020 research and innovation programme* under grant agreement No 727453

European Commission

blueMed